THE WOOL EXHIBITION.

No. II.

MR. GEORGE HODGSON'S machinery at the Crystal Palace for weaving consists of eight looms of various widths; they are adapted for weaving different styles of cloth from plain light Orleans to the most complex heavy woollens. The first is a plain loom, well suited for the fabrication of either worsted, mohair, silk, cotton, or alpaca goods. At present it is weaving an Orleans piece, but this class of loom can be fitted up with as many as ten treadles; jacquards for producing figures or shedding motions from sixteen to twenty shafts can be applied with ease. A plain loom of 32in. reed space at the International Exhibition in 1862—London—ran at upwards of 450 picks per minute; but of course this was done as an experiment to show what could be accomplished in the way of speed by the machinery of this firm.

A patent loom for weaving lasting and Serge de Berrie cloth is the next machine which draws attention. Up to the present time, it has always been necessary to have some contrivance underneath the healds for drawing them down, after they have been lifted; springs, weights, or levers have been employed for this purpose, but there have always been difficulties to contend with, either by the springs giving way, or by the cards which connect the healds and levers, slipping or coming loose. The present invention has in this respect a great advantage over others, brought out as yet for weaving the above-mentioned fabric; possessing at the same time many other excellent points, which cannot fail to attract the notice of a practical man. The healds, which may be either of worsted or wire, are fixed in an iron frame by steel hooks that can be regulated by nuts, so as to make them higher or lower, tighter, or slacker. When once they have been fixed in position, there is nothing either to slip or give way. These frames are connected to the regular system of jacks on the top of the loom by small adjustable round rods. The treadles are in the same position as in ordinary looms, but instead of placing a bowl in a recess, it is put on a pin, cast on the side of the treadle, thus forming a projection, which runs in a groove in the treading tappet, similar to the Woodcroft system. The positive motion of the treadles is transferred to the jack rods by means of a strong treading rod. The wrought iron frames mentioned above work up and down in a sort of double fork, by which the weaver can give the healds the necessary incline. In case a heald thread breaks at any time, there is a very simple contrivance for drawing out the fork and thus liberating the healds, so that it is much easier to repair the breakage than in other systems. Furthermore, it is calculated that the healds will wear much longer when used in this loom, as they are prevented from rubbing against each other, being held in the framing as already stated. Besides a great reduction in the number of heald threads breaking, it will also be found that there is a saving in the quantity of ends that come down in the warp, owing to the easy movement and absence of all strain on the healds. The speed—160 to 170 picks per minute—at which the loom is running, alone proves the easy working and general efficiency of the system.

The third of Mr. Hodgson's looms is an 8/4 (76in. reed space) fast reed loom, specially made for weaving worsted coatings and serges, where only one class of weft is necessary. It is a compact machine, with picking wheels at both sides. It is now working at about 130 picks per minute, weaving a worsted coating, with a 16-shaft twill. The healds are lifted by means of a shedding motion. It is compact, occupies little space, and is easily within reach of the weaver, requiring no gantry, as it is firmly fixed on the top rail, and is substantial without being cumbrous, the whole altitude of the loom and shedding motion being less than the height of an ordinary man. It posssesses the advantage of being able to retain the healds in a lifted position when they are required to be up twice or more times in succession. Directly attached to the angle levers, which lift the heads, are knives with double hooks at one end, and another in the centre on the underneath side. Backwards and forwards work two jacks, and these acting alternately, lift the knives accordingly as they are selected by pattern surface. To retain a knife in position when lifted, the pattern pin places a small catch behind the hook on the low side of the knife, and thus prevents it going back. The jacks are moved by treadles, actuated upon by a regular two winged Orleans tappet on the low shaft; this being a decided advantage, approaching plain weaving as near as it is possible, with a twilling motion.

Standing next to this is a 9/4 (82in. reed space) pick and pick drop box loom, suitable for heavy woollens. It is massively constructed throughout, having the old system of taking up the cloth by weight and double swords; these last have the advantage of producing a swell in the movement of the lay and give more time for the shuttle to get through the shed, thereby easing the friction upon the warp and causing fewer breakages of the threads, owing to the going part not working in a radius but nearly parallel. The system of shedding motion already described above is applied with slight alteration to this loom. On the same stud as the cylinder, which works the shafts, is the card cylinder for governing the box motion. There is a two-holed box on both sides, each working independently. The raising and lowering of the box is effected by means of a lever, operated on by a tappet with two elevations at the back of the loom. On the side of the tappet there are two pins, on each of which is fastened an upright rod, both rods having catches at their other extremities, but these face in opposite directions, so that when one is in gear the other is out. On the top shaft works a "broken-backed" lever with a slot at the end, in which the above-mentioned catches move. By this arrangement an oscillating movement is given to the tappet, which can be regulated by the pattern surface, to remain in one position or change at any given pick. The picking is on the sliding tappet principle, and can be arranged by cards to weave any pattern. The tappets are moved in a very neat way, by means of a scroll on a short shaft parallel to the low shaft, at the other end of which is a small casting with two pegs; working between these pegs is a back-to-back catch which lifts after each pick. In the scroll groove is inserted a single stud, projecting from a horizontal square rod, also parallel to the low shaft. At each end of this is fixed a clutch, which can slide the tappet nose backwards and forwards on any given single pick as directed by the cylinder. A double-nosed tappet is, of course, used opposite each of the two cones.

Next comes a 4/4 (43in. reed space) pick and pick loom, with a six-hold circular box at each end, working independently. As this loom is fitted up with a jacquard, it is calculated to weave the most complicated patterns that can be produced by machinery either in worsted, silk, or cotton. The boxes are turned on the regular circular box principle, that is by means of a broken backed lever, working on the low shaft. Parallel to this at the bottom of the loom is another lever, one end of which is connected to the box by pulling rods, and to the other end are attached hooked rods, which are operated upon according to the pattern. To prevent the boxes turning too far, there is an automatic lock motion applied, so that when the pulling rods turn the box they place the locks underneath certain pegs, thus stopping the box firmly in position. The picking motion is similar to that of No. 4. Close to preceding loom is a 4/4 (43in. reed space) pick and pick drop box loom, with a two-holed box on each side. It presents many new features, both in the picking arrangement and the box motion, and is specially adapted for weaving rep cloths, where the pattern is a series of single picks of two different kinds of weft. The mechanism throughout this loom is so simple and positive that it can be run with ease at 140 picks per minute. Although the picking is on the old principle of sliding tappets, yet there is a novelty in the mode of working them backwards and forwards. The two tappets are connected by means of an iron rod, in the centre of which is a large square opening. From the spur rail projects a stay, which supports a stud bearing a small excentric, which works in the square opening; at the other end of the same stud is a bevel wheel, having twice as many teeth as the one on the low shaft, with which it gears; by this means the tappets are allowed to remain two picks in the same position without moving. The boxes are raised and lowered by means of a tappet with three elevations and three hollows, situated directly underneath and revolving on the axle of the swing rail; by thus working from the exact centre on which the going part swings all oscillation of the boxes is prevented. At the side of the loom hangs perpendicularly a lever, to the extremity of which a pulling rod is fastened which turns the tappet at each pick. Cards for governing the picking and boxes are absolutely done away with here.

The seventh is a 3/4—39in. reed space—circular skip box loom; it possesses the advantage of being able to spring from one shuttle to any other in the circle, and is suitable for weaving complex checks, such as Scots tartans. The method of skipping is entirely new; it is easy to understand, resembling, as it does, the regular circular box principle as much as possible, the ground work being exactly the same. The novelty consists in a sliding bowl or pulley in the middle of the broken backed lever, which works on a three rise tappet. This sliding bowl, by a very neat direct arrangement, is operated on by the cylinder or card motion, which slides it backwards and forwards on to any of the elevations of the tappet as required, two cylinder pegs of different lengths being used to effect this object. When the box is turning it is perfectly free, as all stress is taken off by an excentric, during the required time, allowing the spring to come into action again when the change has been effected. To avoid the possibility of a mistake, there is also applied a system of locks, which are operated upon by another excentric. This loom will weave at the rate of 130 to 140 picks per minute; it answers the same purpose as a twelve-holed shuttle-box, but with this great advantage, that it makes only one-third the waste.

The last loom exhibited is a 9/4 (82in. reed space) pick and pick shedding motion loom, with a six-holed circular box at each end, working independently, on the same principle as No. 4. It is, however, for heavier work, such as woollens and backed worsted coatings. The boxes being of great dimensions, will take a shuttle large enough to admit a woollen cop. The connection of the different working parts with the cylinder is not of the usual stamp, for instead of having separate cylinders for the box and shedding motion, they are combined, as in the drop-box loom. The shaft machine and picking arrangement are similar to those already described. There is applied to this loom a patent loose reed motion, with which nearly as strong cloth can be woven in a loose reed loom as in a fast reed, with the advantage that the loom runs quicker and more easily.

THE PETER THE GREAT I

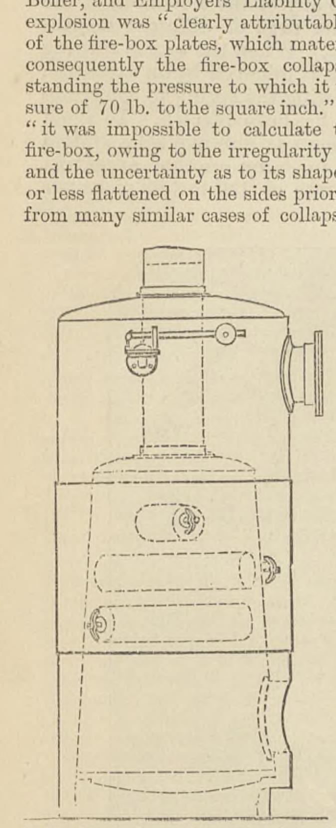
THE PETER THE GREAT.

THIS warship, which we illustrate above, the largest and most formidable of the Russian navy, is now lying in the Clyde, off Greenock, where she arrived from Cronstadt, under command of Captain Vladimir Basargean. The Peter the Great and the Minin are the two mastless turret-ships of the Russian fleet of war-vessels, resembling in design those of the same type of our own navy, the Dreadnought more especially. Preparations are being made for the reception of the Peter the Great by Messrs. John Elder and Co., who are about to replace her present machinery, which has proved unsatisfactory, with that of higher power and improved construction. As she has on board a large store of ammunition, permission has been asked from the General Commanding the Forces in Scotland to store her powder in the magazine at Fort Matilda; at present she draws about 26ft., which must be considerably lessened before she proceeds up the river. The Peter the Great was built in Russia ten years ago, at the Admiralty Works, Gallerny Ostroff, St. Petersburgh, and her engines constructed by Mr. George Baird, a Scotch engineer, at St. Petersburgh, from the designs of Mr. Norman Scott Russell. Her length is 321ft., and her breadth 64ft., but from her great draught it is difficult to realise that her displacement is nearly 10,000 tons, the greater portion of her hull being submerged. The vessel is divided into sixteen compartments by bulkheads with the usual watertight doors. The bottom is double throughout; a portion of the space between the inner and outer skins above the water-line is utilised for the storage of coal. The decks are five in number, five of which are divided by the turrets, which are protected by armour plating about 14in. thick. Her armament consists of four 35-ton guns of Krupp steel, besides a number of vessels of smaller calibre, mounted on the various decks. Although generally spoken of as a mastless vessel, she carries in reality three masts; two of these are very light, but the mainmast is of iron, and of sufficient diameter to enable the men to go aloft by a stair inside it, ordinary ladders being thus unnecessary. She is built of iron sheathed with wood, and is worked by twin screws.

THE BOILER EXPLOSION ON BOARD THE CITY OF ROME.

THE inquest on the bodies of the men killed in this unfortunate accident terminated on the 21st ult., the following verdict being returned by the jury:—"We come to the conclusion that the poor men lost their lives through the explosion which was caused by an over pressure of steam; and we would further suggest that the shipyard people test their boilers periodically." The foreman, in answer to the coroner, said, "that with regard to any neglect, they, the jury, considered the matter and had left it open. No doubt the fireman had exceeded his duty by allowing the over pressure."

The principal engineering witness examined during the inquiry was Mr. Robert B. Longridge, managing-director of the Engine, Boiler, and Employers' Liability Company, who stated that the explosion was "clearly attributable to the reduction in thickness of the fire-box plates, which materially reduced their strength; consequently the fire-box collapsed, being incapable of withstanding the pressure to which it was subjected, probably a pressure of 70 lb. to the square inch." He also stated that although "it was impossible to calculate the collapsing pressure of the fire-box, owing to the irregularity of the thickness of the plates, and the uncertainty as to its shape—for it may have been more or less flattened on the sides prior to the accident—yet, judging from many similar cases of collapse which had come under his notice, he was of opinion that the bursting pressure could not have exceeded 70 lb. per square inch, and may have been less."



If Mr. Longridge's opinion be correct, the boiler was of course quite unfit for a pressure of 40 lb., which was that intended to be carried, according to the evidence of the representatives of the Barrow Shipbuilding Company, and which the fireman in charge of the boiler had been instructed not to exceed. Against Mr. Longridge's evidence, on the other hand, however, was that of Mr. Rodgers, the managing engineer of the shipbuilding company, who stated that the boiler had been tested by water to 60 lb. pressure three and a-half years ago, and then showed no signs of weakness. In Mr. Longridge's opinion no corrosion had taken place since that date, the feed-water used being very good, and the corrosion of the plates of the fire-box having been due to the use of salt water before the test referred to. In fixing the collapsing pressure of the furnace at 70 lb., or less, there can be no doubt Mr. Longridge passed a judgment supported by evidence largely supplied by his own imagination. There was nothing to show that the sides of the furnace were flattened any more than that the form was fairly circular, in which latter case the furnace would have stood far more than 70 lb., and in the absence of any data as to the condition of the boiler in this respect, comparison with any "similar case of collapse" was clearly impossible.

Two prominent facts appeared to be clearly established—First, that a safety valve formerly on the boiler had been removed, leaving one valve only, which according to Mr. Longridge could only be loaded to 58 lb., and would probably blow at considerably less than this on account of the width of the face. Secondly, the pressure of steam in the boiler immediately before the explosion was seen to be 70 lb. by the gauge attached to the boiler.

No explanation was obtained as to why so high a pressure should have been reached in a boiler intended to be worked at 40 lb., and the safety valve of which would blow at considerably less than 58lb. even if the weight had been placed at the end of the lever. There appears to be no reason to suspect that the safety valve had stuck fast in its seat, and the question therefore arises, had the valve been deliberately tampered with by the unfortunate fireman in his endeavours to stop the noise of the escaping steam, which had been complained of; or was the safety valve deficient in area, as appears to be suggested by part of Mr. Longridge's evidence?

On the whole we cannot regard the inquiry into the accident with any degree of satisfaction. The construction of the boiler will be readily understood from the annexed sketch.

The boiler after the explosion fell from a great height and completely staved in, so that its appearance conveys little information concerning the accident. There is no room to doubt, however, that the vertical fire-box gave way, a great rent being torn in it.

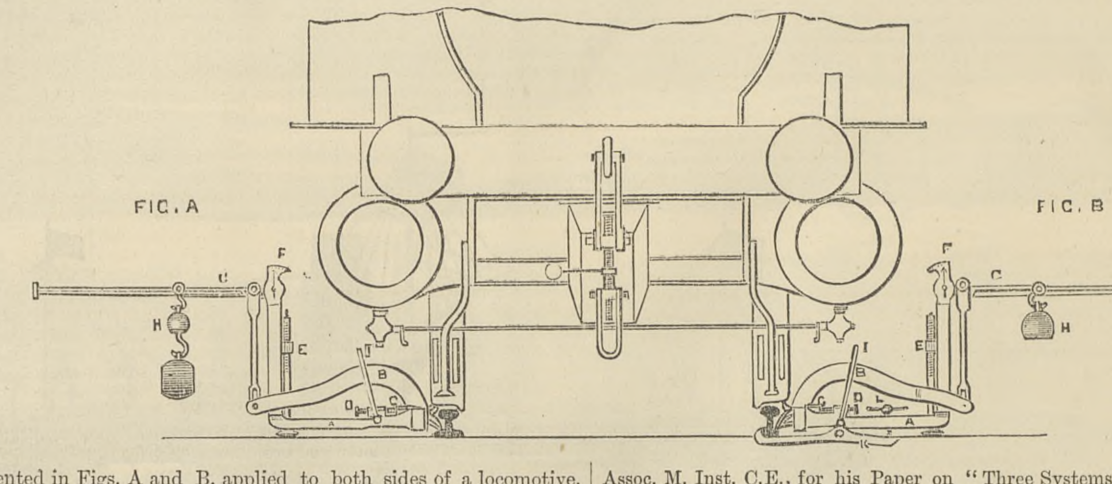
THE FAURE SECONDARY BATTERY.

IT cannot be said that there has been any delay in bringing this battery before the public. Hardly had the interest excited by the letters in the *Times* been raised, before boxes of these cells are brought over to England and exhibited in action before scientific audiences. Last Saturday at the *conversazione* at King's College, a number of cells were used to supply the current required by some score or so of Swan lamps. An evening or so later the battery was used at the house of the president of the Royal Society, when both Swan and Maxim lamps were rendered incandescent by its means. On Wednesday morning several scientific men witnessed experiments made at the rooms of the British Electric Light Company, Heddon-street, with the Lane-Fox lamp, the current being supplied from the Faure battery. These experiments, although they do not decide the economical question, do show that certain progress has been made. With this apparatus certain changes are obtained in the materials used under the influence of a current from a dynamo machine in a voltaic battery. The exact chemical change is as yet probably undecided, but whatever it might prove to be, the material under the new conditions is in such a state that whenever required it will undergo another change, and give back, so to speak, an electric current similar to that which caused the first change. So far as we can gather, the best cells are those which after use show pure spongy lead on one electrode and pure peroxide of lead on the other. Originally the cell consists of two plates of lead, coated as uniformly as possible with a thin layer of red lead, separated by a piece of felt and rolled into a cylindrical shape. This is placed in a jar and acidulated water poured in to completely moisten the felt. A new form of cell is about to be adopted in which the plates of lead will be flat, because it has been found that however great care may be taken to spread the red lead evenly in rolling, the red lead does not remain in its original place, so that the coating on the plates is uneven. There is still much to be done to obtain the true scientific and commercial value of this secondary battery. For example, the question of durability is as yet unsettled, because the invention is so recent. M. Faure has, however, some of those first made, and they are as good now as when constructed some months ago. Sir W. Thomson and Mr. Bottomley are still engaged in the investigation, and the results thus obtained, together with those we may expect when the battery has been practically in use for a short time, and not merely used for exhibition purposes, will go far to enable us to judge the real value of the invention.

EHRHARDT'S PORTABLE LOCOMOTIVE WEIGHING APPARATUS.

WE illustrate herewith a weighing apparatus very largely used on the Continent, though little used in this country. It is intended for the exact adjustment of the weight on the axles of locomotives, tenders, and railway carriages. The following are some of the advantages claimed for this apparatus over the platform weighing machines:—(1) Its portability, as it can weigh trucks, locomotives, tenders, carriages, &c., at the place where they are made or loaded, and thus avoid the labour and loss of time in moving the loaded trucks to the machine; (2) the great saving in prime cost, no foundations being required; and (3) its greater exactness than the three-table machines now used for ascertaining the weight on each axle of a locomotive, whereas this apparatus gives the exact weight on each wheel.

Two machines, which weigh each about 100 lb., are repre-



sented in Figs. A and B, applied to both sides of a locomotive. The makers give the following instructions for using it: "Place one such apparatus under each wheel with the lower part *a*, which at the same time serves as main-frame, resting with its claw on the bottom flange of the rail, and the lever *b*, whose fulcrum is on the main frame *a*, touching the under side of the tire with its front edge. After setting each apparatus plumb by the screw *e*, you advance the wedge *c* by the screw *d*, until the lever *g* gets above the horizontal line to a certain angle. This angle, upon which depends the height to which the wheels are to be lifted from the rails, is shown by the index on the figured arched scale which is above the plummet *f*. If these apparatuses are placed under all the wheels of a locomotive or wagon, and if the levers *g* of all apparatuses are at the same angle, which is indicated by similar figures on the arched scale, you then move the weights *h* on the lever *g* until the index fingers of all apparatuses on the arched scale are brought to *o*. Each wheel is now at the same height from the rail, say one to two millimetres, and the respective weights on each axle can then be read off in kilos. or any other weights from the scale, which is arranged on the upper surface of the lever G. The difference in the weights indicated by the several apparatuses show most accurately the inequality in the load and tension of the bearing springs above the respective wheels, and the same can therefore be regulated surely and easily. The sum of these weights of the various apparatus gives exactly the total weight of the engine or wagon which underwent the above test. When used with "double-headed rails" the foot lever *k* and screw *l* are required as shown at Fig. B."

For loads of 37 cwt. to 145 cwt. they are provided with a single scale on the lever, and with a movable weight on the latter, but for loads of 15 cwt. to 32 cwt. and of 32 cwt. to 150 cwt. a double scale is provided on the lever, and a large and a small weight, both of which are movable. The smaller weight serves to indicate the load from 15 cwt. to 32 cwt. on the one side of the weighted lever, and both weights, the one suspended from the other, will indicate the load from 32 cwt. to 150 cwt. on the other side of the lever.

The machines are made by the Sachsische Maschinenfabrik Chemnitz, the English agents being Messrs. James Scott and Son, 10, Tib-lane, Cross-street, Manchester.

A report speaking in the highest terms of the practical value and successful working and economical results attending the use of the machine has been made to the Committee of Administration of the State Railways of Belgium by the engineer, Mr. Gustave Braet.

MAP OF THE DERBY SHOWYARD.

WE publish this week, as a supplement, a map of the machinery department of the Royal Agricultural Society at Derby. The arrangement of this map differs from that which we have adopted in previous years, and will we think be found an improvement. It will be seen that the whole map is divided into small blocks, each distinguished by a letter. The names of exhibitors are arranged alphabetically, and each is accompanied by a letter indicating the block in which the stand of the exhibitor is situated, and by a number which is that of the stand. The search for any given exhibitor is thus reduced to the simplest possible process, the locality of any given stand being defined within the small limits of the dimension of the block in which it is situated.

THE INSTITUTION OF CIVIL ENGINEERS.

THE originality, labour, and ingenuity displayed by the authors of some of the communications submitted to this Society during the past session have led the Council to make the following awards:—

FOR PAPERS READ AT THE ORDINARY MEETINGS.

1. George Stephenson Medals, and Telford Premiums, to Thomas Forster Brown and George Frederick Adams, MM. Inst. C.E., for their Paper on "Deep Winning of Coal in South Wales."
2. A Watt Medal, and a Telford Premium, to John Isaac Thornycroft, M. Inst. C.E., for his Paper "On Torpedo Boats and Light Yachts for High Speed Steam Navigation."
3. A Telford Medal, and a Telford Premium, to Theophilus Seyrig, M. Inst. C.E., for his Paper "On Different Modes of Erecting Iron Bridges."
4. A Telford Medal, and a Telford Premium, to Max am Ende, Assoc. M. Inst. C.E., for his Paper on "The Weight and Limiting Dimensions of Girder Bridges.
5. A George Stephenson Medal and a Telford Premium to Benjamin Baker,* M. Inst. C.E., for his Paper on "The Actual Lateral Pressure of Earthwork."
6. A Telford Premium, to Richard Henry Brunton,† M. Inst. C.E., for his Paper on "The Production of Paraffine and Paraffine Oils."
7. A Telford Premium, to Charles Colson,† Assoc. M. Inst. C.E., for his paper on "Portsmouth Dockyard Extension Works."
8. A Telford Premium, to Christian Hendrick Meyer, Assoc. M. Inst. C.E., for his Paper on the "Temporary Works and Plant at the Portsmouth Dockyard Extension."
9. A Telford Premium, to Benjamin Walker, M. Inst. C.E., for his Paper on "Machinery for Steel-making by the Bessemer and the Siemens Processes."
10. The Manby Premium, to Joseph Prime Maxwell, Assoc. M. Inst. C.E., for his Paper on "New Zealand Government Railways."

FOR PAPERS PRINTED IN THE PROCEEDINGS WITHOUT BEING DISCUSSED.

1. A Telford Medal, and a Telford Premium, to Professor Dr. J. Weyrauch, for his Paper "On the Calculation of Dimensions as depending on the Ultimate Working Strength of Materials."
2. A Telford Premium, to James Richard Bell, M. Inst. C.E., for his Paper on "The Empress Bridge over the Sutlej."
3. A Telford Premium, to John Lewis Felix Target,† M. Inst. C.E., for his Paper "Experiments on Modules for Irrigation Purposes."
4. A Telford Premium, to William Thomas Henney Carrington, Assoc. M. Inst. C.E., for his Paper on "Three Systems of Wire Rope Transport."

FOR PAPERS READ AT THE SUPPLEMENTAL MEETINGS OF STUDENTS.

1. A Miller Prize, to James Bernard Hunter, Stud. Inst. C.E., for his Paper on "Wood-working Machinery, as applied to the Manufacture of Railway Carriages and Wagons."
2. A Miller Prize, to Matthew Buchan Jamieson, Stud. Inst. C.E., for his Paper on "The Internal Corrosion of Cast Iron Pipes."
3. A Miller Prize, to Thomas Stewart, Stud. Inst. C.E., for his Paper on "The Prevention of Waste of Water."
4. A Miller Prize, to William Henry Edinger, Stud. Inst. C.E., for his Paper on "Brick and Concrete and Concrete Gasholder Tanks."
5. A Miller Prize, to Daniel Macalister, Stud. Inst. C.E., for his Paper on "Caissons for Dock Entrances."
6. A Miller Prize, to Lindsay Burnet,‡ Stud. Inst. C.E., for his "Description of a Cargo-carrying Coasting Steamship, with detailed investigation as to its Efficiency."
7. A Miller Prize, to Edward Walter Nealor Wood, Stud. Inst. C.E., for his Paper on "The Improvement of the Old Harbour at Holyhead."
8. A Miller Prize, to Arthur Stuart Vowell, Stud. Inst. C.E., for his Paper on "Steel; its Chemical Constitution and Behaviour under Tensile Strain."
9. A Miller Prize, to William Marriott, Stud. Inst. C.E., for his Paper on "Boilers."

BOILER EXPLOSIONS.—We have had occasion recently to point out that it was possible a boiler explosion might be caused by the sudden withdrawal of a large volume of steam from it. If the *Pittsburg Commercial* is to be credited, an experiment has been carried out which confirms our views. It thus describes an experiment made on the 16th of June:—"Mr. Lawson exploded his boiler yesterday through the medium of a vacuum created by turning a full head of steam into the cylinder at once. The boiler itself was made of the very best material, and built especially for the experiment in the strongest manner known. It was 6ft. in length, with a diameter of 30in. The iron was made by Singer and Nimick, the boiler itself by W. W. Roberts, and the fittings by Wilson, Snyder, and Co., the latter firm also furnishing the engineers for the test. Just about five o'clock everything was ready for the explosion. At that time the boiler was three-fourths full of water, being 7in. or 8in. above the fire line, and the steam gauge showed a pressure of 380lb. to the square inch, the tensile strength of the boiler being 604 lb. to the square inch. Everything being in readiness, the spectators safely ensconced in the bomb-proofs erected by the Government, the valve was pulled, and a full head of steam turned into the cylinder. Instantly there was a terrific explosion. The ground trembled as if from an earthquake shock, and in a moment there could be heard a rattle on the bomb proof. Mr. Lawson and one or two others waited only a few moments, and stepped out just in time to catch a shower of dirt and grime. Scarcely a vestige of the boiler and furnace was left. It was found that the boiler had been completely demolished. It had not given away merely in one point, but had been torn into fragments with a force that must have been tremendous. Fragments of the boiler, not more than a foot long and four or five inches wide, were found in different places. The fragments all showed that the iron was of an extraordinary good quality, and the force that rended it was of tremendous power."

* Has previously received a Telford Medal and a Telford Premium.
† Have previously received Telford Premiums.
‡ Has previously received a Miller prize.

RAILWAY MATTERS.

The prime cause, says a United States contemporary, of most of the railway accidents of to-day is broken rails. Steel rails do not seem to show a greater percentage of breakage than did iron rails formerly, but a railway authority reminds us that both railway mileage and railway traffic have enormously increased within the past few years; trains and engines have been increased in weight, the average speed is higher, and during the past winter the cold has been extraordinary.

It may be remembered that recently an engine-driver on the London and South-Western Railway died from being burnt by the flames from the furnace of his engine rushing through the fire-hole door. A memorial has been sent by the men to the chief inspector of the line and the locomotive superintendent, asking that the fire-hole doors should be so constructed as to prevent a similar calamity occurring through the faultiness of the engines. A promise has been made that the defect should be remedied. The legal notice required by the Employers' Liability Act has been given to the company.

Elevated railroads are now entitled to rank among American institutions, and in the future will call for a large consumption of iron. There are, according to the *Iron Age*, three schemes of this character under discussion in St. Louis, U.S., and the only question is, which shall be adopted? Philadelphia is making good progress in following the example of New York. Brooklyn encounters an obstacle, partly arising from the configuration of the surface, which favours the construction of tunnels, but the city is in desperate need of some form of rapid transportation. Boston hesitates, apparently on account of objections to architectural disfigurement.

The Scinde, Punjaub, and Delhi Railway ran, during the Afghan campaigns, up to December 31st last, 652 special trains, carrying 471,970 troops and followers, 105,656 horses, ponies, and mules, 15,408 bullocks, 8645 camels, 470 guns, artillery, and engineers' carriages, 140,570 tons of commissariat, ordnance, and military stores, and 78,405 tons of material for the frontier railways. This large number of men and animals had been carried without a single accident of any importance, and as a consequence of the success of the arrangements made by the traffic manager, Mr. Ross, that gentleman has had the Companionship of the Order of the Indian Empire conferred upon him.

The evidence given by Mr. Menelaus, of Dowlais Ironworks, before the Select Committee on Railway Charges, is of interest. He stated that the Dowlais Company last year raised over one million tons of coal, using half, and selling half. They sent away over the railway 106,000 tons of finished steel, 51,000 tons of iron, and 19,000 tons of pig iron, spiegel, and scrap. They sent over the railway 590,000 tons of coal, and including everything, 767,000 tons, or 2480 tons per day. In the same period they received 417,000 tons of Spanish ore, and of coal and coke 145,392 tons, and of pitwood, 13,000 tons. Dowlais pays 1s. 8d. per ton for its coal to Cardiff, and 1s. 11d. for its Spanish ore to Dowlais, and the tolls per week amount to £4183.

The Government inspection of a new single line railway has just been completed. The line branches off at the Appledore station of the Rye and Hastings branch of the South-Eastern Railway, sixty-five miles from London, and passes through or by the villages of Snargate, Brenzett, Old Romney, Mydley Chappel, and the ancient town of Lydd, where there is a station, to a point about 100 yards north-east of Dungeness Lighthouse. The railway is to serve the purposes of dispersing more easily the agricultural produce of the Romney Marsh, which it almost evenly divides, giving access to beds of shingle, now largely used in concrete buildings, and accommodating the artillery and rifle practice grounds owned by the War-office. It will probably be opened for public traffic in the course of the present month.

According to the *Diaro Official*, railroad making in Mexico is being pushed on with great rapidity, upwards of 40,000 men being employed on the numerous new lines now in process of construction. General Grant's contract for the line from the city of Mexico to the frontier of Guatemala, which on its way will throw out several branches, has been approved by the Chamber of Deputies. The line, which is to be completed within ten years from the date of the contract, is to be built without subsidy, but the company will have the right of way and the free importation of all articles needed for the construction of the road during the period of construction and for twenty-five years after completion. The tariffs can be raised up to a point at which they will yield a net revenue of 10 per cent. on the capital of construction, and the Government retains the right to purchase the line at the expiry of ninety-nine years, paying in cash its actual value.

From the time an old rail arrives in the yard at a United States rolling mill until it is converted into a new rail it is handled thirty-one times. The process, according to the *American Manufacturer*, is as follows:—It is first unloaded from the car, then picked up and run on a set of rolls to the shears, then cut up, when cut piled into fagots, then loaded on to a barrow and charged into furnace, heated to a welding heat, then hauled out and placed on iron bogies, run to weighing rolls, handled six times until finished to a bloom, then returned to the bogie, carried to a re-heating furnace, brought to a welding heat, then returned to the rolls on a bogie, passed through the rolls nine times, then run to saws, where both ends are cut off at once, then laid on the cooling bed; when cooled placed under the straightener, which takes out all minor crooks. The burr on the end is then filed off, when the rail is inspected, then taken to the punching machine and fitted for fish plates, thence to the slotting machine, where it is slotted for the spikes; then the rail goes on the benches in the yards, and from thence to the cars.

Of steel rails the American *Iron Age* last received says:—"There has been a good deal of business done during the week, but at a very wide range of prices. A sale of 2500 tons, for summer delivery, was made at about 63 dols. at mill, with other sales from that down to 56 dols. at mill. For summer delivery 62·50 dols. and upward is quoted, and orders are hard to place. Foreign rails are offered at about 61·50 dols. to 62·50 dols., according to port, for July and August shipment, and several lots taken at about 62 dols. For winter delivery there has been some pressure to sell, and one Pennsylvania mill has taken an order from a Southern road at about 56 dols. for 20,000 tons. The rapidly increasing capacity for production leads manufacturers to fill up as largely as possible, and it now seems likely that at anything above 56 dols. buyers will take hold very sparingly, unless their necessities are urgent. Iron rails are active and sales are reported at 46·50 dols. to 51 dols. per ton at mill, according to section. Old iron rails are steady, but with few sales, holders asking 27 dols. to 28 dols. per ton in Philadelphia, while buyers are disposed to hold back for lower prices."

About noon on Saturday a collision took place on the Lancashire and Yorkshire Railway at the Kirkgate Station at Wakefield. Twenty-five persons were injured, some damage was done to the rolling-stock, and the traffic was interrupted for about a couple of hours. It seems that about the time named the Lancashire and Yorkshire 12.3 passenger train from Wakefield to Manchester was just about to move off from the platform side at the west end of the station when a special train, consisting of a number of horse-boxes, entered the station from the west, or Manchester end. The driver of the horse-box train ran past the home signal, which it is said was against him, and the buffers of his engine caught one of the buffers of the engine attached to the passenger train. The last-named engine (No. 361) was thrown off the metals, and the force of the collision caused the coupling chains to break, and the carriages becoming detached from the engine, which was thrown off the line, ran towards Normanton. They were quickly stopped, when it was ascertained that about twenty-five of the occupants had received slight injuries, chiefly about the head and face. All the passengers were able, after a short delay, to proceed on their journey, or to return to their homes.

NOTES AND MEMORANDA.

According to an American exchange, if iron is placed in a furnace and completely covered with soot, the temperature then raised to a red or white heat, and continued for fifteen or thirty minutes or longer, according to the mass of iron to be operated upon, and then removed from the furnace and allowed to cool, the surface will be found thoroughly cleaned, and covered with a coating which is impervious to rust under ordinary circumstances.

The greatest feat ever accomplished in telegraphy is the transmission of the whole of the New Testament to Chicago from New York, which was accomplished in less than seven hours. The operators started on four wires at 5.30 p.m., and additional wires were employed until at 9 p.m. no fewer than 20 were in use, and at 12.20 a.m. the last word was sent. It is certainly a great feat, but it would be interesting to learn how many errors were made, for even the best regulated telegraphs are apt to blunder at times.

The *Archiv der Pharmacie* gives the following formula for making paper for wrapping up silver:—Six parts of caustic soda are dissolved in water until the hydrometer marks 20 deg. Beaume. To the solution add four parts of oxide of zinc, and boil until it is dissolved. Add sufficient water to bring the solution down to 10 deg. Beaume. Paper or calico soaked in the solution and dried will effectually preserve the most highly polished silver articles from. the tarnishing action of the sulphuretted hydrogen which is contained in such notable quantities in the atmosphere of all large towns.

According to the *American* a series of experiments have been carried on in Ohio, near Pittsburg, under the auspices of the national Government, which casts light on the true cause of boiler explosions. The theory reached by the new experiments is that the withdrawal of a quantity of steam from the upper part of the boiler creates a vacuum, and to fill this the superheated water flashes into steam, which strikes the boiler-top with such an impact as to rend it. The pressure may be such as the boiler could resist if it were steady and equable. Instead of this it takes the form of a blow more violent than that of a trip-hammer. The experimenters believe that this danger can be met by making an adjustable separation between the part of the boiler from which steam is drawn into the cylinder, and the rest.

When making some experiments under the direction of M. Chevreul, M. Niepce de St. Victor, who tried helio-chromic experiments on a large doll bedecked with jewels and resplendent with coloured silk, made the remarkable discovery that black is not the mere absence of light, but is entitled to be considered a colour of itself, and has a special chemical action of its own. The colour of the sensitive plate was violet, and on this the camera impressed all the colours of the doll, including white; but as the blacks had also been impressed as black, it led to this experiment:—A hollow tube, black from the absence of light, was presented to the camera, together with another article of a definite black colour, with this result, that the former was represented by an unaltered state of the original violet colour of the surface, while in the latter case a very deep black resulted.

According to a report of the director of the United States Mint lately issued, the total gold circulation of the United States, including bullion in the Treasury, amounted, at the commencement of May, to 520,000,000 dollars, of which about 264,000,000 dollars were held as Treasury and national bank reserves, and 256,000,000 dollars were in actual circulation. There has been a total gain of gold coin and bullion to the country since July, 1879, of 234,000,000 dollars, of which 35,000,000 dollars was added to the Treasury, 59,000,000 dollars to the banks, and 140,000,000 dollars to the active circulation. The total amount of gold in the country makes a fair showing compared with the principal countries of Europe, being exceeded only by two. The amount estimated to be in England in 1880 was 596,000,000 dollars, of which 428,000,000 dollars was in actual circulation; and France, with 927,000,000 dollars of gold, had a circulation of about 816,000,000 dollars. The larger proportion of gold in active circulation in the latter two countries the director attributes in part to the fact that their coinage consists most exclusively of denominations of less value than 5 dols. The English sovereign is equivalent to 4·86½ dols. of American money, while in France, out of a total coinage during the last 77 years of 1,743,288,000 dols. of gold, nearly 99 per cent. was in pieces of less than 5 dols.

One of the American contributions for the Electrical Exhibition at Paris will be a modification of Mr. Edison's magnetic separator for the treatment of iron sand found in large quantities on the south shore of Long Island and in other localities on sea coasts. According to Mr. Batchelor's statement to the United States *Evening Post* the Long Island sand contains 26 per cent. of the finest iron known. Innumerable attempts have been made to separate the sand, and magnetic plates have been used before, but with no success on account of the presence of what is known as titanite iron, a substance which spoils iron. Edison discovered that titanite iron was less magnetic than the pure iron particles, and constructed his separator with that fact in view. The sand falls a distance of 4ft. in a thin stream from a slit in a V-shaped box holding about a ton. Under this box is a receiver divided into two compartments, the dividing partition being placed nearly under the slit in the sand reservoir and parallel to it. If no magnet is brought into play the sand all falls into one side of the box; but when a powerful magnet is brought near enough to act upon the falling shower, the pure iron particles are deflected in their fall and fly on the other side of the partition. The particles of titanite of iron are not attracted equally with the iron and are not deflected sufficiently to fall into the compartment with the pure iron. A company has been formed for the extraction of iron from Long Island sand, and is now at work with its first machine at Quogue, near Moriches, on the Great South Bay. This machine, which cost 700 dols. to make, is managed by one boy, who keeps six men and two carts busy bringing sand for his hopper. It treats, we are told, one hundred tons of sand a-day, producing about twenty tons of pure iron, costing one dollar a ton to produce and selling for six dollars.

Mr. F. E. Kidder has recently performed a series of experiments at the Massachusetts Institute of Technology, having for their object the determination of the moduli of elasticity and of rupture in small beams of white spruce—*Abies alba*—and such other information as might be derived from the data obtained. The results of these researches are embodied in a paper read before the American Academy of Arts and Sciences and printed in the current number of the *Journal of the Franklin Institute*. The conclusions drawn from the results of the experiments are as follows:—The modulus of elasticity depends not only upon the elasticity of the material, but also upon the length of time that the load is applied. When subjected to loads not exceeding one-sixth of the breaking weight, spruce beams do not take a permanent set; but even under very small loads, if applied for any length of time, there will be a temporary set. Knots and gnarls in beams loaded at the centre, when not within one-eighth of the span of the centre of the beam, do not materially affect the elasticity under small loads. Deflection is very nearly proportional to the load, far beyond the customary limits of the strain, and the modulus is consequently very nearly constant for all moderate deflections. A high modulus of elasticity does not always accompany high transverse strength. In spruce beams the upper fibres begin to rupture by compression under about four-fifths of the breaking weight, and the neutral axis, at the time of rupture, is very near the centre of the beam, as shown by the fracture. Beams which are subjected to severe strains for a long time, bend more before breaking than those which are broken in a comparatively short time. The modulus of elasticity of small spruce beams, of a quality such as is used in the best buildings, may be taken at from 1,600,000 lb. to 1,700,000 lb., and the modulus of rupture at 11,000 lb.

MISCELLANEA.

A new code of boiler rules, containing suggestions and rules for owners and tenters of boilers, has just been compiled for use by the South Staffordshire Institute of Mining Engineers. The best provisions of the Manchester Association and similar bodies in Germany, France, and America, have been laid under contribution.

In accordance with a resolution recently passed at Sir Josiah Mason's Science College, the Birmingham Town Council have invited the British Association to hold its meeting of 1883 in Birmingham. On the same occasion, trustees alike for the Mason Orphanage and for the College were appointed by the Council to act with those appointed by the founder himself.

A new iron hopper steamer of 600 tons, built and engined by W. Simmons and Co., Renfrew, was launched complete on the 30th of June from their works at Renfrew. It has been constructed under the direction of Sir John Coode, C.E., for the harbour works at Colombo, India. It is named "Perseverance," and is the second special hopper steamer supplied by this firm for these operations.

Messrs. James and Samuel Spencer—agents for Mr. John Spencer, the Tube Works, West Bromwich—3, Queen-street place, Cannon-street, E.C., have gained a gold medal at the Melbourne Exhibition for their anti-corrodo tubes and fittings, coated by Barff's rustless process. This is in addition to the jurors' award of the First Order of Merit, and is the only gold medal awarded for tubes.

The Japanese papers report that a new palace for the residence of the Mikado is about being built at Yeddo, which will be entirely of wood, and will cost 5,600,000 yen (nearly £1,120,000). There will be, however, a grand reception hall, in which all grand State ceremonies will be performed, which is to be built partly of tiles and partly of wood, at an estimated cost of 170,000 yen (about £34,000).

Messrs. G. Bray and Co., Leeds, are about to light Piccadilly with their patent street lanterns. Nearly two hundred of these lanterns have been purchased by the several lighting authorities in London, and are in use at the crossings. They were, we understand, the first flat flame lanterns of high lighting power ever introduced, and seem to be the only lanterns which have made a successful stand against the electric light.

The use of Fletcher's annular furnaces is extending rapidly—the Westinghouse Brake Co., which adopted this system in its London Works about a year ago, now has two, and a second has just been started at its Paris works, and there is one at the Pittsburgh manufactory. Each furnace is for a Morgans' patent crucible of 60 kilo. capacity, and when it is remembered that a pot of gun-metal can be fused readily within the hour, it is easy to calculate the present melting capacity at these works.

The Birmingham Corporation are resolved upon another somewhat extensive outlay on public works. The Finance Committee has already been authorised to borrow £21,000 for the erection of the market house, the covering in of the Smithfield vegetable market, and other works. They lately invited tenders for the erection of shops and other buildings on the market frontage in Jamaica-row. Of the three Birmingham architects who tendered, Messrs. Osborne and Reading, of Bennetts Hill, have secured the work at a cost of £14,000. This raises the sum to be expended on the whole improvement to £35,000.

The Horsely Engineering Company, Limited, of Tipton, have obtained the contract for the whole of the ironwork and apparatus required for the erection and completion of the Tipton new gas works. There will be two 70ft. telescopic gasholders, and all other machinery to correspond. The total weight of iron in the whole apparatus is about 700 tons. The works will, in the first instance, be capable of producing about sixty million cubic feet of gas per annum, and the arrangements will admit of the capabilities being doubled with the least possible outlay. They will include all the latest improvements in gas-making, and it is expected that they will be in operation in March next. This new works is for one of the four districts which were formerly supplied with light by the Birmingham and Staffordshire Gas Company, but which have been severed from it since the property of the company was purchased by the Birmingham Corporation.

There arrived in Cardiff on Saturday morning, on the completion of her trial trip from the Tees, the steamship Anjer Head, which has been completed by Messrs. Raylton, Dixon, and Co. of Middlesbrough, to the order of Messrs. Angier Brothers, of Bishopsgate-street, London, being the second vessel of her size which has been built for this firm by the above-named builders. She is a boat of 286ft. over all, by 36ft. beam, and 24ft. 6in. depth of hold, having a gross tonnage of 2015 tons and carrying capacity of 2900 or 3500 tons measurement. She is in every respect a very first-class merchant steamer, being built in excess of Lloyd's highest class; has iron main deck, and upper deck of pitch pine; water ballast in fore and main holds, and under boilers. Her engines, which are by Messrs. Thos. Richardson and Sons, of Hartlepool, have given most satisfactory results, as the vessel made the run to Cardiff from the Tees in 62 hours, an average of nearly 12 knots per hour.

An important improvement is, says the *American Manufacturer*, about to be made at the Henry shaft of the Lehigh Valley Coal Company, near Wilkes-Barre, Pa. There is a slope in the mine whereby the coal is hoisted from a lower vein. The pumping engines are located at the foot of the shaft, and the steam for working these engines and the engine at the slope, is run through pipes from the boiler room above the ground. The amount of steam thrown off and the heat from the pipes make it extremely warm in the mines. The steam also interferes somewhat with ventilation. On account of these causes the *employés* suffer much inconvenience. It is expected to overcome the sources of complaint by using air as a motive power. The compressors will be situated at the head of the shaft, and the air will be conveyed through pipes to the engines in the mine. The work of putting up the compressors has been begun, and they will soon be in readiness. The ventilation will then be improved to a great extent, and the temperature of the mine made much more pleasant for the workmen.

Lord Coleridge has recently decided that a steam tricycle is a steam engine within the Locomotives Acts, 1865 and 1878. An appeal came before him from the decision of Mr. Marsham, the police magistrate at Greenwich, in which he held that the steam tricycle recently invented by Sir Thomas Parkyns was within the provisions of the Highways and Locomotive Acts of 1865 and 1878. The machine was fully described in the case, and it appeared that it was capable of travelling at the rate of ten miles an hour, without any escape of steam, or showing any indication of being driven by steam. The machine in question is an ingenious invention, consisting of an ordinary tricycle with the addition of three metal boxes, containing a complete steam engine, a condensing apparatus, and a reservoir containing methylated spirit, which is designed to be used for the generation of steam. The magistrate was of opinion that the machine in question was not within the mischief contemplated by the Acts, but considered himself bound to convict on clauses 3 of the Act of 1865 and 28 of the Act of 1878, in which "locomotive" is defined as "a locomotive propelled by steam, or by other than animal power," and he inflicted a nominal penalty of 1s. Mr. Mellor, Q.C., and Mr. Channell were for the appellant. Mr. Mellor argued that these statutes were penal statutes, and that as the tricycle was found not to be within the mischief of the Acts, it ought not to be held to be within them; and he pointed out that the requirement to travel not more than two miles an hour, and to have three persons in attendance, would prevent the use of the machine. Mr. Leese, for the respondent, was not called upon. Lord Coleridge gave judgment in his favour, thinking the case came within the Act.

THE LICHTERFELD ELECTRIC RAILWAY.

MESSRS. SIEMENS AND HALSKE, BERLIN, ENGINEERS.

(For description see next page.)

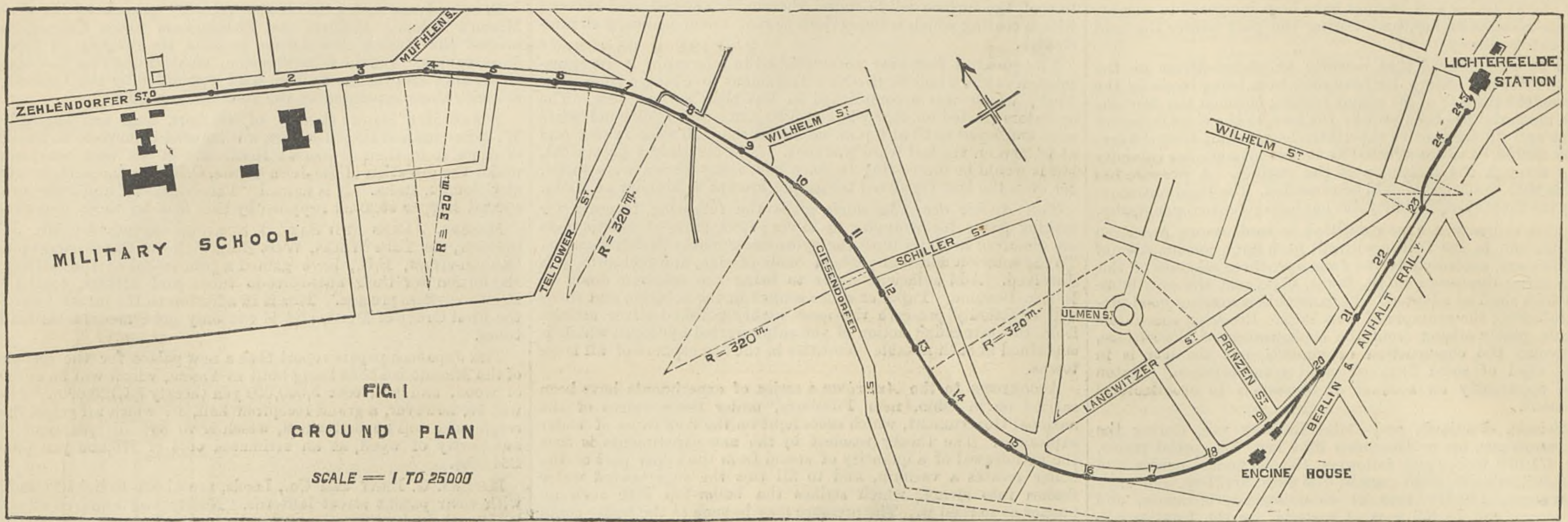
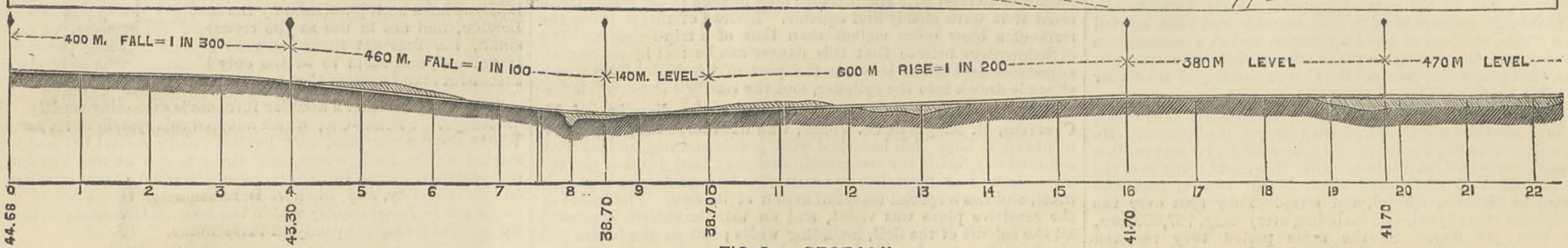


FIG. 1
GROUND PLAN
SCALE = 1 TO 25000



HORIZONTAL SCALE = 1 TO 100.000 FIG. 2 SECTION VERTICAL SCALE = 1 TO 10.000

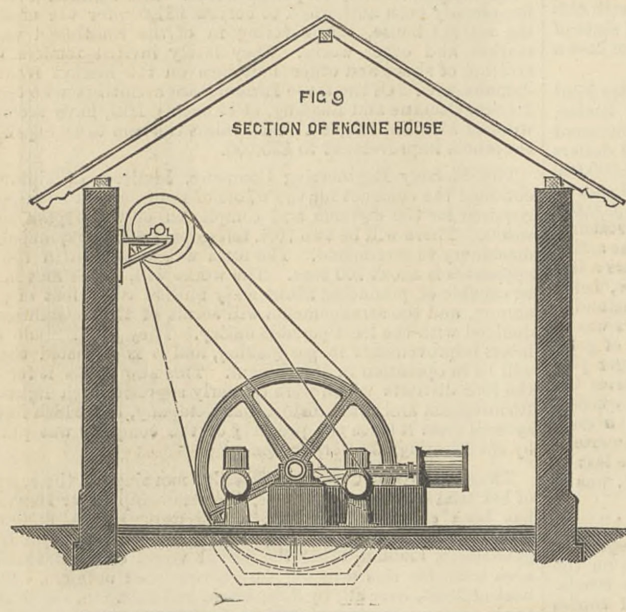


FIG 9
SECTION OF ENGINE HOUSE

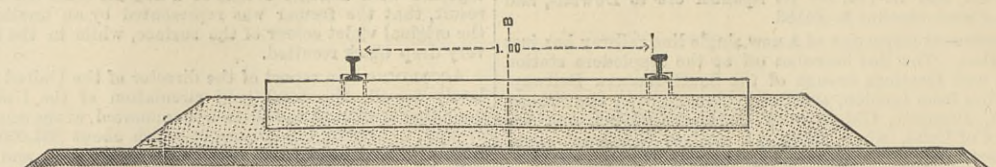


FIG. 3 SECTION ON THE OPEN ROAD

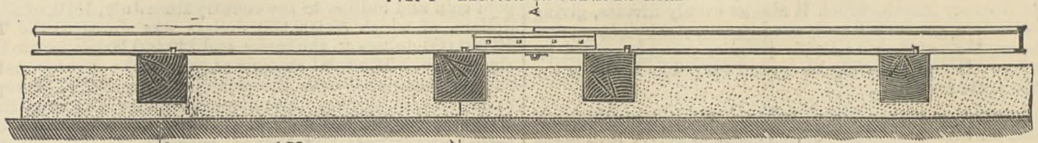


FIG. 4 LONGITUDINAL SECTION AT A.B.

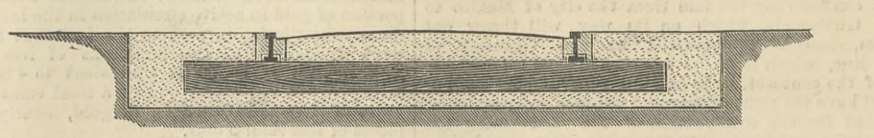


FIG. 5 SECTION AT CROSSINGS AND ON THE HORSE-ROAD

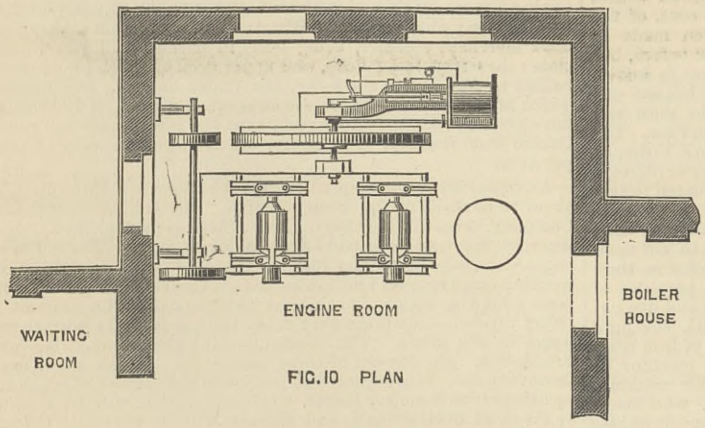
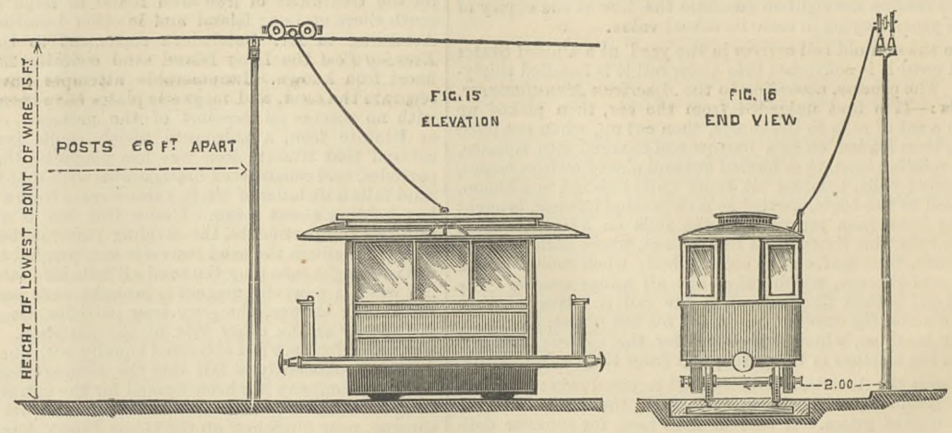


FIG. 10 PLAN



VIEW OF INSULATED WIRE TRAMWAY

FIG 6 CROSS SECTION. STATION 2

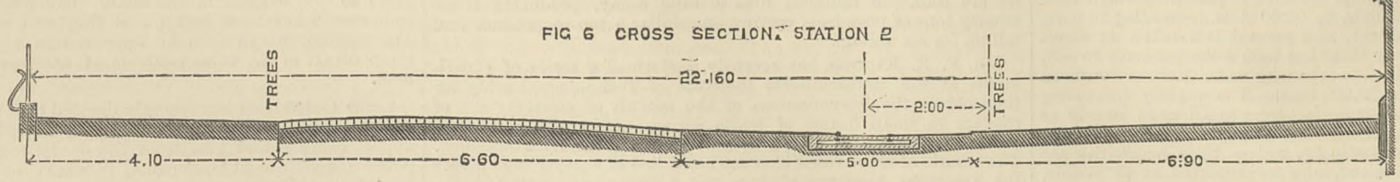


FIG. 7 CROSS SECTION. STATION 6

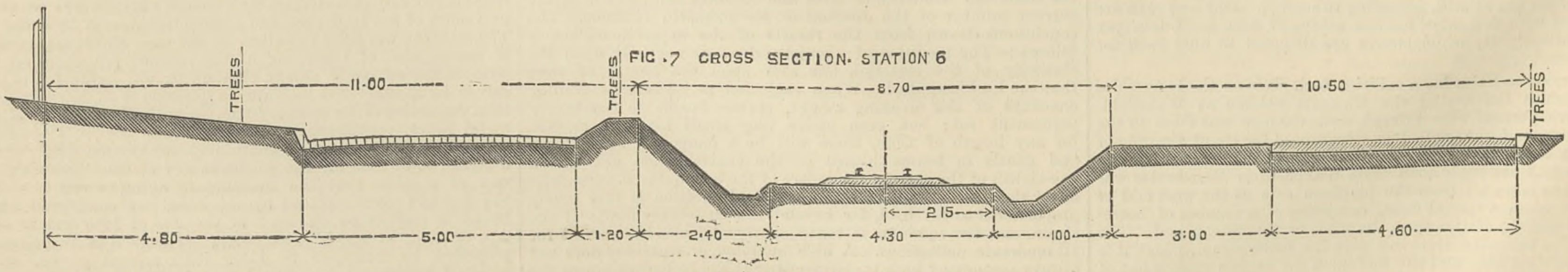
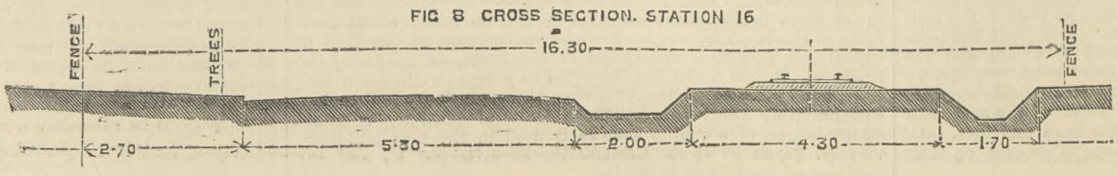


FIG 8 CROSS SECTION. STATION 16



THE LICHTERFELD ELECTRIC RAILWAY.

MESSRS. SIEMENS AND HALSKE, BERLIN, ENGINEERS.

SECTION THROUGH THE ROTARY ENGINE

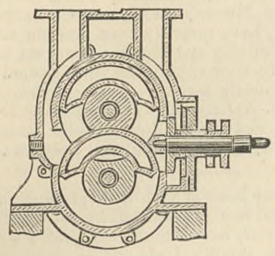
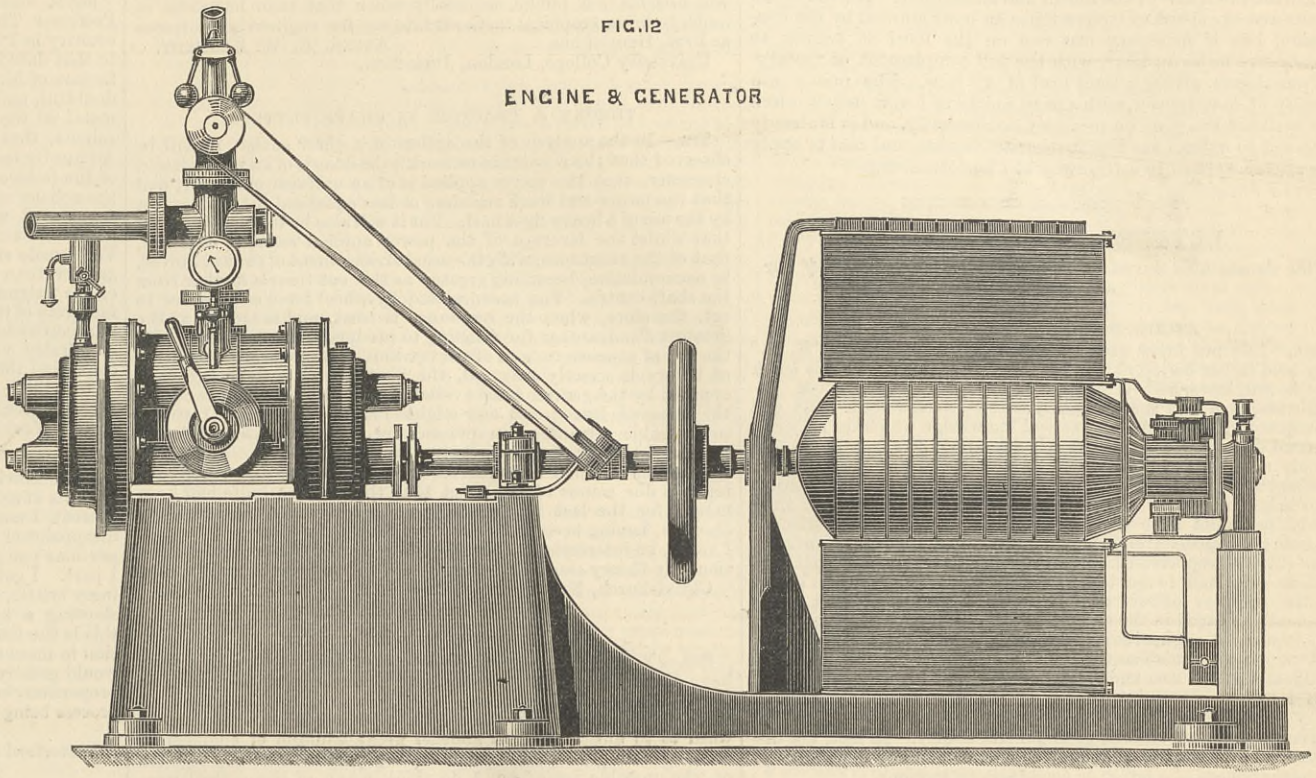


FIG. 11

FIG. 12

ENGINE & GENERATOR



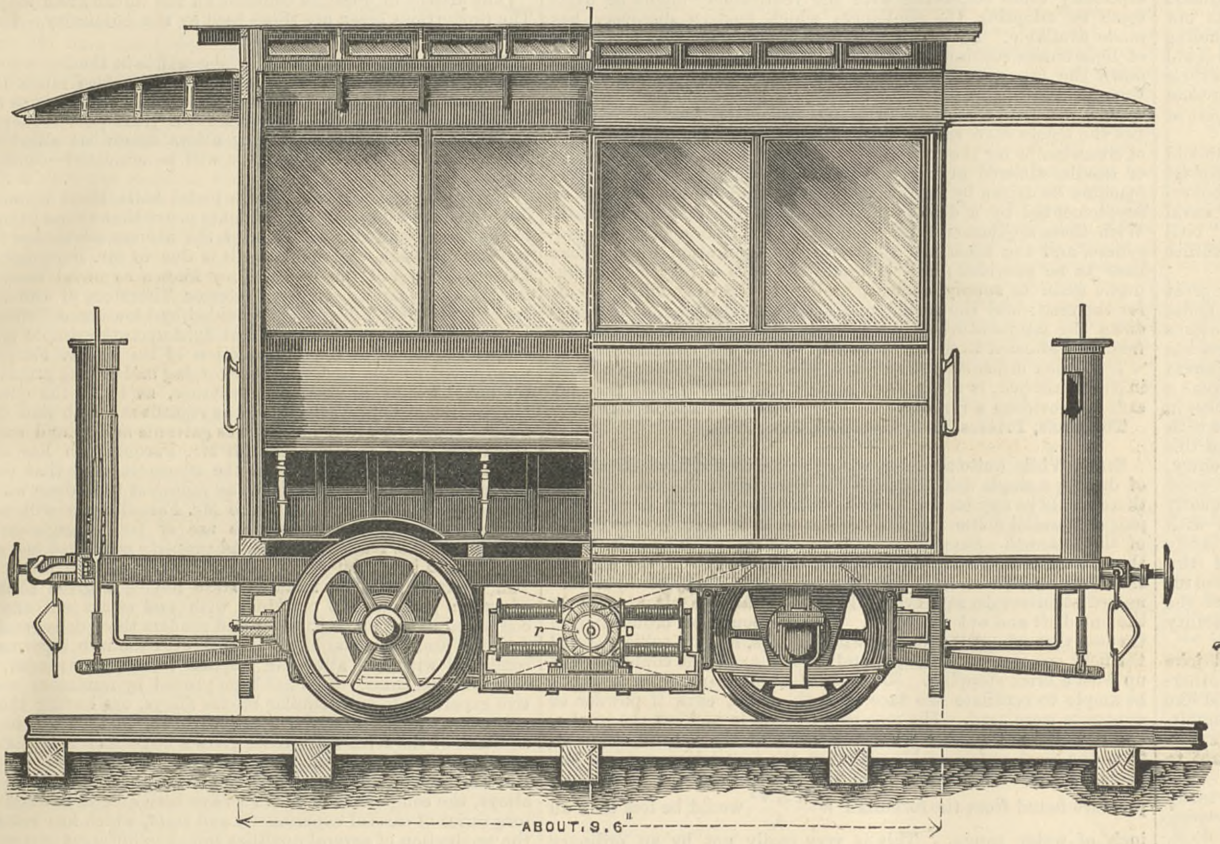


FIG. 13 SECTIONAL ELEVATION OF CARRIAGE

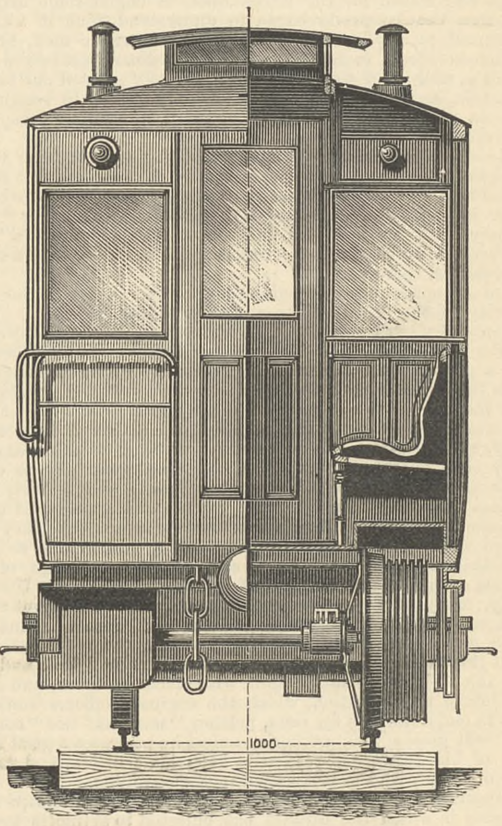


FIG. 14 SECTIONAL END VIEW

THE LICHTERFELD ELECTRIC RAILWAY.

THE following account of this railway, the opening of which has lately attracted so much attention, is condensed from a paper read by Dr. Werner Siemens before the Verein für Eisenbahnkunde, on 21st May last.

The laying down of this line grew out of a concession made to Messrs. Siemens and Halske, to lay an electric railway in the Friedrichstrasse at Berlin. This was found impracticable; but the firm, sooner than allow the honour of the first electric railway to be lost to Germany, determined on building a short line at their own cost, and cast about for a suitable locality. This was found at the Central Military School, recently built, which, during its building, had been connected by a short line of railway with the Lichterfeld station of the Berlin and Anhalt Railway. The earthwork of this railway was still in place, and with the consent of the various authorities it was utilised for the laying of the electric line. This line, although placed on the ground, was, however, arranged throughout with a view to the requirements of a line raised on posts, such as had been originally intended, in order that the experiment might be a conclusive one as to the working of such a line. Thus the two rails were chosen as the conductors for the forward and the return current, although this necessitates special insulating arrangements. The principle of the Siemens electric railway—as successfully applied at the Berlin and Düsseldorf Exhibitions—is now well known. A dynamo-electric machine—the generator—driven by a steam engine, sends a current of electricity through some metallic conductor—in this case the rail—to a similar machine—the motor—mounted on wheels, to which it is coupled by mechanism. The electric current rotates the motor, and through it the wheels whereupon the train moves. The two machines being similar, either of them is able to act as a generator or as a motor; and thus if the train be propelled by any other means—*e.g.*, in running down an incline—the motor becomes a generator, and sends back electricity to the original generator, by which it can be converted into useful work. The result is that in practice the motor machine always generates a current of a certain strength, which goes in the opposite direction to the driving current and diminishes its effects. The amount of this diminution varies with the speed at which the train travels, being less—within the limits of practice—as the speed is higher, and *vice versâ*. As a consequence of this, it is found in practice that definite relations exist between the inside conductors, the coils of wire within the machine, and the outside conductors, and that the resistance of the last should not be higher than the resistance of the machine itself, otherwise the loss of effect is increased. Hence, with a given machine, it is necessary to have conductors, which, however varied in form, do not give a resistance exceeding this limit. Hence there is an obvious convenience in making use of the rails, which are always of section so large that even in a length of some miles their resistance does not exceed that of the wires in the machine. If separate wires are used their section must be increased at intervals by affixing additional wires or otherwise, which can be accomplished without any practical difficulty. This method, however, involves an increased expenditure of force, due to the increased section, and it is therefore desirable to find some other method of keeping the resistances within the proper limit. For this purpose, instead of diminishing the resistance of the conductor, we may increase the resistance of the machine, by using longer or thinner wires for the electro-magnets and induction coil. The whole question of designing the apparatus of an electric railway is thus rather economical than technical. But it must be remembered that currents which have to overcome a high resistance require a high degree of insulation. On the Lichterfeld line the small power required made the question of insulation less important, and it is worked in fact with a known and determinate amount of loss, due to the front end being on the street itself.

Should special means of insulation be required many are available, the choice varying according to circumstances. In a line elevated on posts, and resting on wooden sleepers, these latter form an insulation in themselves. In a line laid upon the ground, but so that the rails rest usually on the sleepers only, and are only exceptionally in contact with the ground, the experience at Lichterfeld shows that, even in a length of several kilometres, no special means are required; but chairs of glass, ashphalt insulators between rail and sleeper, and ashphalt coatings for the rails, have all been tried with success. Where, however, the line is actually laid in the street such means are insufficient; a wire tramway hung from insulators on the telegraph posts must then be resorted to, as in Fig. 2. A small trolley running on this way, and connected by a wire to the carriage, keeps up the electric communication. By this means the electric system may be applied even to tramways; while in tunnels, or where great speed is required, light rails may be substituted for the wires.

The question often asked, whether in an electric railway two trains may be on the road at once, may be answered in the affirmative. It is only a question of properly proportioning the resistance of the outer conduction to that of the machine. In fact a service of frequent light trains is specially suited to the electric system, since the motor is not in itself, as in the case of steam, a ponderous object. The general arrangements of the line are shown clearly in Figs. 1 to 8. In Fig. 4 is shown the mode of jointing the rails; in addition to the ordinary fish-plates light strips of iron are rivetted on the bottoms, passing from one rail to another, and forming an electrical connection. In Fig. 5 is shown the cross section at crossings, &c., in Figs. 6, 7, 8 the detail of the cross sections at the three stations, No. 2, 6, and 16. The horizontal steam engine, shown in Figs. 9 and 10, belongs to the pumping station for the Lichterfeld water supply, and is only used provisionally. The motor to be used permanently is a rotary steam engine of Dolgorouke's patent, as shown in Figs. 11 and 12. We shall not give a full description of this engine at present, as it is not yet at work. It will be seen, however, that it consists of a casting in the form of a double cylinder, within which rotate two rotary pistons. Two such castings are placed end for end, so as to form a twin machine, with pistons at 180 deg. interval; by this means the balancing of the strains, which has always been a difficulty with rotary engines, is provided for. The parts are so arranged and so exactly fitted that no packed joints are needed. The rapidity of rotation makes the engine specially suitable for making a dynamo-machine.

Figs. 13 and 14 show the carriage, which resembles an ordinary tram-car, but carries between the two axles a dynamo machine. The current is conducted from the rails into the wheel tyres, and from them to strips of metal fixed on the wooden bodies of the wheels. On these strips rest springs, which are themselves prolongations of the two poles of the machine. The wooden bodies completely insulate the tyres from the axles, and no other metallic parts of the car come near the electric connections. The car is provided with an electrical regulating apparatus, in place of the mechanical apparatus used at the exhibition railways, and with another apparatus which at once governs the speed within certain limits, and prevents accidental interruptions of current.

It was foreseen from the first that the proper insulation of the rails was not possible in the part laid upon the street; here, therefore, a suspended wire tramway, as already described, and as shown in Figs. 15 and 16, is provided.

The electric railway is at present working regularly in connection with the trains of the Berlin and Anhalt line. The trains run at the average speed of twelve miles an hour allowed by the concession, but if necessary can run on the level at twenty to twenty-five miles an hour, with the full complement of twenty-six passengers, giving a total load of 4·8 tons. The motor can develop 5½-horse power, with a dead weight of less than half a ton. The working has gone on perfectly satisfactorily, and it is already proposed to extend the line further to Steglitz, and also to apply the electric system to a tramway at Charlottenburg.

LETTERS TO THE EDITOR.

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

ENGINE-ROOM ARTIFICERS, R.N.

SIR,—I do not know what position your correspondent "E. X." may hold in her Majesty's service, but it is evident from his letter that he can know little or nothing of that of which he writes.

His assertion that the Admiralty entered mechanics in 1868, and subsequently, to supply the practical knowledge which the majority of naval engineers lacked, is simply false upon the face of it, as is plainly shown by the class of men selected for entry—namely, mechanics without sea-going experience. Had that "practical knowledge" of which "E. X." writes been really required, their Lordships would have been compelled to try to get experienced sea-going engineers from our mail steamships instead of entering men—fitters, coppersmiths, smiths, boiler-makers, and pattern-makers—who had to be taught their practical engine-room duties by the engineer officers of the Navy. I may state that I was personally engaged in the entry and examination of candidates for appointment as engine-room artificers, and that I have, since that, had to examine merchant service engineers for Board of Trade certificates of the first and second classes, and I can positively say that I have never met with any of the engine-room artificers on entry who have been equal to the merchant service engineers in respect to practical knowledge or general ability. In fact, not one in ten had ever started a donkey engine, or had any experience of the management of a boiler or machinery in motion.

The real reason for the introduction of engine-room artificers was, that the Admiralty began to understand that it was not economical to employ a large number of scientific men, holding position as officers, to do the work which ordinary mechanics could do just as well; and this fact was frequently pointed out to their Lordships, several naval engineers choosing rather to resign than serve on in a subordinate and bad position, without prospect of promotion.

I do not intend to define what a practical naval engineer should be, as there are many various opinions on the subject; but I must confess that I cannot admit that an ordinary fitter, smith, or boiler-maker is entitled to be called a "practical engineer," or "naval engineer," any more than I can admit that a navvy is a "civil engineer," a scavenger is a "sanitary engineer," or that a collier is a "mining engineer."

I am not opposed to the engine-room artificers, nor is the great majority of the naval engineer officers opposed to them. Quite the contrary; but I object to their claims being advanced by means of false pretences. That the entry of engine-room artificers has been a great success is due to the fostering care of the engineers of the Navy, the large majority of whom would gladly welcome a large increase in the number of the artificers, and a reduction in their own numbers. But to enable this to be effected at once with safety, a better class of men should be entered at first; and this better class can only be obtained by giving better pay on entry, better messing and washing accommodation, and a fairly good pension. The engineer officers of my acquaintance would gladly see some system instituted which would supply the Navy with trained engine-room artificers, to whom a watch could be safely entrusted; or who would have some little knowledge of the working of boilers and engines before being sent to sea. Unfortunately, many of them are sent to sea far more ignorant of the management of machinery than the stokers; hence their inability to keep a position of authority over the men.

But this is not all. Many of the artificers will talk and joke with the stokers on duty; drink with them on shore, and otherwise injure their position, which the engineer officers would like them to maintain. As for rank, neither "warrant" nor "commission" will give a man authority unless he possesses a good knowledge of his duties, self-respect to keep his position, and tact to carry on duty with the stokers without quarrelling.

Respecting the question of watch keeping, I have known many instances in which the captain has objected to artificers keeping engine-room watch, and the engineer officers have had to do it, watch and watch, *i.e.*, six hours on duty, and six hours off, as occurred to myself for several months some years ago, until, in fact, another assistant engineer was applied for, and sent out; but I have never heard of a single case of engineer officers objecting to artificers keeping watch in the engine-room.

I would suggest that in order to effect a very large and immediate reduction in the number of engineer officers, the artificers should have their pay raised on entry to 6s. per day, a decent mess place with washing accommodation provided for them in common with the writers and schoolmaster, and their old rank of "next after the warrant officers" be restored to them. I have no doubt large numbers of good workmen would leave the dockyard factories, and enter the Navy, which would be far better for the service than recruiting from the "wasters" of private factories, and getting men of whose antecedents nothing can be known. The scale of pension should also be revised and increased, so that the artificer should know exactly how much he would be entitled to after any number of years' service. Furthermore, in case of being invalided through injury on duty, special pensions should be awarded for life, irrespective of length of service.

If these suggestions were carried into effect, the number of engineer officers may be safely reduced by at least 200 without prejudice to the service; and this is not only my own opinion, but that of many other officers of long service, and of most, if not all, of the junior engineer officers. EXPERIENCE.

June 27th.

NOTATION OF RECIPROCAL DIAGRAMS.

SIR,—Discussions as to priority of publication or invention are somewhat disagreeable, but the matter which I wish to mention to you is one of sufficient importance, I think, to justify me in bringing forward such a subject. In a review of Mr. Chalmers' book on "Graphical Statics," last week, you drew attention to what was called Mr. Bow s notation for reciprocal stress diagrams. I fully agree with your reviewer as to the value of that notation—it is simply the direct expression of the reciprocity, and it appears not too much to say that without it reciprocal diagrams would have no chance of coming into practical use. I do not in the least wish to deny Mr. Bow's originality in devising it, nor the great extent to which it has been used in consequence of his book, but it is only right to say that it had been not only used but published by my colleague, Prof. Henrici, some time before the "Economics of Construction" appeared. The date of Mr. Bow's work—of which we have for a long time hoped to see the continuation—is October, 1873. Prof. Henrici, after having used the notation for some time, brought it before the Mathematical Society in April, 1871, in a discussion upon a paper by Prof. Crofton, of Woolwich, on "Stresses in Warren and Lattice Girders." It will be found referred to in the "Proceedings of the Mathematical Society," vol. 3, p. 233. I believe I am right in saying that the notation, as Henrici's, had made its way into actual use in several important institutions before the publication of Mr. Bow's book. In saying this, of course, I have not the slightest intention of questioning that it was separately devised by Mr. Bow; but still, if it is to bear any name, it seems right that it should receive that of the man who first made it public, especially when that man has done so much to bring graphical methods into use for engineering purposes as Prof. Henrici has. ALEXR. B. W. KENNEDY.

University College, London, June 25th.

THEORY *v.* PRACTICE IN CHAFF CUTTERS.

SIR,—In the analysis of the action of a chaff cutter, it will be observed that the resistance or work to be done is of an intermittent character, that the power applied is of an uniform character, and that the power and work are more or less equalised in this respect by the use of a heavy fly-wheel. But it will also be further observed, that whilst the leverage of the power applied remains constant, that of the resistance, with the usual arrangement of convex knives, is accumulative, becoming greater as the cut travels farther from the shaft centre. The accumulated fly-wheel force commences to act, therefore, when the resistance is least, and is applied at the greatest disadvantage for assisting to produce uniform motion. By the use of concave instead of convex knives, however, the condition of things is exactly reversed, the greater resistance being then opposed by the greater force available, and the lesser resistance by the lessened force; and one might reasonably expect, I think, considerable advantage in practice by their adoption. I lately suggested the use of concave knives to one of the leading English firms noted for their manufacture of chaff-cutters, and received a reply in due course to the effect that the concave knife had been known for the last fifty years, and that it was almost entirely obsolete, having been superseded by the convex knife. It would, I think, be interesting to others besides myself to hear an explanation why theory should so entirely differ from practice in this case.

Christchurch, New Zealand, May 20th. W. A. COMBER.

THE CHANNEL TUNNEL SCHEME.

SIR,—Your very interesting account of this undertaking must have disappointed a good many people who, like myself, have no other interest in the success or failure of it further than an intelligent desire to see accomplished what has been looked forward to in anticipation as another great triumph of engineering skill. It would be presumption on my part to offer any opinion on the probable issue, yet I do think many of the difficulties—especially those connected with the ventilation—might be overcome by adopting the appliances which modern discovery has made available. Let there be a double tramway with a number of light trucks continually running up one side of the heading and down the other, and let the trucks be driven by electro-motors through the medium of the metals on the Siemens principle, with a powerful dynamo-machine at the open end of the heading. Let the trucks each carry a Swan lamp, and let there be a number of Swan lamps for the men to work by in addition, but no oil lamps or candles allowed in any part of the heading. Let the cutting machine be driven by pneumatic pressure, and let the exhaust be supplemented by a direct air supply from the pneumatic main. With these appliances there would be no vitiation of the atmosphere, and the necessary allowance for respiration would alone have to be provided; and it would not take a very large pneumatic main to supply enough, and more than enough fresh air for the men; and the cooling of the air, on expansion, would keep down the temperature of the heading, while I think the foul air might be allowed to find its own way out of the cutting.

The other difficulty you point out, of the men striking a fault in the chalk bed, is a far more serious contingency, and past my skill in providing a remedy. ROBERT RENTON GIBBS.

The Elms, Princes Park, Liverpool, June 29th.

SIR,—While quite agreeing with you as to the impracticability of driving a single drift through the Channel, I do not see that there would be any insurmountable difficulty met with in driving a pair of parallel drifts from both sides so as to meet in the centre of the Channel. Supposing the intended tunnel to be 28ft. wide, then a pair of drifts 7ft. square could easily be driven, one on each side, leaving 14ft. of solid rock between them. They could be connected at intervals, say, every fifty yards, and the air brought in the one drift and out the other. The air could be brought from the last throughout to the face with brattice, as in a colliery, until the next one was put through, and then the old one could be built up with a brick stopping. 3000 cubic feet of air per minute would be ample to ventilate the face of both drifts, even if powder or dynamite were used. The men could travel in and out the intake, and it would not matter what the state of the return was. To take the most unfavourable point for the ventilation, suppose one pair of drifts, eleven miles from the shore, then the ventilating pressure found from the formula $P = \frac{K S V^2}{A}$ would be less than an inch of water gauge. This is very easily got by an ordinary centrifugal fan. At many collieries there is a water gauge of 3½in. The amount of work is very good, but when it is compared with the work that is done every day in our collieries, it is not so remarkable as at first sight it would seem. In a place 8ft. wide and 7ft. high two men hew and fill into wagons 12 tons of coals during eight hours. Supposing them to work continuously, this would be 240 cubic yards of material hewn by manual labour in a week; and this does not fall so very much short of what was said to have been done by the machine. All this coal is removed out of the place by a single line of rails, and this could be easily done in the tunnel. All that would be required would be an ordinary tail-rope haulage. The quantity to be removed is only 30 tons in each shift of eight hours, and this could either be run out in one or two races, in both cases the tubs being collected in the return till the race was made up. The speed would not require to be more than five miles an hour. As for the sudden flooding of the drift, there need be no danger if proper precautions are taken. All that would be necessary would be to keep a bore-hole 10ft. or 12ft. in advance of the face. If any fissure were met, the water would only come through this bore-hole. An air-tight dam could be made, and air pumped in, and the pressure kept up till the water was "tubbed" back, and then the work could go on as before.

When the two pairs of drifts were joined, it could be widened out to the width of the tunnel in the middle, and worked to both sides, the ventilation continuing as before. This would be better than bringing the air right through the tunnel, as the workmen would always be working in fresh air, and the travelling road would always be fresh.

This system of working would be very much better than any system of pipes, or even than driving the tunnel its full width, as it would be impossible to get a division so nearly air-tight as the rock in its natural condition.

Although the ventilation, while the tunnel is being driven, is very simple, it will be no such easy matter to ventilate it when trains are passing through it. The air will require to travel two and a-half times as fast as in the Mont Cenis tunnel to produce the same result, and it will take more than thirty-nine times the power to do it. Supposing the air in the Mont Cenis tunnel to travel at the rate of 5ft. a second—a common speed in coal mines—the speed in the Channel tunnel would require to be 12½ft. a second in order that the air in the tunnel should be renewed in the same time—about every two and a-half hours. If we suppose the area of the cross-section of the tunnel to be 392 square feet, and the perimeter 80ft., there will be 2360-horse power in the air. Our best ventilating machines at collieries do not give more than 50 per cent. of the power applied, so that 4720-horse power will be required. ROBT. THOS. MOORE, B. Sc, C.E.

Rutherglen, June 29th.

THE ADMIRALTY AND NEW ALLOYS.

SIR,—I would ask your permission to be allowed to make a few remarks on the article which appeared in your publication on "Muntz's Metal *v.* Naval Brass." If accurately made Muntz's metal is superior in every respect to the alloy now known as "naval brass." This is not a new alloy discovered either by Professor Thurston, of New York, or Mr. Farquharson in this country in 1874, as it was patented in 1864, although long previous to that date it was well known to those acquainted with the manufacture of Muntz's metal. The advantage of the discovery was so doubtful, and the character of the alloy as compared with Muntz's metal so thoroughly understood by those acquainted with the subject, that the manufacture of what is now supposed by the Admiralty to be a new discovery, has practically ceased. The cause of the failure of defective Muntz's metal in the manner described in the article referred to, is perfectly understood by those who are acquainted with its manufacture, and such failure never takes place unless either the mixture or the treatment has been inaccurate. The tensile strength and ductility of good Muntz's metal are both greater than in naval brass. This company being the successors of the original patentee of Muntz's metal, and the largest manufacturers of it in the world, have recently been making naval brass in accordance with the Admiralty specification, and we believe for Admiralty use, and the further experience thus gained has only confirmed the opinion previously formed on the subject.

J. ALBERT MUNTZ, Managing Director.

Muntz's Metal Sheathing, Bolt, and Patent Solid Brass Tube Works, French Wall, near Birmingham, July 4th.

SIR,—Having seen in your issue of 24th inst. proportions of components of naval brasses, and being in want of a good tough metal at present, I made some on trial, but I must say that I was greatly disappointed at the result, though I strictly adhered to the proportions you gave, viz., copper, 62 parts; spelter, 37 parts; and tin, 1 part. I got two ingots cast, both of which I found to be exceedingly brittle, breaking easily with a slight blow of a hammer, and showing a highly crystalline appearance at fracture. Whether this is the fault of the proportions or of want of special manipulation in manufacture, I am at present unable to determine. You would greatly oblige by letting me know if you are sure of above proportions being right, and also if you are aware of any special process being necessary in manufacture.

EDWARD BARRY, Loco. Supt.

Waterford and Limerick Railway, Limerick Terminus, July 4th.

[The article in question contains all the information we possess. The proportions given are those used by the Admiralty.—ED. E.]

SIR,—The subject embraced by the article in the last number of THE ENGINEER under the above title is one of so much interest that I venture to offer a few observations, and to add some further information upon it, having for several years past been engaged in perfecting and manufacturing alloys somewhat allied to the kinds treated of with—as I think will be admitted—considerable success.

As regards the failure of Muntz metal bolts, there cannot be a doubt, as the Admiralty experiments prove that the addition of tin to the copper and zinc alloys is of the utmost advantage in preventing corrosion, and much credit is due to Mr. Farquharson for having discovered the useful alloy known as naval brass. The investigation carried on by Professor Thurston, of the Stevens Institute of New York, who was aided by Lieutenant Tobin of the United States Navy, threw a great light upon the simple alloys of copper and zinc, but the introduction of tin by Mr. Farquharson so adjusted as not to destroy the forging and rolling properties of the metal was of far greater importance, as by it the quality of the metal was not only improved as regards strength and density, but its character altered as regards galvanic action and corrosion. With the three metals to which Mr. Farquharson has confined himself, I believe he has made the strongest alloy that could be produced; but there was something more yet to be done which has been accomplished—as I feel sure Mr. Farquharson will admit—by the discovery I made in the use of ferro-manganese. The addition of this metallic compound properly combined has a most marked and beneficial effect in all the bronze and brass alloys. The manganese in its metallic state having a great affinity for oxygen, a portion of it combines with and clears out any oxides contained in the melted metals and renders them dense and homogeneous, and the remainder, together with the iron, is permanently combined with the alloy and imparts increased strength, toughness, and hardness. This has been proved by numerous comparative experiments with similar bronze alloys, one having the ferro-manganese added and the other without, and in all cases the addition of the ferro-manganese gives a large increase of strength with a corresponding augmentation of hardness and toughness. But all these qualities are still further developed in certain special alloys, the compounds of which I have been able to determine by a long series of careful experiments and tests, which has resulted in the production of several qualities suited to different purposes, and known by the name of manganese bronze, large quantities of which are now being manufactured and used for a variety of purposes. For tensile strength, the quality of manganese bronze employed is somewhat allied to Mr. Farquharson's naval brass, but the addition of manganese enables more tin to be incorporated, and it thus more nearly approaches gun-metal in character, but it greatly surpasses both in strength and toughness; it can be rolled and forged hot, and drawn cold. Plates and bars made of it when annealed have an average tensile strength of 30 tons per square inch, and stretch 40 per cent. in length before breaking; when rolled cold, the tensile strength goes up to over 40 tons, with an elastic limit of more than 30 tons, and an elongation of 12 to 15 per cent.; by further rolling and cold drawing as much as 70 tons per square inch have been obtained.

Plates, angle bars, and rivets of this metal were supplied for a torpedo boat built for the Admiralty under contract that they should stand the Admiralty test for steel; and I think I am correct in saying that this was the only bronze or brass metal which stood this test successfully, and it was adopted accordingly. For castings other qualities are manufactured possessing great transverse strength and toughness, and employed for various purposes. The strongest of these was subjected to a series of tests in the presence of Mr. Farquharson on the part of the Admiralty, in comparison with the best gun-metal that could be produced, the bars being 1in. square and resting on supports 12in. apart. With a steady pressure applied in the centre the gun-metal bars broke with 2912 lb., but it required 6048 lb. to break the manganese bronze bars, and they sustained nearly 1 ton before any permanent set could be detected. Steel bars subsequently tested took a permanent set with about 10 cwt., though the ultimate strength was about the same as the manganese bronze. The same bars subjected to impact gave the following results, the distance between supports being the same, viz., 12in., and the weight 50 lb. dropped on the centre of the bar from a height of 5ft.: The gun-metal bars broke with seven to eight blows, the manganese bronze bars sustained from thirteen to seventeen blows, while the steel bars broke with only three. The ultimate bend of the manganese bronze bars was in each case in excess of the gun-metal, and about four times that of the steel.

These tests determined the Admiralty to adopt the manganese bronze for the propellers of the Colossus, the castings of which are now nearly completed, and it has also been extensively adopted for propellers in the mercantile marine, as well as in various parts of the engines and for machinery generally. As the use of a bronze material for propellers is quite a new feature in vessels of commerce, I may perhaps be allowed to point out some of the reasons which have led to its introduction, and the advantage it possesses over steel. First, the blades can be made very considerably thinner, the surface is beautifully smooth, and the form of the blade is preserved true to its theoretical shape, whereas in steel the surface is rough and the form is always distorted by the annealing process they have to undergo. These advantages certainly increase the speed of the vessel; but another important point is their durability and ultimate economy. The life of a steel blade does not average more than three years. I have seen some that had to be replaced in less than two; this is in consequence of the pitting and corrosion to which they are subject, whereas the manganese bronze blades are in this respect practically indestructible.

The cost of the bronze blades is about double that of steel, so when at the end of three years the steel has to be renewed the cost would be the same as if the bronze blades had been adopted in the first instance, but every three years after this there is the additional cost of a new set of steel blades; whereas if the bronze blades are used there is none during the life of the vessel, and when the time arrives for the vessel to be broken up the bronze will always fetch 7d. or 8d. per lb., while the steel is practically valueless.

P. M. PARSONS.

Lombard-street, Southwark,
June 30th.

SAFETY VALVES.

SIR,—According to the way "Tommy Fair Play" writes in your issue of the 24th inst., one would imagine that the nickel was the "open sesame" about the pop valve he mentions, but I think had he made a valve of the same type as his nickel seated ones, the results would have been the same, unless there is some sympathetic galvanic action goes on between the steam and the nickel, which is not known to engineers at the present day. Had Mr. Fithian, when he made his experiments with the pop and the common valve, only used a more elastic spring and a flat seated-valve, it would have been impossible for the steam to rise more than 5 per cent., as this is the accumulation allowed by the Board of Trade, and hundreds of valves of the common type are passed through their hands every year by engineers, who either object to pay for a valve made by one of the regular makers, or like to do all their own work.

I have seen the so-called pop valve with the nickel seat under steam, and the lift and opening is very similar to what Mr. Fithian has in his report; but one thing he has forgotten to tell us, and that is, what pressure it lost from the time of opening till it closed, because in the one I saw it lost nearly 9 lb. before coming down to its seat again, and as this is a most important point to engineers who have to maintain a high speed, the pop valve will have to be improved a long way yet before being adopted. In all the valves that have come under my notice, but especially those of the three known makers, the lift has been about 1-24th of its diameter. This in a 3in. valve would give us an area opening of 1·17 against 1·75 of the pop valve, but those I speak of were flat-seated valves, and of course give a larger opening in proportion to their lift than the bevel seated one, which is the style of the pop valve I saw, and I have always found that if a valve lifted more than 1-24th of its diameter it did not come back to its seat unless with a much greater loss of pressure than is generally stated by safety valve makers to be the maximum reduction they allow. It is also due to Mr. Adams to say that the pop valve I saw was made in the very same style as his, with a slight addition of its own that does not make it work any better. "Chief Engineer" asked me in one of your late issues to give him the name of the makers of a better safety valve than Adams's. It is against my principle to push any firm's wares to the injury of another, but the firm I mean will come to the front all in good time, not only because of the working of their valves, but the handiness in setting when steam is up, without taking off the easing gear, or removing any heavy parts—a most important point to anyone that has the keeping of them in repair; they can be set in two minutes, and locked up complete ready for sailing.

"Tommy Fair Play" has opened up one or two important points anent safety valves, and he has my thanks for doing so, as I think the subject will bear a little further ventilation.

Liverpool, June 28th. BILLY PLAY FAIR.

LAW AND CLARK'S CIVIL ENGINEERING.

SIR,—The letter of Messrs. Crosby Lockwood and Co., in your last issue, makes it necessary for me to ask yet once more for space for a few lines in reply. When I wrote last year to Messrs. Strahan and Co.—whose name being on the title-page as publishers I had supposed actually to be such—Messrs. Lockwood informed me, in reply, that a new edition of the "Civil Engineering" had been entrusted to Mr. Clark, and was nearly all in type. Knowing that it was the earlier portion that I had written, any suggestions of mine would then have been too late, and I felt secure in the belief that, as Mr. Clark had not consulted me, my portion of the work had been left without any material alteration.

Messrs. Lockwood justify their having placed my several works in the hands of Mr. Young and Mr. Clark upon the plea that they thought I was dead, and they lay down the somewhat startling dictum that a publisher is justified in treating an author as dead—notwithstanding his name and address appear in the Post-office Directory—unless, as an act of "courtesy" he occasionally reports himself at the publisher's shop.

In the 150 pages, which are all that now remain of the "Rudiments of Civil Engineering," written by me, there are sixty-two errors—as you will see by the accompanying list—which were not in the original edition; a fact which I think fully justifies the remarks in my previous letters. As to the remaining 488 pages which I have not yet examined, I can say nothing.

Messrs. Lockwood having referred to Gregory's "Mathematics for Practical Men," it is only necessary for me to state that, in my opinion, the addition of about half-a-dozen notes, amounting in all to little more than half a page, hardly justifies Mr. Young in putting his name upon the title page in the conspicuous manner that he has done.

HENRY LAW.

5, Queen Anne's-gate, July 4th.

A POOR MAN'S PLEA FOR CHEAP PATENTS.

SIR,—Although I am but a poor man, and obliged to work hard to keep a large family, I am a considerable inventor. You may not have heard of me, but I can assure you I often knock off a couple of inventions in the course of the evening, when smoking my pipe after the wife has put the children to bed. I am in the habit of noting these things in a book, in the hope that, some day or other, I shall be rich enough to patent some of them. Were it not for the oppressive tax levied by a base and mercenary (so-called) Liberal Government upon inventors, I should long ago have been able to secure the sole right to a few of these ideas, and should, no doubt, have been riding in my carriage by this time. Sir, the patent laws of this country exist only for the rich, and almost every week I am doomed to see my brilliant ideas stolen from me by those who are better off than myself. For this reason the perusal of your weekly abstracts of patents fills me with rage and envy. In the very last number of THE ENGINEER I see notices of four inventions of mine, all of which will assuredly be a source of untold wealth to the respective patentees. One is for an umbrella, the frame of which revolves when it meets with an obstacle, and so escapes without injury, on the principle of the willow, which bends unharmed to the blast, whilst the stubborn oak is uprooted and destroyed. It is in vain to tell me that this is not new, and that it has been patented over and over again. I do not believe it.

Again, some time ago, whilst on an excursion in the country, I was much struck by the bowed and bent aspect of a poor old man who was breaking stones by the roadside. Is such degrading labour necessary, I reflected? I concluded that it was not, and by the application of a beautiful philosophical principle I invented a method of dividing stones into small fragments, by heating them and suddenly quenching the mass in cold water. I tried an experiment on a small scale with some of my children's marbles, and it answered admirably; but my hopes of fame and fortune are blasted by an announcement in your last number that someone else has taken out a patent for this very thing.

Once more—who has not deplored the vast expenditure of power requisite to draw a glass of beer in a public-house? Years ago I invented a system which, if carried out, would effect a revolution in the beer engine trade. I proposed to put the beer into a cylinder fitted with a loaded piston, which would force the liquid to any height, so that the only exertion required of the barman would be turning on of a tap. Alas, my idea has been patented by another, and is described in your last issue. A scoffing friend of mine, who believes in nothing, says that this was patented long ago by one Bramah—I think the name was.

I am also the inventor of a ruler running upon rollers for drawing parallel lines, which I see alluded to at p. 17. Some time after I had invented it, the sceptical friend above referred to took me to a shop window in which several of these instruments were displayed. I entered and protested against the robbery; but the only satisfaction I got was that the thing had been known for years past, and that it was actually patented just one hundred years ago in the name of Eckhardt. I need scarcely observe that I have my own opinion on the subject.

One more instance of the hardships of my position as a poor inventor and I have done. On p. 15 there is an account of a method of collecting the dust from grinding wheels by means of a fan. That also is my idea; but how do you think they attempted to rob me of my originality? They said that it was to be found in the Society of Arts "Transactions" fifty years ago, and that it had been tried at Sheffield, but the grinders objected because it did away with the unhealthiness of the trade and so tended to lower wages. Thus they contrived to put an affront upon me as an inventor, and also to insult me through my order.

But for the harshness of those cruel patent laws I should not be obliged to sign myself as I now do.

A POOR INVENTOR.

Camberwell, July 6th.

P.S.—Since writing the above I have invented two capital things. One is a bearing which requires no oil. I do away with the ordinary brasses and let the journal run on little wheels which revolve as the shaft goes round. The other is a castor consisting of a ball held in a sort of claw, so that the line of pressure passes directly through the centre of the ball. Of course you are aware that the ordinary furniture castor is constructed upon the most unsound mechanical principles. Each of these inventions would be worth a fortune if I only had a few pounds to go to the Patent-office with.

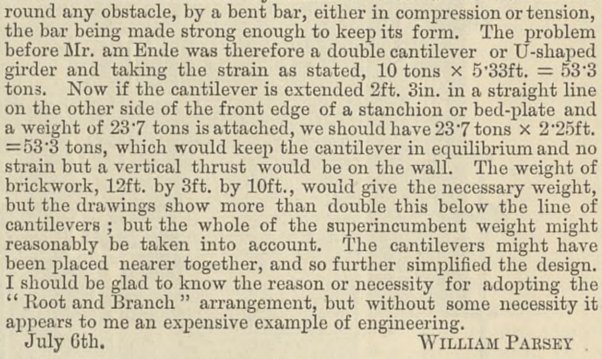
THE WROUGHT IRON GALLERY, TOWN HALL, READING.

SIR,—I have read with much interest the article on the above work in your last number, but it appears to me that although the design is well worked out, and the principles of the "Root and Branch" are correctly applied, the whole affair is made too much of, and that the object could be attained by much simpler means, less material and labour in construction, and of course less cost. The "Root and Branch" principle is very simply illustrated by the well-known mechanical device by which a force can be transmitted round any obstacle, by a bent bar, either in compression or tension, the bar being made strong enough to keep its form. The problem before Mr. am Ende was therefore a double cantilever or U-shaped girder and taking the strain as stated, 10 tons × 5·33ft. = 53·3 tons. Now if the cantilever is extended 2ft. 3in. in a straight line on the other side of the front edge of a stanchion or bed-plate and a weight of 23·7 tons is attached, we should have 23·7 tons × 2·25ft. = 53·3 tons, which would keep the cantilever in equilibrium and no strain but a vertical thrust would be on the wall. The weight of brickwork, 12ft. by 3ft. by 10ft., would give the necessary weight, but the drawings show more than double this below the line of cantilevers; but the whole of the superincumbent weight might reasonably be taken into account. The cantilevers might have been placed nearer together, and so further simplified the design. I should be glad to know the reason or necessity for adopting the "Root and Branch" arrangement, but without some necessity it appears to me an expensive example of engineering.

July 6th. WILLIAM PARSEY

PROPOSED BRIDGE OVER THE DOURO.

SIR,—In THE ENGINEER of July 1st your correspondent, Mr. Reilly, checks, by direct calculation, the results of some of the strains computed by the graphic method, and appears to think, because this is the case, that the primary strains calculated by him are correct. It is not a difficult matter to check by the graphic method the strains calculated in my last letter. Take, for instance, cases (b) and (c.) Through B draw the vertical B o, set off B v =



(750 × 55 × 50) = 855 tons, draw $v\,s$ at right angles to B o, then B s = the thrust on A B at B = 1060 tons, $v\,s$ = the horizontal strain at B = the thrust at C = 632 tons, or the same as those obtained previously. This, however, does not prove that I am correct in my method of treating the bridge as a whole; it only proves that these members are subjected to certain strains from a load acting in a particular manner, whether the strains are calculated by the graphic or other methods. What I contend is that Mr. Reilly is wrong in regarding the structure as consisting primarily of two great cantilevers, A_1 D C and F_1 H C, as the points A D and F H are not connected together in any way and the points B G are articulated, and that it ought to be considered as composed of two double cantilevers, D B C and H G C, supported on two inclined struts A B and F G. I think Mr. Reilly is somewhat confused by the moments about B, but have no doubt if he will construct a small model of cardboard weighted in a similar manner and having properly articulated points as in the bridge, it will illustrate to him the action of the loads more clearly than a written description could do. If Mr. Reilly does this, I hope he will forward the results to THE ENGINEER.

In my last letter, in case (e), I inadvertently used 112 tons—Mr. Reilly's figures—instead of 55 tons in the line above—a mistake apparent to any one reading my letter.

July 6th. A COMMON FIVE-EIGHT.

ON STEEL CASTINGS.*

By Mr. FRANK W. DICK.

IN this paper I propose to give a short description of the steel castings made at the Hallside Steel Works by the Terrenoire process. Although steel castings are known, appreciated, and largely used by many engineers, still it is a fact that at present a great number are either entirely unacquainted with them, or have conceived totally mistaken ideas about their nature and merits. Much of this misconception has no doubt arisen from the doubtful success which attended the crucible steel castings brought before the public some years ago.

The principal defects in these castings were hardness and want of solidity, and truly homogeneous metal was a rarity. It was found that by crucible casting blowholes were less likely to be formed than in casting on a larger scale by the Siemens-Martin or Bessemer processes; hence notwithstanding the expense and the many disadvantages inherent to the crucible method, it has been somewhat extensively applied, both in this country and on the Continent. In crucible steel castings a high percentage of carbon is employed to insure fluidity in casting, and the subsequent process of annealing is relied on to make them soft enough for working. In spite of every care these castings are often so hard as to be useless.

The accompanying honeycombed specimen shows what measure of success attended the first attempts at steel casting from the furnace. No matter how strong the material, it is perfectly evident that a casting such as this is quite unsuited for engineering purposes. A further objection which militated against the earlier steel castings was their want of homogeneousness. Hard spots were of frequent occurrence, surrounded by softer material. These spots appeared as lumps when the casting was turned or planed, and made it impossible to keep an edge on the cutting tool. But these objections are fast becoming things of the past, thanks to the Terrenoire process. It is now possible, and is a matter of everyday practice to get castings made of a material which is soft, strong, tough, and free from blowholes, which can be hammered cold or hot, which welds easily, and in fact, which behaves in every way like superior wrought iron, with this difference, that it is very much stronger than wrought iron. It may appear strange that a simple casting should possess toughness equal to or greater than iron which has been wrought; but it has been found from experiments made at Newton (as already noticed by Euverte) that the properties of a piece of steel (free from blowholes) depend entirely on its chemical composition and its molecular condition, and not on the manner in which that condition has been induced, so that if different means can be found to produce similar conditions in steel, the final result is not affected by the method employed. For castings such means are found in annealing and tempering, the effects of which will be noticed later on.

It has been already stated that the difficulty encountered in early attempts to make castings of Siemens-Martin or Bessemer metal was the formation of blowholes. In the Terrenoire process this fault is entirely remedied by the use of a silicide of iron and manganese. "The presence of a trace of silicon is found to have the singular effect of preventing that violent evolution of gas from fluid steel at the moment of solidification," which caused the objectionable unsoundness. In the fluid steel there is carbonic oxide in dissolution. During solidification this gas tends to escape, but is decomposed by the silicon and silica produced, and afterwards a silicate of iron, which would remain interspersed in the steel were it not that the presence of the manganese permits the formation of a very fusible silicate of iron and manganese which passes off into the slag. The metal when run into the mould remains perfectly quiet, and a sound casting is readily obtained, possessing a smooth skin and sharp edges.

A principal characteristic of this metal is its extreme toughness. On the table there are exhibited some turnings taken from a mill pinion, which argue the possession of that quality in the material in a high degree. There are also some bars shown which have been bent cold to an angle which few brands of wrought iron would reach. In one sense this toughness is a drawback—it renders the work of taking off the gates and runners one of extreme difficulty. It is of no use to attempt to "nick" them round and break them off, they must be turned or slotted off. The breaking strain varies according to the nature of the casting and the subsequent treatment. Plain castings of some size may be made of very soft metal, while more intricate ones require to be made rather harder, but in no case is the metal really "hard," *i.e.*, too hard for tooling. In general the variation does not exceed six tons per square inch, and ranges from 29 to 35 tons per square inch. The extension varies from 36 to 12 per cent. in lengths of two inches, and from about 17 to 6 per cent. in lengths of eight inches parallel. Stronger qualities can be made, but any increase in strength is gained at the expense of toughness. The elastic limit I have invariably found to range from $\frac{1}{2}$ to $\frac{5}{8}$ the breaking strain.

The ultimate character of the steel depends much on the treatment to which it is subjected after being cast. I do not refer to the practices of long continued annealing and heating in contact with oxides of iron, often adopted in connection with crucible steel castings, but simply to the effects of heating and cooling in different ways. Before you are three samples of steel taken from the same casting. The first, which exhibits a largely crystalline fracture, shows the steel simply as it is cast; the second, which is much more compact in appearance, has been heated to a cherry red and cooled gradually; the third, which has a very close texture, has (after annealing) been again heated to a cherry red and cooled in oil. Beginning with the casting in its original state, the effect of re-heating and cooling gradually is to greatly increase the toughness and the extension, to increase a little the breaking strain (except in very soft metals, in the case of which it is not much changed) and to decrease a little the proportion which the elastic limit bears to the breaking strain. By re-heating and dipping in oil the breaking strain and elastic limit are increased, the toughness and extension are diminished, and the metal is compacted. It will be noticed that the effect of dipping in oil appears to be analogous to that of hammering; much the same changes are induced. I have here two bars, 1in. square, cut from the same casting. One is annealed simply, the other is annealed and dipped in oil. They were tested transversely with 3ft. bearings. The annealed one took its first permanent set with a load of 0·4 tons applied midway between the supports, and finally sunk with a load of 0·7 ton. It has been bent through considerably more than a right angle, and is not broken. The one dipped in oil took its first permanent set with a load of 0·5 ton and sunk when loaded with 0·9 ton, breaking when bent through 90 deg. These bending tests corroborate the results of many tensile tests with regard to the increase of strength and decrease of toughness due to cooling in oil.

The art of steel founding is now so perfected that it is scarcely too much to say that anything which can be cast in cast iron can be cast in steel. The applications of steel are already almost innumerable. From it are made crank shafts, thrust shafts, connecting rods, excentric rods, crossheads, guides, propeller blades and bosses, and even the nuts for them, gearing of all descriptions—the toothed wheels already cast ranging from a few pounds to as much as 12 tons in weight—carriage and wagon wheels, locomotive bogie centres, rolls and rolling mill gear, anchors, hydraulic cylinders, steam hammer faces and anvil blocks, and so on. It is seldom that a working stress of more than one ton per square inch is allowed to be put on cast iron. Hydraulic rivetters of Hallside steel are in daily and satisfactory use under a working stress of 14 tons per square inch. Here then we have a material which can be moulded to any shape as readily as cast iron, and which is stronger and tougher than wrought iron. Moreover, like wrought iron, it can be wrought under the hammer and welds with facility. It is almost unnecessary to point out the advantanges which accrue from the possession of such a metal. The simple process of casting will, in numerous cases, displace the more difficult method of forging. In cases, also, where the engineer is tied to weight—as often instanced in marine engines—it is evident that the use of a material which is at least six or seven times stronger and more reliable than cast iron offer one means of securing lightness without the sacrifice of strength.

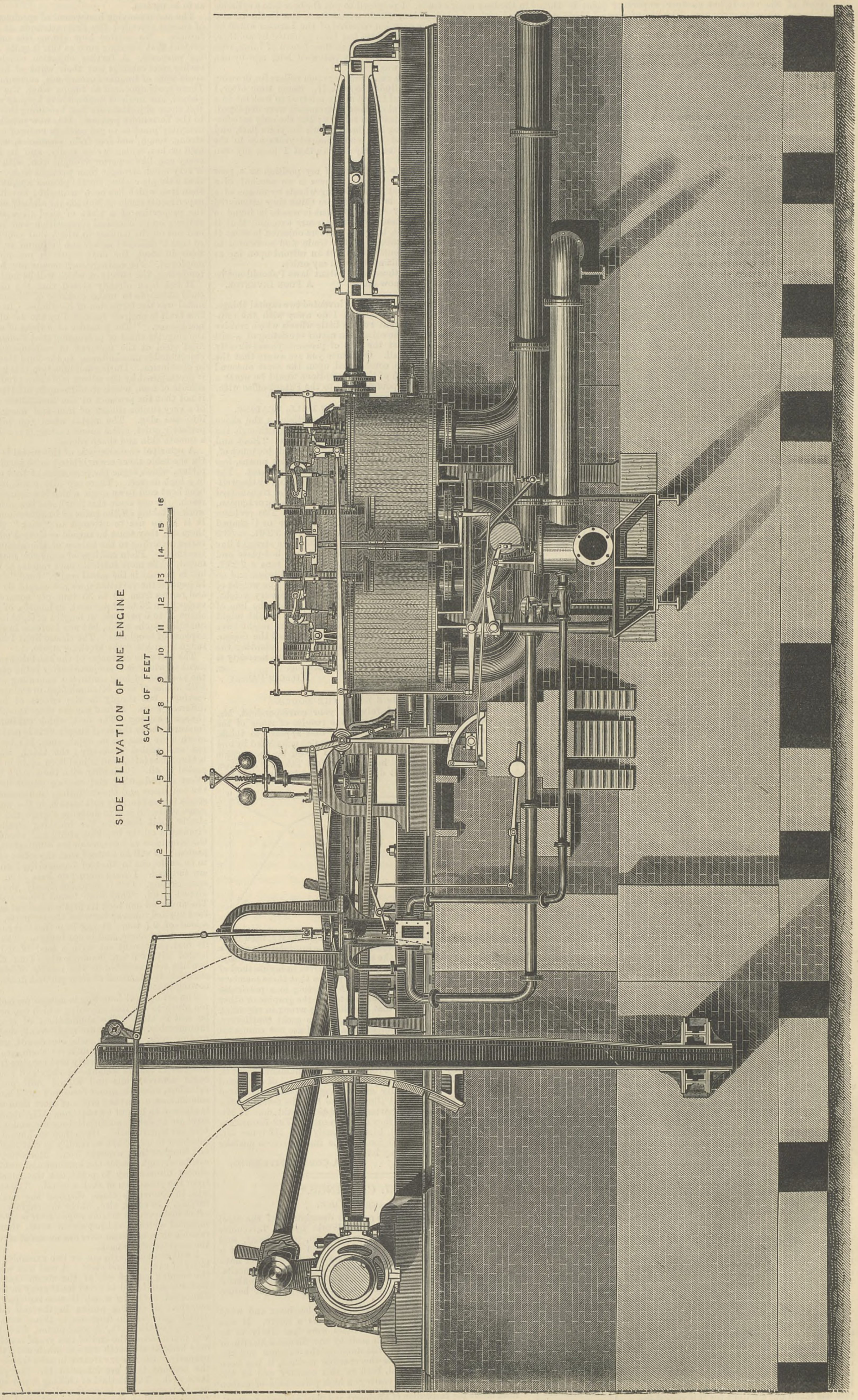
I will conclude with one or two examples of the relative durability of cast iron and steel. A cast iron worm in connection with the turning gear of one of the steam cranes in the foundry at Hallside was found to grind itself away in from two to three days. The steel worm by which it was replaced lasted eight or nine months. A driving pinion in the rail mill when of cast iron usually gave way in from one to three weeks and failed through breakage of the teeth. A steel pinion, made to replace one of these, was taken out at the end of two years' continuous work, and then only because the teeth were so much worn that they did not gear properly. Steel is invaluable in rolls which are much cut into by the sections they are intended for. In plain rolls the surface lasts well. The method of chilling is not used, but the hardness can be increased by increasing the carbon. It should perhaps be mentioned that the shrinkage of steel castings is about $\frac{1}{4}$in. per foot.

* Read before the Institution of Engineers and Shipbuilders in Scotland, 22nd February, 1881.

No. 3 WINDING ENGINE, SILKSWORTH COLLIERY.

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

(*For description see page 29.*)



SIDE ELEVATION OF ONE ENGINE

SCALE OF FEET

PUBLISHER'S NOTICE.

*** *With this week's number is issued as a Supplement, a Map of Machinery Department, Royal Agricultural Society's Showyard, Derby. 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.*

ENQUIRER.—*A letter lies at our office for this correspondent.*

J. W. C. (Morriston).—*We shall be happy to meet your wishes.*

H.S.—*If you refer to the appointments to county surveyorships, every information is supplied to intending candidates by advertisements which appear from time to time, as vacancies occur, in our own columns and those of other journals.*

A. B. (Dumbarton-road).—*There are no single treatises on the construction of bridges, or locomotive and marine engines, which cover the whole ground. Nor is it possible to advise you as to the best books to buy until we know what you have already read. If you have read very little, then the treatise on "Iron Bridges" in Weale's Series, and Bourne's "Catechism of the Steam Engine," will do to begin with.*

RODGERS' JET EXHAUSTER

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers give me the address of Mr. Rodgers, patentee of the steam jet exhauster for forming a vacuum in the condenser previous to, and to facilitate the starting of the engines? Any information from parties having had experience of the above will greatly oblige.

G. S. H.

Hull, July 4th.

PATENT FUEL-MAKING MACHINERY.

(*To the Editor of The Engineer.*)

SIR,—I shall be obliged if any of your readers will inform me what is the best machinery for manufacturing patent fuel from coal-dust, and who is the maker. The coal-dust to be treated is in heaps which have laid for many years, and contains a quantity of small shale. This shale must be eliminated by suitable machinery.

A.

July 5th.

THE ENGINEER.

JULY 8, 1881.

MARINE BOILERS.

A MOVEMENT has been set on foot in Liverpool which may lead to very material changes in the construction of marine boilers. Alterations are suggested—and, indeed, are being carried out, we understand, by two or three firms independently of each other—and if the changes in design proposed are found to answer, there can be no doubt that the example set by Liverpool engineers and shipowners will be freely followed. Nor is it unreasonable that a change should be made. The modern high-pressure marine boiler is by no means all that a boiler should be—by no means so good that it is out of the question to think that it can be improved upon. We may take as a type a three-furnaced boiler, to carry 70 lb. Such a boiler will be about 12ft. in diameter by 10·6ft. long. It will contain three furnaces, each 3ft. in diameter and a little more than 7ft. long, and each furnace will have a separate back up-take, and sixty 3in. tubes 7ft. long. A boiler of this kind, if fitted with a large steam drum, will steam well, and may be depended upon with fair coal, to work a pair of compound engines up to 500 indicated horse-power. Its shell plates will be nearly 1in. thick, and its total weight without water will be, roughly, 28 tons, and it will hold 14 tons of water. Its gross weight, therefore, will be, under steam and allowing for grate-bars, &c., not far short of 45 tons. It will have a grate surface of about 57 square feet, a tube surface of 900ft., the crowns of the furnaces will amount to about 100 square feet, and the uptakes may be taken as 120ft. more. The total heating surface will be, therefore, a little over 1100 square feet. If we contrast this with a locomotive boiler, we find that the latter will not weigh, complete with water and in working order, more than 12 or 13 tons. It will have 1100ft. of heating surface and 18 to 20 square feet of grate, and it may be depended upon to develope 600-horses power in a non-condensing engine. The cubical space occupied by the locomotive boiler will not be more than one-fourth of that taken up by the marine boiler, and it will be, on the whole, quite as economical, if not more economical. Thus, for the given weight and space it would be possible to have four locomotive boilers for one marine boiler. It will, of course, be urged that the objections to the locomotive type of boiler would prove fatal to its use at sea. When we come to examine these objections, we find that they are—that it would not be possible properly to fire a locomotive boiler at sea, because of the position of the fire-door; that the tubes would be quickly choked up with soot, rendering constant sweeping necessary; that the water-spaces are so small that they would become furred up, and that a great deal of priming would take place. In dealing with these arguments we may point out, to begin with, that a boiler of the locomotive type never yet has had a fair trial at sea in the mercantile marine; and that when it has been tried in the Navy—as in torpedo boats—it has given great satisfaction. As to the firing, nothing is needed save a rearrangement of the fire-door—easily contrived—to settle that point. If proper smoke-burning appliances such as are used in locomotives were employed, the sooting up of the tubes would not present an insurmountable difficulty; and the water supplied to the boilers being distilled, is at least as pure as that fed to locomotives. There is no reason save prejudice why a locomotive boiler should not be used with great success in steamers making short voyages, say of ten or twelve hours' duration; but we are very far from supposing that the boiler of a locomotive engine if put into a ship would be suitable for Atlantic voyages. Still we believe that it is quite possible to learn an important lesson from railway practice. It cannot be indispensable that a marine boiler of a given power should weigh four times as much as a locomotive engine boiler of the same power. The difference is so great that there must be room for reducing the weight of the marine boiler without impairing its efficiency.

The engineers to whom we have referred, favour the opinions expressed in the preceding paragraph; and we understand that the modifications which they are introducing in marine boiler practice take the direction of reducing the diameter of the shells, and augmenting the draught, and consequently the weight of fuel burned per square foot of grate per hour, while the furnaces and their tubes are also made of smaller diameter than is now the rule. This is to say, that the changes are changes in proportion more than in anything else. To put the idea involved in other words, it will be seen on reflection that a two-furnace boiler may be made which will be much more powerful for the weight and space occupied than a boiler with three furnaces. We may cite as an example a boiler of the following dimensions: Grate surface, 23 square feet; heating surface, 520 square feet; number of tubes, 114; diameter, $2\frac{1}{4}$in.; length, 6ft. 3in.; length of furnaces, 6ft.; diameter of furnaces, 2ft. 4in.; length of boiler, 8ft.; diameter, 7ft.; weight, 9 tons; weight of water, say 4 tons. The total weight would be 13 tons, or, about one-third of that of a three-furnace boiler. Two such boilers would take up in a ship about 3ft. more in width, 5ft. less in height, and 2ft. less in length than the three-furnace boiler. The cubical space occupied would be for the latter $12 \times 12 \times 10{\cdot}5 = 1512$ cubic feet, while the space occupied by the two boilers would be, allowing 1ft. between them for lagging, 840 cubic feet. At 40ft. of displacement to the ton, the three-furnace boiler would represent 37·8 tons, and the two smaller boilers 21 tons only. Their actual weights would stand in the ratio of 45 tons to 26 tons. The heating surface of the single boiler would be 1100ft., that of the two smaller boilers very nearly the same. The first cost of the small boilers, their safety, and the ease with which they would be made—no plate more than $\frac{5}{8}$in. thick being required in their construction—the augmented strength of their flues, and the comparative ease with which they could be put into a ship and taken out of it, are all strong points in their favour; and others will no doubt suggest themselves to our readers.

We do not think it can be generally questioned that improvements are urgently required in the design and construction of marine boilers. The existing boiler is at the best the heaviest and most unwieldy steam generator that it is possible to make. It is extremely costly; it is very easily ruined; for its weight and dimensions it makes but little steam, and its failure when, as is usually the case, there is but one boiler in a cargo boat, will totally disable the vessel. Any reduction which can be effected in its size, its weight, and its present cost, without the sacrifice of any of the good qualities it possesses, is to be desired; and we are pleased to find that in so important a shipping centre as Liverpool, proposals for changes in its construction are not only tolerated, but fairly discussed, and even put in practice. For the present we cannot speak fully of what is being done in Liverpool, but at the proper time we shall say more on the subject.

COMMON ROAD RAILWAYS.

JUST now the construction of railways along the sides of highways and parish roads is being advocated by many persons; and the scheme has been suggested as specially applicable to Ireland. So far gold mines have apparently absorbed all the floating capital available for rash speculation; but there are evidences that the tide is beginning to turn, and it is very probable that common road railways will have their day. We do not intend to class them with intensely speculative gold mines; but it is just as well that the possible value of such lines should be fully understood. In one sense, such railways as the Wantage tramway, are to the last degree speculative. Whether they can or cannot be made to pay depends solely on the conditions under which they are made and worked, and according as these are favourable or the reverse, so will they succeed or fail; but concerning the nature of these conditions it is almost impossible for the general public to know anything, and even engineers may fall into grave mistakes. It will not be out of place to say a few words concerning the whole subject for the benefit of our readers.

As a rule, a proposal for the construction of a common road railway is based on certain propositions. The traffic has become too great to be accommodated by the highway—this applies very rarely indeed. The making of a tramway or railway would be followed by an immense increase of traffic between the two points to be united. The district would be greatly benefitted. Shareholders are certain to make a large profit. The whole cost of land for a railway would be saved by laying the rails on the highway. Such lines have proved very successful in Italy and elsewhere on the Continent, why not here? We believe that these are all the more important arguments which are adduced in favour of any new scheme of the kind, no matter what. Putting sentiment on one side, and away with it, the desire to benefit country folk, morally and physically, by the introduction of cheap means of transit, we have remaining nothing but questions of pounds, shillings, and pence. Can a line made on a highway pay a fair dividend to the shareholders to whom it belongs? To say that whether it will or not depends on circumstances, is not to answer this question; but to say what the circumstances are that will make it pay, is a good answer. Let us see what some of the circumstances affecting the prospects of a common road railway are. Few lines of the kind at present exist in this country, but enough is known to enable us to speak with tolerable certainty. The reason why railways are to be laid on the roads is to save the purchase of land and the construction of earthworks, bridges—in short, the whole substructure of a railway. Given the common road, and the railway company have little or nothing to do but find the permanent way. The cost of a single line in the country will not be great. The rails will weigh 45 lb. per yard, and each 20ft. length will have eight sleepers. Then for a mile the cost will be, for materials, say £1000; labour and miscellaneous expenses ought not to cost more than £500 more, so that it ought to be possible to lay a line for £1500 per mile. It is very unlikely, however, that the cost will ever be kept down to this, but we shall assume that it can be kept down. To work such a line by steam there must be at least three engines, three passenger cars, and let us say half a dozen goods wagons. These will cost not much less than £4000. The total cost of a mile of common road railway will therefore be, fully equipped, £5,500, and the interest on this sum at 5 per cent. is £275. If the railway were situated in the outskirts of a populous town there would, perhaps, not be much difficulty in making this profit; but we are not dealing with populous towns but with country lines, and it requires no great shrewdness to see that a line one mile long could not be made to pay. As for passengers, they would not care to be carried only a mile, and goods would not pay for the loading and the unloading. We mention a mile line only to impress on our readers' minds the fact that the length of a common road railway is one of the circumstances which may materially affect its prosperity. A certain quantity of rolling stock must be provided, no matter how short a line is; and it may be taken as an axiom that—other things being equal—that line is most likely to pay which has the greatest length for the smallest quantity of rolling stock. Thus, for example, five miles and ten miles may be taken as reasonable lengths for common road railways. Now in a rural district, three engines, three passenger carriages, and half-a-dozen goods wagons, would probably suffice to conduct the traffic of either line, but on a ten mile line it would be fully employed, while on the five mile line it would not. The total cost per mile of the ten mile line equipped, would be £1900, while that of the five mile line would be £2300. The cost of working the long line ought to be less per mile than the cost of working the short line. We need not say more, we think, to prove that the length of a line will be found to exercise an important influence on its prospects.

It must not be forgotten that although a cheap substructure is obtained by using the high road to carry a railway, the route taken is, as a rule, unfavourable to steam traction. So unfavourable are the gradients in some cases that although a road can be made and worked, it cannot be made to pay. A short steep hill often constitutes the ruling gradient, and the engines are, to use an expressive phrase, "killed by inches" in trying to haul their loads up it. The difference between working on a level or nearly level road—say, one with no incline steeper than 1 in 100—and working roads with inclines of 1 in 30 or 40, is enormous. There can be no doubt but that the working of such steep banks has had much to do with the failure of all attempts hitherto made to work tramways with steam successfully. We have no hesitation in saying that no railway ought to be laid on a common road if the incline in any place, however short, exceeds 1 in 50. It is just because the lines worked by steam on the Continent are nearly all comparatively level that they have been successful—so far. Those who have any scheme for the construction of common road railways brought before them will do well to consider very carefully what the inclines are. Curves can be managed by radial rolling stock, but inclines must be got over by sheer power. It may be argued that railways are made to pay which work inclines of 1 in 50 and even steeper. To this we reply that the proportion of such railways to the great mass of our iron roads is very small; and the proportion of such steep inclines to the more level portions of any paying British road is very small indeed—much more minute than it is likely to be in the case of a common road railway.

Furthermore, there is little analogy between a railway locomotive and the engines which have hitherto been worked on steam tramways. When, therefore, it is found that a moderate length of steep hill has to be overcome, it will be better to construct, even at considerable cost, a piece of railway to avoid this hill, than to attempt to work it by, so to speak, main force. The engineer called upon to pronounce an opinion concerning the merits of a given route will do well to make a very careful personal examination of the road proposed to be used, and satisfy himself that the gradients are not prohibitive, which they may very easily be.

In all cases where rural common road railways are constructed, they will be found to unite a small town to a railway-station, as in the case of the Wantage line; or they will unite a village or villages with some market town, perhaps a seaport. What we have said concerning the length of line will be seen to have a very important bearing on its goods traffic. It would not be worth while to load garden produce, for example, into railway wagons for conveyance for a short distance, save under peculiar conditions, to which we shall come in a moment; but it might be very well worth the farmer's while to have his produce carried ten miles for him, although he had first to load up his own carts and then haul his corn or roots a couple of miles to the station. There is, however, one method of utilising even short lengths of common road railway for goods traffic which has not yet received the attention it deserves. If the goods wagons are so made that they can travel either on the common road or on the railway—a thing which involves no great difficulty—then the whole labour of carting to the station may be avoided. In such a case the farmer could send his horses to the railway for a couple of wagons, these he would have loaded at his leisure, and returned full to the station. They would then be run on the line and taken away by the engine to their destination at the proper time. Arrived there they might be hauled by horses at once to the quay, the market, or the store. A system of working such as this would at once impart that flexibility to the common road railway, the lack of which is now one of its most serious defects.

TEES-SIDE WATER SUPPLY.

THE question of water supply for the Tees-side district, and especially for manufacturing purposes, is coming into prominence. It is five years since the Act passed which compulsorily took the supply out of the hands of the private company, and placed it in that of the Water Board chosen from the members of the two corporations of Stockton and Middlesbrough. The Board paid very dearly for the works, and as there was from the trade depression a falling off in the demand, it did not feel inclined to enter on the construction of those vast works which it deemed necessary five years ago, and for which its compulsory powers of purchase are fast running out. But for the last year the demand for water has been rapidly growing, and the Board deems it expedient to exercise its powers of purchase before they expire; but there is a serious financial difficulty. The great cost of the works—between £800,000 and £900,000 — rendered the revenue that had given a good dividend to the private company insufficient to pay interest now; and the balance has to be drawn from the rates of the two corporations. Hence there is on the part of many of the most influential members of the latter a not unnatural desire to prohibit further expenditure till the present supply is remunerative. The Board may draw from the river Tees, its present source of supply, not more than 60,000,000 gallons of water weekly. When it acquired the works it was pumping about 48,000,000 gallons weekly—a little more than one-half being for manufacturing purposes. At the present time it is pumping close upon 58,000,000 gallons a week—nearly 38,000,000 gallons being for manufacturing purposes—so that it is apparent that there is not an adequate margin for increasing needs. Indeed, the difficulty is how the needs of the next year or two will be met, for any works entered upon must take years to complete, and the demand is rising rapidly, whilst the supply is near its full, and is incapable of being exceeded. Naturally, as the demand increases, the revenue of the Board rises, but the fact that there was in the last financial year a loss on the supply to the Middlesbrough Corporation alone of £6951, and that for the year now expiring a loss of about £1000 was calculated on, shows that the construction of works at a cost of from £200,000 upwards, would mean a burden of no light weight for years to come on the ratepayers. It is by no means easy to point a way out of the difficulty, for the demands of the consumers in the statutory area of the Board must be met; the present source of supply is almost drawn upon to its full limits, and within those limits a profit is only just possible under favouring conditions, so that there will be a natural reluctance of the ratepayers and their representatives to undertake expensive works in the Tees Valley that must be unprofitable for many years to come. If a temporary source of supply could be found by the purchase of water from neighbouring works, this would relieve the Board until the normal increase of revenue and the decrease of expenses had given a balance in favour of the works, or of the owning corporations rather. Without some such expedient a financial millstone will be hung round the necks of the two towns for years to come, and even with that very great straits must be endured during the period of construction. The cost of the works may be said, for the capacity they are intended for, to be low when it is remembered that the two reservoirs in the Wear Valley of the Weardale and Shildon Water Company, cost nearly a quarter of a million, and that, roughly speaking, their capacity is only three million gallons daily. It is thus doubtful whether the scheme of the Water Board will be completed for the amount named; but whether it is or not, its carrying out will entail a heavy further cost on the ratepayers in the two towns for some time to come.

THE RIVER TEES.

THE Tees Conservancy Commissioners have been greatly troubled during the past spring by the enormous quantity of silt which has been brought down from the upper reaches of the river and deposited in the navigable parts. This silt, amounting to many thousands of tons, must be dredged up at a heavy expense if the full depth of the channel is to be maintained. The banks of the river are largely composed of soft clay, loose in texture, and sloping down somewhat abruptly from a considerable height. Heavy rains acting upon such banks produce a continual series of landslips. Observations show that these movements are always in progress. The banks everywhere resemble a series of steps separated by fissures. As the lowest one falls into the river, a new one separates itself at the top, and the whole series slips down a stage. Trees and shrubs of considerable size slide down gradually with the soil in which they are rooted, and eventually float away, unless caught and made secure in the meantime. No practical way has yet been found of preventing this disintegration of the river banks, which operates equally against the landowners and the commissioners. The latter have recently inquired whether they could not compel the riparian owners to take better action to prevent the nuisance, but were legally advised in the negative. Consequently they decided at their last meeting to try persuasive means. They have therefore passed a resolution declaring that henceforth they will contribute 4d. per ton upon all slag used for protecting the banks of the river in such a way as their engineer may approve. And further, that should they decide at any future time to increase such contribution, then any frontager who may have taken advantage of their present offer shall be entitled to claim any such excess retrospectively. Dirt has been scientifically, or rather perhaps pedantically described as "matter out of place." All will agree that any slag removed from the unsightly tips, where it is now commonly deposited, and made to do useful duty in the above way, will deserve a new and honourable name hereafter to be invented.

LITERATURE.

Text-Book of Systematic Mineralogy. By HILARY BAUERMAN. Longmans, Green, and Co. 1881.

A SYSTEMATIC mineralogy has long been much wanted, which would occupy an intermediate position between the small elementary text-books which confine themselves to giving briefly and in a more or less disconnected form a general desciption of minerals, and the large works which partake more of the nature of a dictionary. The author of the work under consideration has endeavoured to make the book connected and systematic throughout. Even if he had not succeeded, credit would be due to him for the attempt. It is extremely difficult in compiling a small text-book so to arrange that every part of the subject shall receive attention in exact proportion to its merits. In the endeavour to accomplish this, and at the same time to avoid giving meagre descriptions of important things, the author has been forced to consign descriptive mineralogy to another volume, not yet issued. It is true this would not have been necessary had a greater amount of knowledge on the part of the student been assumed. In this, however, we think the author has acted wisely. Instead of stating bare facts, he has prefaced them with a brief description of the principles on which the various phenomena depend. Thus, in treating of the optical properties of minerals, the various theories concerned, such as that of wave motion, are first elucidated. Whether these explanations of points relating to physics will be sufficient for a student without previous knowledge of the subject, is extremely doubtful; but even if they are not, they will materially assist him in obtaining the necessary information by marking out its nature and boundaries. The same thing may be said of the chapter relating to mineralogical chemistry. A student would be very unwise to attempt to obtain from this work alone the knowledge of chemistry requisite to any one studying mineralogy; but he may get useful hints as to the points to which his attention should be more especially directed.

About 200 pages of this book, containing in all about 390 pages, are devoted to physical crystallography. The methods here followed are mainly derived from Groth's treatise. The order adopted has, however, been reversed, and the geometrical properties of crystals are considered before their physical structure. This latter arrangement is, perhaps, on the whole, the more convenient, and further, it is sactioned by custom. This part of the volume is extremely well illustrated by carefully-drawn woodcuts. The notation of the faces is by indices on Miller's system, while the forms are designated in the text by the symbols employed by Naumann. The author tells us in the preface that he would have preferred to adopt the former system exclusively, but taking into consideration that Naumann's system is largely used in many text-books and original memoirs, he thought it better to give the student an opportunity of familiarising himself with both systems. In dealing with the hexagonal system, in order to show clearly the relation between it and the tetragonal system, the Bravais-Miller notation by indices on four axes has been adopted. Twinning and irregularities in crystals are extremely well treated; better, in fact, than in any book with which we are acquainted. The same remarks apply equally to hemihedrism and combined forms. That part of the crystallography relating to the hexagonal and tetragonal systems might with advantage be revised, being faulty in several places. The mathematical problems and crystallographic formulæ on page 76 are also by no means free from errors. It is not easy to see why the formula $3 \Delta = 0$ is given instead of that usually employed; and, as it is not correctly worked out, the advantage of the substitution is still less apparent. In the chapter on the physical properties of minerals, we find hardness defined as specific cohesive power. It is sufficiently evident that the author has never, designedly or accidentally, sat down on a piece of cobblers' wax, otherwise he would never have asked us to accept in good faith such a definition. Lead containing much antimony would be hard, yet its specific cohesive power would be nothing at all compared with that of copper, which is relatively very soft. A substance may be hard, yet brittle; soft, yet tough.

It will be new to most people to hear that mineralogists, as a class, look upon brittleness, flexibility, elasticity, and malleability as degrees of *tenacity*. So says Mr. Bauerman on page 212. We are glad to see on page 213 a most useful table of minerals, arranged according to their specific gravity, taken from the Annuaire of the Bureau de Longitude. In the description of the methods of taking the specific gravity of minerals, mention is made only of the use of a delicate balance, which is very costly, and of methods in which the volume of water displaced is gauged or some form of spring balance is employed. For most purposes sufficiently exact determinations can be made with a pair of ordinary dispensing scales. We have seen this done in the Metallurgical Laboratory of King's College, London, where, by weighing the water before and after immersion of the substance, a result is obtained not varying on the average more than 0·05 from that obtained with the most delicate balance. On page 218 is the somewhat astonishing statement that "the same method—*i.e.*, the separation of minerals of widely different specific gravity by means of a fluid having an intermediate density—is applied on the larger scale in the separation of gold from galena and iron pyrites by a fluid of intermediate density, namely, mercury, in the Hungarian gold mill, although in this case the result is not quite so simple, the metal being, to some extent at any rate, dissolved in the separating fluid." Nothing is less likely to have been the intention of the users of this process than that imputed to them. Mercury has the power of dissolving gold, and for that reason alone is it used. About seventy pages are devoted to the optical properties of minerals. Here, as in the treatment of crystallography, illustrations are plentiful. Polarisation and dispersion phenomena are treated very fully and clearly. The statement on page 291 that chlorophane is a green variety of fluor is misleading. This substance is usually white; its name is derived from its emitting, when heated to 200 or 300 deg. C., a brilliant green phosphorescent light.

The chapter on blowpipe analysis is, perhaps, the least satisfactory in the book; still, though not all we should wish, it contains a great deal of useful information in a comparatively small compass. It is necessary to bear in mind in considering a book of this kind that each portion cannot possibly be treated as fully as a specialist would desire; the information contained in it must be supplemented by the study from time to time of works treating of special points, and also by actual practice under the guidance of an expert. Inaccurate descriptions cannot, however, by any means be excused. That relating to the reducing flame is such. We are told of a flame "which is of a neutral or non-oxidising character, and is called the reducing flame." The reducing flame is what its name implies. There is insufficient oxygen in it to consume the whole of the gaseous hydrocarbon. This is easily shown by a bead of borax containing oxide of manganese held on a platinum wire. The bead is coloured when held in the oxidising flame, but becomes colourless in the reducing flame. Again, further on, boracic acid is spoken of as hygroscopic, and lower down a bead containing nickel is said to be coloured in the oxidising flame reddish to brown when hot, whereas it is of a violet colour, and might easily be mistaken for a manganese bead. On p. 307 tin is said to give no incrustation on charcoal. It gives a white incrustation easily obtained. We are surprised to find the test for distinguishing between lead and bismuth not given. The use of potassic iodide and sulphur—Cornwell's test, should be known to everyone; the red incrustation it produces being particularly characteristic.

In the chapter on the relation of form to chemical constitution, orthoclase and albite, are spoken of as isomorphous. The one is monoclinic, the other triclinic. Further on it is stated, in speaking of change by oxidation, that ferrous sulphate crystals "can only be preserved in absolutely dry air, or in the vapour of a hydrocarbon." This substance effloresces, and therefore the drier the air the less favourable would be the conditions for preserving the crystals; for the same reason hydrocarbon vapour would be useless. Change of temperature is an important function in these cases. In pointing out these errors we have no intention to depreciate the value of the book as a whole, but simply to put the student on his guard.

The text is very free from printer's errors. We notice "dihexagonal" for tetragonal. The publishers are certainly to be complimented on their part of the work, and on having introduced to the public a book which will prove very useful to many. Those who would study mineralogy scientifically will find in this volume what is wanting in others which in respect to price are within the reach of those for whom this series of text-books was designed.

TENDERS.

LLANSAMLET, NEAR SWANSEA.

TENDERS for roofs, woodwork of three sulphuric acid chambers, and woodwork of mill and mill engine-house, for the Swansea Complex Ore Company, Limited. Mr. James W. Chenhall, C.E., engineer.

	Roofs.				Acid chambers.				Mill-house, &c.		
	£	s.	d.		£	s.	d.		£	s.	d.
Thomas Watkins and Jenkins	4300	0	0	..	1100	0	0	..	160	0	0
Thomas White	3303	19	10	..	1255	6	6	..	236	4	11
Isaac George	3161	13	0	..	1117	6	2	..	242	12	7
Thomas Williams—accepted..	2498	11	1	..	1029	13	0	..	273	19	3

THE Council of University College, London, have appointed Mr. G. Roger Smith Professor of Architecture, in succession to Mr. Hayter Lewis, who has resigned and has been appointed Emeritus Professor. Mr. Roger Smith has discharged the duties of the post for two or three sessions.

PROTECTION.—For years past English newspapers of every class have been denouncing the demand made by some manufacturers for protection, under the name of reciprocity, as nothing short of madness. They have pointed to its inconsistency with the whole doctrine of English economy, and insisted on the absurdity of "laying burdens on the English consumer, simply because the French or the American consumer was already burdened." Yet the new French tariff has aroused such resentment in England that some of these very papers begin to talk of retaliation by the imposition of duties on French wines, silks, bric-a-brac, and the like, as far from unlikely. This is a sign of how great the decay there has been of orthodox political economy in its native home. For thirty years back every foundation of the science has been undermined by the ablest English writers. While here and there a Fawcett or a Cairns has been patching the old edifice, we have seen Stuart Mill, Cliffe Leslie, Thornton, Patterson, Ingraham, Bagehot, and a host of others, labouring for the discredit of the principles which McCulloch, Cobden and Senior regarded as all but axiomatic. The strange thing is that these iconoclasts have all been pronounced free traders, some of them violently such. They seemed to think that after they had destroyed every prop on which the free trade theory rests, the theory could stand without their support. The full harvest of their labours will be reaped when England comes to reject a doctrine which has left her dependent on all the rest of the world for food, without securing her access to the foreign markets for her manufactures, upon which she has placed her dependence. —*The American.*

VISITS IN THE PROVINCES.

SILKSWORTH COLLIERY, DURHAM.

No. I.

OF all the industries which have made, and still continue to make our country take the first position in point of importance in the world, none have added more to her greatness than coal-mining in Northumberland and Durham, with Newcastle as a great centre of a rich district. For generation upon generation, ever since the time when King Henry III. granted the "honest men of Newcastle" liberty to dig for coals, has the name of Newcastle been a household word, and its neighbourhood has been the birthplace of engineers and of the greatest engineering projects.

Some few years ago Sir William Armstrong, in his address before the British Association, explained that when coal was first taken away from this quarter the packhorse, carrying a load of 3 cwt. from the mine to the point of shipping, was the only mode of conveyance to be had. The insufficiency of this method suggested the making of roads, and on these roads and by means of carts 17 cwt. could be taken as a load; but the roads were rough and uneven, so wooden rails were next adopted, on which the wheels of the wagons used could run, and thus a load of 42 cwt. might be drawn. Ever since the first discovery of coal in Durham and Northumberland, the demand for it has been pressing and increasing; but from the earliest times there have been found gloomy men to prophecy the working out of all the mines. In 1611 we find an eminent authority giving twenty-one years as the limit of the life of the pits or seams of that time, the output being then at the rate of something like 500,000 tons per annum. Less than twenty years ago, Sir William Armstrong gave the life of the coal-fields as 200 years; but about four years ago a report was made by a number of the leading mining engineers of the country, as to the probable quantity of coal still to be mined, with the result that in the county of Northumberland very nearly 2,000,000,000 tons still remained in the beds, and that Durham possessed almost a like quantity. It is calculated that only something like 1,100,000,000 tons have yet been taken since the beginning. Now the present rate of output is about 35,000,000 tons per annum, so that if the deductions of these mining engineers be correct, we have still a fine balance to draw upon, and generations still unborn will suffer from no lack of North Country coal. As the produce of coal has increased, so as a matter of course has the capital employed. In the year 1829, Mr. John Buddle stated before a committee of the House of Commons, that he estimated the amount of capital laid out in the coal trade of the Tyne to be £1,500,000, exclusive of the shipping interest, while the estimated capital employed in the Wear collieries, that is those of Durham, was just £1,000,000 sterling. In 1854 the capital employed in the production of 16,000,000 tons was estimated at £30,000,000, some £14,000,000 of this representing pit plant, £10,000,000 railways, and £6,000,000 shipping. Since 1854, a revolution has taken place in the shipment of the coal, and now the smart and fast iron screw colliers which carry the coal produce from the Tyne and the Wear, represent a greater outlay of capital than did the old wooden ships of years ago. Considering this there can be little doubt that not much less, if anything, than £70,000,000 sterling are invested in the coal trade of the counties of Durham and Northumberland.

The profits from mining have at all times been small, and before coal and coke became to be so largely used in the manufacture of iron, disaster upon disaster followed those who meddled with coal. However, heavy losses a couple of centuries ago were of rare occurrence, the getting of the coal being then very inexpensive. The collieries were, as a rule, of limited depth, and worked in a very crude fashion. A report made to the Earl of Mar, in 1709, informs us that the usual depth of pits then sunk in Northumberland was from twenty to thirty fathoms; that the expense of sinking was about £55; and that the cost of the only machine then in use for drawing coals, a horse gin, was £28. In the last years of the last century, Hebburn Colliery was sunk to a depth of 144 fathoms. This was, however, considered a remarkable achievement, and on "that account could hardly fail to be attended with disaster." In the beginning of this present century, out of thirty-four sea-coal collieries not more than a dozen were sunk to the depth of 100 fathoms. In 1842 there were no less than twenty-two collieries sunk to the depth of over 100 fathoms, the total number of collieries then at work in Durham and Northumberland being seventy-seven. The seams near to the surface are gradually becoming worked out, and so we must look forward to going deeper and deeper, and no doubt great changes will take place in the methods of working, as well as of sinking collieries to a great depth, in a very short time. In some workings the cost of conveying the coals to the shaft is much greater than in others, and the cost of pumping is very dissimilar in pits even close together. Statistics compiled some years ago show that the cost of pumping in some cases exceeded that of drawing by some 300 or 400 per cent. A few instances of this may interest our readers. At Tyne Main the pumping engines represented 260-horse power, as against 103-horse power for drawing engines. At Heaton the pumping engines were 304-horse power; drawing engines, 113-horse power. The most remarkable case, however, and one that has never been paralleled, is that of Dalton-le-Dale Colliery, where the pumping engines registered 1150-horse-power, while the drawing engines only did 60-horse power. When we say this case has never been paralleled, it is meant as a comparison between the coal gained and the water pumped. At the village of Whitburn, a few miles from Sunderland, in the county of Durham, possibly the most remarkable case of difficulty from the opposition of water is to be found; but as coal has not yet been won, it was not included amongst the above examples. Some three and a half years ago the Whitburn Coal Company started to sink two shafts, with the intention of going to the Hutton seam—some 300 fathoms below the surface. No difficulty was experienced until some 23 fathoms had been sunk, when such a quantity of water was encountered as to form an obstacle which could not be surmounted by the ordinary methods of sinking. Under the direction of Mr. John Daglish, every engineering means was undertaken to overcome the difficulty, and all to no purpose. The following pumping sets were continually at work:—Two of 30in., having a 6ft. stroke, and making 14 revolutions per minute; two of 20in., having a 5ft. stroke, and making 22 revolutions per minute; and two of 20in., with a 5ft. stroke, making 18 revolutions—the quantity of water pumped being at the rate of 10,578 gallons per minute. But this was of no avail, and after a fair trial it was abandoned, and the Belgian or Kind-Chaudron mode of sinking, by means of tubbing, was adopted. This method, which has been most successful, is very ingenious and elaborate, and is too well understood by our readers, no doubt, to require description here.

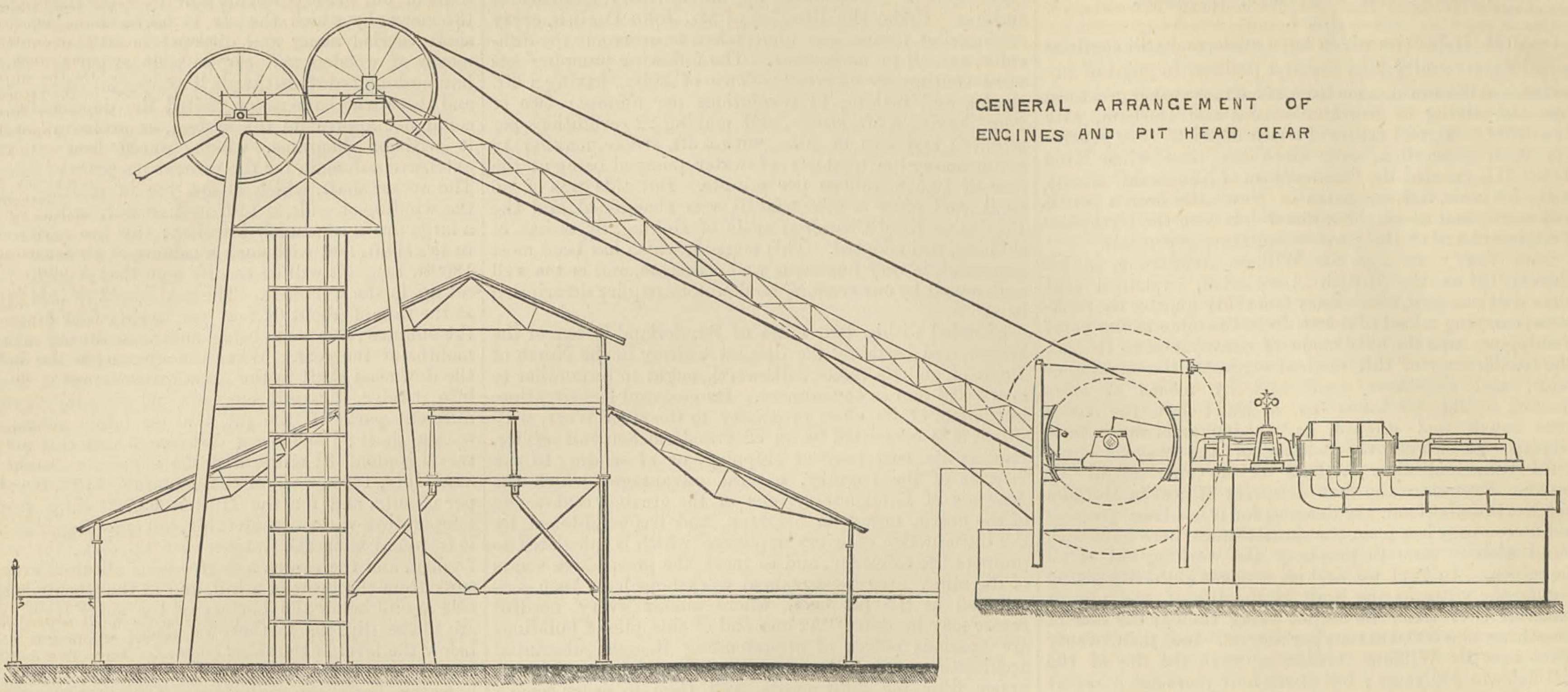
Situated within two miles of Sunderland is one of the largest, and certainly the deepest colliery in the North of England, and its name, Silksworth, ought to be familiar to every coal user in the country. Its geographical situation, in the fact of its close proximity to the river Wear, with which it is connected by an easy and efficient rail service, renders its coal easy of shipping, or of sending to the interior of the country, natural advantages which the Marquis of Londonderry, one of the greatest coalowners of the north, means to heighten, and has heightened, by the introduction of every appliance which is calculated to promote the efficiency, and to meet the prospective wants of the mine. Large permanent workshops have been constructed at the pit head, where almost every needful repair may be done. At one end of this pile of buildings are spacious offices of unpretending though substantial architecture. Next the offices comes a storehouse, with an upper floor for light goods, and then in order come a saddler's shop, rope house, timber shop, joiner's shop, iron store, smith's shop—in which there are punching and drilling machines, and a small forge hammer, as well as five single and two double fires. Next comes a fitting shop, in which there is an engine, lathe, shaping, screwing, and drilling machines. Then comes a hay-cutting room, sawmill, granaries, lamp cabin, and repairing shops, the whole line of buildings being brought to end by a pick-sharpening shop, containing four fires, at which competent men ply their busy trade in keeping the tools of the hewer in order. Near to and around the pit head a large and thriving colliery village has sprung up, the first brick of which was laid in the early part of 1868, and since then the building of house after house has gone on, and as the resources and workings of the colliery increase, so of necessity will the little colony of its immediate dependents increase. Up to the present time over 626 houses have been built, and some more are in course of erection. They are divided into different classes for the accommodation of miners of different conditions, the miner with but a wife and no children having a house to suit his requirements in the same way as his more lucky brother who "has his quiver full" can find a house of larger proportions. All the houses are, however, designed in character, and each of a class exactly like its fellow. Little plots of ground of about 80 square feet are attached to each house. The whole town is laid down on the system of American towns—that is, the streets are at right angles with each other; and seen from the road as the visitor drives or walks from Sunderland, the whole village presents an appearance at once compact, regular, clean, and substantial. In these houses live the 1048 miners who work the colliery, and with them, and depending on them, are women and children to the number of 2156, making thus a grand total of 3204, in addition to which there are eighty-five lodgers in the houses not immediately connected with the masters thereof, but who are, nevertheless, engaged in the work of the colliery; and thus we see that the workings of this pit represents daily bread for no less than 3289 mouths. The men are engaged in the workings during eight of the twenty-four hours, and so have sixteen hours a day to themselves for rest and for recreation. They are divided into three gangs or shifts. The first day shift begins at 4 a.m., and continues till 10 a.m., when a fresh batch of men is ready to relieve duty; the second day shift terminates at 4 p.m., when the first night shift begins, and when its eight hours has run the second relieves. The great bulk of the work is done during the day shifts, the men engaged in the night work only driving the winnings, there being but few hewers at work.

The work of sinking the pit was commenced on the 16th of August, 1869, and two years later the first seam of coal was reached; but as this vein was of a poor quality and thin, operations were pushed on, and sinkings were continued. In February, 1873, at a depth of 270 fathoms—1620ft.—a rich vein of first-class household coal was reached, and this was known to be part of the Maudlin seam. The engineers, knowing that another seam ran close to this Maudlin, continued sinking, and exactly a month later they reached that which has been termed the Hutton seam, at a depth from the surface of some 1740ft. The sinkings for the No. 2 pit were commenced on December 3rd, 1869. The first seam was reached in April, 1872; the Maudlin seam reached on March 3, 1874; and the Hutton on May 1st, 1874. The downcast shaft to both of these seams is 16ft. 7in. in diameter, and is divided into two equal parts by means of a 3in. wooden brattice. One side of this is used for winding coal from the Maudlin, whilst the other works the Hutton seam. Up to the present time the Maudlin seam has been, and continues to be, worked considerably more than its fellow, the present rate of output being—Maudlin, 1150 tons; Hutton, 350 tons per day. The entire Silksworth royalty extends over an area of some 2728 acres, and there is little doubt that both seams extend over the entire of it; but a much greater yield of coal will be had from the upper or Maudlin seam, from the fact of its being 17in. thicker than the lower one, their respective thicknesses being—Maudlin, 5ft. 9in.; Hutton, 4ft. 4in.

It would be a very difficult matter for us, within the limits of this article, to explain the admirable and elaborate system of ventilation which is adopted in collieries. Those of our readers who have had the good fortune of visiting some of our great coalfields will be quite conversant with the means by which the air is taken from the downcast shaft, carried along and directed to all the workings by means of wooden and canvas walls called brattices until, having done its duty in the pit, it escapes into the upcast shaft, and those who have never visited the depths of a colliery could not appreciate the system, or probably understand it without diagrams, which would lead us into too extensive a domain for the present purposes of this article. The upcast shaft, which is not yet in working order for the winding of coals, is 14ft. in diameter, and at its bottom a large fire is constantly burning: this fire rarifies the air in the shaft, and with such a column of air heated—nearly 1800ft. long—it will be readily seen that a current will be set up in the workings. The coal burnt in this furnace is at the rate of about 6½ tons per twenty-four hours during the summer, five tons being sufficient during the colder months of the year. When the air reaches the bottom of the downcast shaft in the Maudlin workings it is split up into twelve different currents, which are conveyed to different parts of the pit, and so taken round to the upcast shaft; the longest distance which this air has to travel is about 3½ miles, and the supply, as tested on the 32nd July, 1880, was, for the Maudlin, 110,650 cubic feet per minute, and for the Hutton 69,720 cubic feet. The temperature varies considerably, but speaking as to average it is found that the intakes are 66 deg., the workings 78 deg., and the return a degree less. Both the shafts are sunk from the brow of a hill, and in the workings the east side are all below the bottom of the shaft level, as they are to the dip, the farthest in places being about 100ft. below the level of the shaft bottom. The natural gradient of the seam is 2in. to the yard, or 1 in 18; in many parts, however, faults are to be met. These faults seem to be convulsions of the strata, where it dips more precipitously, and at some of them the gradient is as quick as 7in. to the yard, and remains at that incline for a very considerable distance. A certain amount of difficulty was felt in getting the coal up these steep ascents, but that has been overcome by the use of a double line of rails, and thus the wagons can be made to nearly balance each other in their transit. Each wagon is made to contain 10 cwt. of coal, and is drawn along by a pony. During a visit to the mines, and whilst plodding along some of the offshoot workings, one may hear a far-away rumbling, which seems to increase in sound; soon a light is seen afar, and a gallant well-conditioned little pony comes along at a good pace, having his load behind him, the charioteer being comfortably ensconsed on the shafts between his steed and the wagon; and in this way is the wagon drawn to one of the great highways of the workings, where it with many others is attached to a steel rope and drawn by engine power to the bottom of the shaft; arriving here, it is run into the cage, and so sent to bank. A large and comfortable stable is provided for the accommodation of the horses and ponies in the pit, the number employed at Silksworth being 172, and, judging from the sleek, glossy, and well-fed appearance which they present, there is no doubt that they are well cared for, and that quite as much as many of the carriage horses which we daily see in this our upper world. Most of them are blind, which is probably caused by the perpetual darkness in which they live; in some cases, however, they have been made so by the cruelty of their drivers, and with the assistance of red-hot irons. Happily this is but rare in any colliery, the natural humanity of the men, as well as a wholesome terror of the law, forbidding such cruel measures. The ventilation of the whole of the workings is, as we have hinted, very good, so much so that there is scarcely any accumulation of gas, and no explosion of any kind has taken place in this pit. A careful system of examination of the lamps used is adopted. The lamps are trimmed and lighted at the bank, and before being handed to the miner they are locked, each one having a supply of oil which will keep it in going order during the eight hours of the shift. No two locks on any of the lamps are alike, and so it is virtually impossible for the miner to carry a suitable key were he inclined to open his lamp. The men, however, are themselves fully aware of the danger of so doing. As soon as they reach the bottom of the shaft an officer examines their lamps again, so every precaution against danger is taken. The hewers up to this time have used the "Clanny" lamp, but it is now being superseded, and the officials use the "Davy." The engineers are but little troubled with water, a very small quantity being found, and if we put it at 2500 gallons per day we are within the mark. This water is taken out in tubs, each of which holds about 130 gallons.

The coal having been won from the workings and sent to one of the main highways, as we have shown—for indeed a colliery is in all respects like a town under ground, with its streets and alleys, its highways and its byways—is drawn along to the shaft bottom by means of a steel rope, which coils round a drum. There are in the Maudlin workings, three such drums, two 6ft. 6in. in diameter, and one 7ft. 6in. They are driven by a double cylinder engine, designed somewhat like the well-known engine of Messrs. Robey, of Lincoln, having the engine fixed to a bed-plate, over which a long boiler, like that of a locomotive, stands. The cylinders of this engine are 18in. in diameter, having a stroke of 2ft., and the gearing with the drums is in the proportion of 3 to 1. A similar type of engine is used, though of smaller dimensions, for hauling the coal from the workings of the Hutton seam. Steam is exhausted from both of these engines by means of a large pipe leading into the upcast shaft. The coal having reached the shaft bottom, it is run into the cage which is there in readiness, and which is able to carry at a load eight of these wagons or tubs, as they are termed in pit phraseology. The load being secured in its hoist, a signal is given to the engine man at bank, who begins to draw up his load, the weight of which is—Cage and chains, 6720 lb.; eight tubs containing 10 cwt. each, 8960 lb.; weight of tubs alone, 5 cwt. 5 lb. each, 4520 lb.; rope, 27 lb. per fathom, 7290 lb.; total weight, 27,490 lb., or just

SILKSWORTH COLLIERY.—ELEVATION OF No. 3 ENGINE AND PULLEY FRAME.



12 tons 5 cwt. The rope above mentioned as weighing 27 lb. per fathom, is 5½in. circumference, and is made of improved "plough steel." It is attached to the top of the cage, and of course the weight of the load when close to or at bank is diminished by the weight of this rope, which is then coiled round the drum. The coal on reaching the bank is run out of its cage, and is emptied from its tub over some screens, which divide the produce into various qualities. There are twenty-eight of these screens now in use, and more can be added when wanted. Below the screens a line of railway runs, and wagons are put under that screen through which the quality of coal is being run that they are to be loaded with, and when full they are sent off to be shipped at Sunderland or at Seaham, or they are sent inland by means of a junction with the North-Eastern Railway some two and a-half miles from the pit mouth.

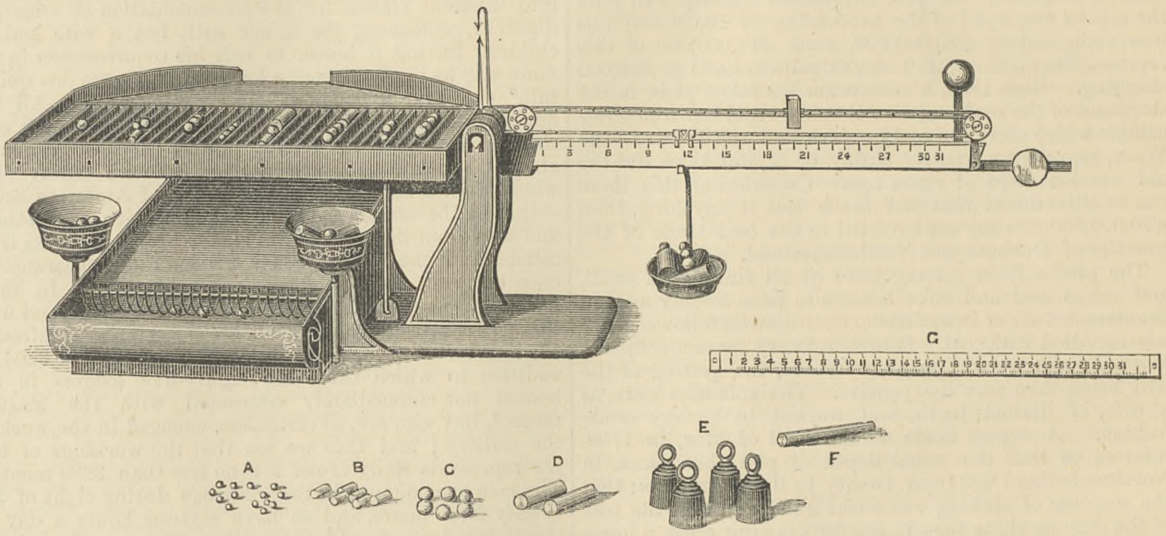
The winding plant at this colliery is perhaps the most perfect and the most remarkable in England. We give this week, at page 26, a view of one of the engines, and also above a diagram showing the arrangement of the pit-head gear. In a subsequent impression we shall give additional drawings and a description of this machinery. It will suffice to say now that the winding engines are fitted with Daglish and Lawrence's automatic expansion valve gear, and are, we believe, the only winding engines in England the cut off in which is controlled automatically by the governor.

THE AVERAGING MACHINE, AN EXPONENT OF THE PRINCIPLE OF MOMENTS.*

By W. S. AUCHINCLOSS.

THE processes of mathematics and mechanics have, in many respects, mutual relations, like those existing between force, light, and heat. Many of the formulæ of mathematics find direct expression in mechanical devices, so that the mind naturally glides from one to the other. The greater the attention paid to this characteristic the clearer will the principles of mathematics appear, and the more marked the rapidity with which solutions can be effected. The averaging machine, illustrated herewith, is an exponent of the principle of moments. In the development of this machine, the first effort was to determine a simple rule for computing average dates. For this purpose the principle of moments was found applicable, and a rule constructed thereby. The next step was to give mechanical expression to the rule. This has been secured by the device represented in the adjoining cut. The machine consists of a scale and a series of weights. The scale, when not ladened, maintains its equilibrium irrespective of the position of the scale pan. The arm of the beam has thirty-one notches, representing the days of the month, and the scale pan is hung on a small saddle capable of being moved from end to end of the beam. A carrier bar is fastened directly over the scale arm, and upon it a counterweight slides freely. This counterpoise exactly equals in weight the scale pan with its saddle. Two delicate watch chains are attached to opposite sides of the counterweight. They pass around little carrier wheels secured to the extremities of the arm, and are fastened to opposite sides of the saddle. In this way the saddle and the counterweight become, as it were, links in an endless chain, so that the counterpoise responds instantly to the slightest motion of the scale pan, and maintains the equilibrium of the system, for all positions of the same. By this device the weight of the pan is no longer a factor in the problem, but in effect the pan is rendered imponderable. The two balls shown at the extremity of the scale arm are used simply for purposes of adjustment as customary on all scales. Directly over the fulcrum are the usual index pointers. The platform of the scale has 31 transverse grooves. These are arranged equidistant, and are capable of receiving the weights. The platform is hinged to the opposite arm of the scale, and is surrounded by a metallic fence, that is shaped like a spout on the far side. This spout serves to guide the weights in their descent to the separator, after the solution of any problem. Each groove is properly numbered from 1 to 31, inclusive, to correspond with the number on the scale arm. The various problems of "average date" are determined by the use of five varieties of weights shown in the cut, under letters A, B, C, D and E. The A and C balls are made of lead. The B and D cylindrical bodies are made from wrought iron rods. All of these weights are nickel-plated to prevent soiling the hands. Each ball, C, is equal in weight to 10 balls of A, while each weight, E, is equal to 10 of C. In this way A, C and E may represent units, tens and hundreds; or 10, 100, 1000; or 100, 1000, 10,000; and so on; expressing as the occasions requires, whole numbers or decimals. The weights B and D are used for the purpose of economising time. One of B equals five of A, and one of D equals five of C. The use of these intermediates saves tedious counting of the balls, A and C, and their characteristic form prevents possibility of mistakes.

It remains only to describe the separator before explaining the mode of using the machine. The separator is located directly under the platform. The balls, when dumped by the latter, are received on an inclined plane, which are covered with rubber to deaden the sound. This incline causes the balls to roll to the front of the machine, where they fall upon a wire screen. This is of suitable size to allow A balls to drop into their own compartment, but retains the C balls, thus effecting a perfect separation. The weights B and D should be lifted from the platform and lodged in cups on the right and left of the separator. When it is required to determine the average date of a number of purchases made during any month, it is only necessary to place weights representing the amounts purchased in the grooves representing the days, fill the scale pan with exactly the same amount of weight as placed on the platform, then move the pan along the scale arm until the weights in the pan exactly balance those on the platform. The reading of the scale arm will give the "average date" of the purchases to which 30, 60 or 90 days must be added according to terms of sale. The woodcut shows but one form of averaging machine, but as occasion requires, the number of grooves can be greatly increased and the machine adapted to various requirements. The machine can be used for solving a great variety of problems by varying the grooves, notches, and weights. If, for instance, a vertical line passing through the fulcrum is made to exactly divide the system of grooves and notches, so that all are equidistant, and no blank spaces intervene between the line and the No. 1 groove, or the No. 1 notch; then the machine will solve a vast variety of problems of direct and inverse proportion; as, for instance, the diameters and speeds of pulleys; the diameters, circumferences, and areas of circles, of ellipses and so forth. With speed problems it is only necessary to let the grooves of the platform represent the diameters of the large pulleys, and the notches on the arm the diameters of the small pulleys; whereupon the speed of the large pulley will be represented by whatever weight placed in the groove will balance the weight in the pan, which latter represents the speed of the small pulley. It is evident that if any three quantities are given, the fourth can at once be determined. Again, if the distance of any groove from the fulcrum be taken as unity, and the scale pan located at a distance in the opposite direction equal to 3·14159+, then any weight in the pan that will balance a given weight in the groove will represent the diameter of a circle; while the weight in the groove will represent the circumference of the same circle. By using weights of different specific gravities in the pan and on the platform, or else by using specially graduated scales, problems in square root can be determined with like facility. For every day services these capabilities are of little moment, as compared with the process from which the machine derives its name. They are, however, of interest to the student, for they clearly illustrate the intimacy of the relation existing between the processes of mathematics and mechanics. In the matter of averaging commercial accounts, the machine leaves the workings of the mind far in the distance, for by its aid one can solve 100 accounts per hour without fatigue, or uncertainty as to results. The machine has an additional advantage, for it can be successfully operated by those who have but little skill with figures. The writer ventures the opinion that for every formula or rule in mathematics—possibly excepting higher mathematics—a suitable mechanism can be devised which will perfectly illustrate and express the same. It is not claimed that in every class of problem the extreme precision of a mathematical solution can be attained, for as a matter of expense, it may not be expedient to seek a perfection of adjustment that will insure such results. This is illustrated in the case of the averaging machine. It would be possible to adjust it with the perfection found alone in an assayer's balance, so that the wing of a fly, or even the scratch of a pencil would affect the equilibrium, but the outlay would be entirely unnecessary, and what would it signify? The machine might indicate a certain payment should be made at 3.30 a.m., when in practice no one could be found at that early hour either to pay or to receive the money.



* Read before the American Society of Civil Engineers, March 2nd, 1881.

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

(*From our own Correspondent.*)

THE net average selling price of bars of all descriptions during the months of March, April, and May, was £6 9s. 6·45d. per ton. Compared with the average price of the previous three months, this is a drop of 3s. 5d. per ton, since the prevailing figure of the earlier period was £6 12s. 11d.

But for the fact that the sliding scale provides a minimum, puddlers' wages would fall 3d. per ton, and millmen's wages in like proportion. This minimum figure of 7s. 3d. has, however, prevailed throughout the past quarter; hence there will not now be any change in wages.

Medium bars are quoted about £6 10s. per ton, and common sorts £6 to £5 15s. Marked bars remained at £7 to £7 12s. 6d. with only a slow sale. Hoops and strips were reported as continuing in capital demand at, for the former, £6 5s. to £6 10s. for ordinary merchant sorts; and for the latter, £5 15s. to £5 17s. 6d. for gas tube qualities. Cooper's hoops were about £6 10s. to £6 15s. Sheet makers were again in a position to announce gratifying sales. Singles were quoted £7 10s. to £8; doubles, £8 5s. to £8 10s.; and lattens, £9 10s. to £9 15s. and £10. Galvanisers announced the receipt of a satisfactory Australian mail this week, and most of them are very well filled up with orders. Boiler-plates were not improved in demand, and makers found it impossible to realise better prices. Common sorts were £8 10s. to £9; and superior, £9 10s. to £10.

The tin-plate trade was somewhat disorganised. Native makers quoted this afternoon:—Cokes, ordinary quality, 16s.; best cokes, 17s. to 18s.; charcoal, ordinary qualities, 20s.; best ditto, 22s. per box. The chief buyers at present are the United States and Australia.

Pig iron maintained previous strength. Messrs. Alfred Hickman and Son, who are the largest pig makers in the district, quoted—common, £2; part-mine, £2 10s.; and hydrates, £3. Their stocks, they reported, have decreased upon the month 400 tons.

Hematites were stiffer than for some time. One Cumberland brand was up 2s. 6d. per ton upon the quotation of only about a week before. The rise left the price at producers' furnaces at 57s. 6d., and is due mainly to increased sales to the Sheffield steel makers. Barrow hematites were—No. 1 foundry, 72s. 6d.; No. 3 foundry, 69s. to 70s.; and No. 4, grey forge, 65s., all delivered in this district. Tredegar hematites were 65s. to 66s. delivered. Staffordshire all-mine pigs remained at £3 to £3 2s. 6d.; part-mine sorts were £2 10s.; and cinders, £2 to £1 17s. 6d.

The quarterly meetings come off in Wolverhampton next Wednesday, and in Birmingham on the following day.

With the end of last month Mr. Richard Williams, the general manager of the Patent Shaft and Axletree Company, severed a connection of thirty-seven years with the concern. But although he retires from his post, he yet purposes keeping up intimate relations with the works as a director.

Amongst the most recent artistic constructive ironwork that has left the foundry department of the Coalbrookdale Ironworks, Shropshire, is a set of handsome ornamental entrance gates, the presentation of the Shropshire Horticultural Society to the town of Shrewsbury. The productions are of cast iron, of renaissance design, and include a double main entrance gate and a hand gate, with the necessary three cast iron piers. Each gate was cast in a sheet, and the whole forms a splendid illustration of the moulder's art. The castings are erected at the Quarry, Shrewsbury, in which spot the meetings of the Horticultural Society have been so successful.

To-day—Thursday—the Association of Municipal and Sanitary Engineers and Surveyors is beginning its annual three days' gathering in Birmingham. The election of officers and other association business, together with the President's inaugural address, formed the first part of the programme. The outfall sewage works and the sewage farm at Saltley were afterwards inspected and explained by the borough surveyor. The annual dinner, under the presidency of the Mayor, concluded the first day. Discussions and papers upon local works visited form Friday's programme, and Saturday is to be spent in an inspection of the Corporation gas and water works.

The strike among the nailers of the Sedgley and Gornal neighbourhood still continues. Their usual meetings have been held to strengthen the operatives in their determination to hold out. It is stated that efforts from sources extraneous to the trade are being put forth to effect an agreement.

Messrs. F. E. Lewis and Alex. McBean, iron and mineral brokers, Wolverhampton, have dissolved partnership. Each gentleman will in future carry on business on his own account in the respective agencies which they divide between them.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—A better feeling is still maintained throughout the various branches of the iron trade of this district, but so far as the raw material itself is concerned it can scarcely be said that any very material improvement has yet been actually established. A considerable amount of business has certainly been done during the past fortnight, but this for the most part has been at about old rates, and now that makers are asking advances in prices inquiries are checked. As I have pointed out previously, the large stocks of pig iron held throughout the country must necessarily act as a dead weight upon any upward movement in values, and in the face of these buyers, who appear to have pretty well covered their present requirements by the purchases recently made, do not care to buy further, on speculation, at advanced rates.

Lancashire makers have been selling pretty heavily at their late rates, and this week they are asking an advance of about 1s. 6d. per ton, the quotations for delivery into the Manchester district being now 44s. 6d. for forge, and 45s. for foundry qualities, less 2½ per cent., but at those figures that has been little or no business doing.

In outside brands sales seem to have fallen off during the week, and transactions are still confined chiefly to Lincolnshire irons, for which, delivered equal to Manchester, 44s. to 45s. per ton, less 2½ per cent., is asked. Derbyshire and Middlesbrough iron continue practically out of this market at the prices at present asked by makers.

In the manufactured iron trade a fairly improved condition of things seem to be maintained. At the large finished ironworks in the Manchester, Bolton, and Warrington districts the orders at present in hand are sufficient to keep makers going for the next two or three months, and although no materially better prices are obtainable, sellers are firm. For bars, hoops, sheets, and wire rods there is a good inquiry, and a fair amount of business is being done in light rails for shipment abroad. For delivery into the Manchester district bars average about £5 15s. to £5 17s. 6d.; hoops, £6 7s. 6d. to £6 10s.; sheets, £7 12s. 6d. to £7 17s. 6d.; and wire rods about £7 per ton; light rails f.o.b. at Liverpool are quoted at about £6 per ton.

Contracts for the fire-proof and other ironwork for four or five cotton mills which are to be erected in this district have recently been placed in the market. These have as usual been competed for by Belgian houses, but I hear on good authority that Lancashire makers have been successful in securing the contracts.

There seems to be a slight increase of activity in the engineering and machine shops of this district; but this activity does not appear to bring very remunerative prices, and although the workmen are better employed than they were, the position of the masters continues unsatisfactory, as there is a disposition to fill workshops with trade almost at any price rather than allow them to get into semi-stagnation.

I have heard no little surprise expressed that the Manchester Chamber of Commerce, which in the French Treaty negotiations has been very active on behalf of the textile manufactures of the district, has done little or nothing to represent the interests of the engineering branches of trade. Certainly Manchester, which I remember Ald. W. H. Bailey recently described as the metropolis of engineering, is of sufficient importance in this direction to demand attention, and, so far as the interests of labour are concerned, it may be safely asserted that in the city of Manchester itself, and its great suburb of Salford, there are more adult persons employed in the factories of the engineering trades than in the factories of the cotton trade.

The coal trade continues extremely dull, and so far as the depression could be intensified, it has been by the recent hot weather, which has materially interfered with the requirements, not only for house-fire purposes, but with the consumption for iron-making and mill purposes. In gas-making coals a fair business has been done, as this is the season of the year for giving out the usual contracts. Engine classes of fuel are in moderate demand at about late rates. All classes of round coal are going heavily into stock, and many of the pits not working more than half time. Nominally list rates are without alteration, but concessions are so repeatedly made to secure temporary business that it is scarcely possible to say what the actual selling prices really are. Best coal at the pit mouth averages about 8s. 6d., and seconds 6s. 3d. to 6s. 9d., whilst common round coals can be got at any price from 4s. 6d. per ton upwards; burgy averages about 4s. to 4s. 9d., and good slack, 3s. 9d. to 4s. 3d. per ton at the pit.

An important question affecting the working of large collieries has been raised during the past fortnight. At the last meeting of the Manchester Geological Society, Mr. Joseph Dickinson, her Majesty's Chief Inspector of Mines, intimated that, as the result of an opinion recently obtained from the law officers of the Crown as to the interpretation of the fifty-first section of the Coal Mines Regulation Act, 1872, it would now be compulsory for the night shift or labourers, as well as the miners ordinarily employed at the colliery, to be out of the mine when shots were being fired, and that only the persons actually engaged in firing the shots would be allowed in the mine at the time gunpowder was being used. As in some large collieries it requires a very numerous staff of night men and many hours' work to get the roadways and working places in thorough readiness for the ensuing day, it will be seen how seriously the carrying out of this interpretation of the section will interfere with operations, and the question was naturally raised at the meeting of the South Lancashire and Cheshire Coalowners' Association held in Manchester on Tuesday. No definite resolution was come to, as it is probable the subject will come before the Association again at a future meeting, but the general opinion was expressed that at the time the Act was passed the impression was that the 51st section was intended only to refer to the miners employed at the colliery, and not to the night shift or labourers who were engaged in attending to the ordinary safety of the mine.

The recently established Manchester Coal Exchange has made good progress, the secretary announcing at a meeting of the managing committee, held on Tuesday, that the number of subscribing members—which last was 227—had this year increased to 375, whilst the balance carried forward from the previous twelve months had, after allowing for rent up to the end of the present year, and all current expenses, been more than doubled.

Barrow.—The rather better demand for pig iron which I noted a fortnight ago continues up to the present. The inquiries which are coming to hand are more numerous, and much of the unhealthiness which has afflicted the hematite pig iron market has disappeared. Orders are being more freely given, and prices are quoted at slightly higher rates. The output of the furnaces, which was kept at its highest, has of course been the means of increasing stocks very considerably; but since the tonnage of metal has been reduced at the furnaces, the increased demand has worked a large quantity of the stock which was held. A heavy tonnage of pig iron remains yet on stock, and the demand must show a much greater increase than is at present experienced. It is thought that a turn for the better has taken place in the market, and I am not without hope, from what I see and what is told me by the best authorities, that there is some ground for the belief that the market has touched its lowest. Prices show an advance of from 1s. to 1s. 6d. for Bessemer all round samples, and No. 3 forge brings 54s. to 55s. per ton at makers' works. The activity in the steel trade is well maintained, and a push is being made to execute deliveries as quickly as possible. A few good contracts have been booked. Shipbuilders and other industries are well employed. Iron ore in better demand. Coal and coke moderate.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

STOCKTAKING is very general in this district about the end of June and first week of July. It is now proceeding while I write, and not a great deal of work has been done in several of the large establishments since my last letter.

At Messrs. S. Fox and Co.'s, Limited, Stocksbridge Works, Deepcar, there is a brisk demand for cables and other kinds of wire, and Fox's paragon frames—an important "speciality" at Stocksbridge—are in great request for the continental markets, particularly France.

An effort is being made to form a limited company for the purchase and working of Wheathill Foundry, Rotherham, said to be the oldest in the town. The proposed capital is £15,000 in £10 shares. The purchase money is £7250, and a working capital of £3250 is provided for. The goods produced are stove grates, kitchen ranges, and general builders' castings.

Through the kindness of Dr. Webster, the American Consul here, I am able to give the statistics of exports of Sheffield goods to the United States for the quarter ending June last, which completes the half year. The results are :—April, steel £28,169 ; cutlery, £14,700; total, £117,443. May, of steel, £30,103 ; cutlery, £18,787 ; total, £121,379. June, steel, £24,652 ; cutlery, £22,090 ; total, £121,763. Steel, then, shows a value of £82,925 ; and cutlery of £55,577, the total for the quarter being £360,587. This is an increase of nearly £80,000 as compared with the previous three months, and is £69,000 more than the corresponding period of last year. On the face of it this is very gratifying, but in the great speciality of steel it is not gratifying to observe a decrease to the value of £24,000. As the increase in cutlery is only £1200, it is evident that the gross increase is on the heavy goods, particularly steel rails. These are not now obtainable as a separate item, as the trade being in the hands of two firms, the figures would, if published, simply disclose their business, which is not the object of Consular courtesy.

In view of the miners' amalgamation in South Yorkshire, a correspondent points out that the miners' agents are now face to face with the fact that the yearly output of coal has reached 147,000,000 tons, or nearly 14,000,000 tons of an increase, and all this, too, with 52 fewer mines in operation.

On July 1st engine coal was reduced to 4s. 6d. per ton ; other sorts unaltered.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE Cleveland ironmasters' statistics for June were made public on Sunday morning. They revealed a decreased production of 6488 tons of Cleveland, and of 5107 tons of hematite and spiegel iron, as compared with May, making a total decrease of 11,595 tons, or about 5 per cent. of the total production. The month having, however, only thirty days, as against thirty-one for May, this decrease is not much more than is thereby accounted for. Shipments to foreign ports have increased by 5249 tons, and coastwise by 10,599 tons, the latter being mainly to Scotland. Stocks in makers' hands have decreased by about 9000 tons, whilst in warrant stores they have increased by about 14,000 tons, making a total net increase of 5472 tons. These returns are regarded as, upon the whole, unfavourable to producers. They show that a considerable portion of the make of the month is, as yet, undisposed of to consumers ; and of what has been sent away, the greater portion of the increase has merely found its way to Scotland, there, in all probability, to displace so much Scotch pig, which must be accumulating all the more. If this substitution of English for Scotch pig had not taken place at an increased rate over May, there would have been a total increase of stocks of 16,000 tons. This almost unexpected result is somewhat accounted for by the loss of two days during the month at the manufactured ironworks owing to Whitsuntide holidays, besides some odd days through petty strikes. Local consumption is at such times completely stopped, whilst production of pig iron goes on unabated, for no holidays are observed at blast furnaces. The effect of these statistics, and the considerations involved by them, was to produce a flat market on Tuesday, though, perhaps, no actual change in prices could be recorded. Very few transactions took place, producers, consumers, and speculators all alike seemed inclined to hold off and see what the future would bring forth. The price for No. 3 g.m.b. may be considered to be 37s. f.o.b.; forge, 36s.; and warrants, 38s. The quantity of pig iron in Connal's stores is now 179,833 tons, being an increase of 2019 tons during the week. The shipments of the first three days of July have been at about the same rate as during the previous month.

The finished iron trade is improving. The 2s. 6d. per ton advance which was declared last week has, after being severely contested for a few days, now become fairly established. The contracts recently made have considerably exceeded the quantities run off, and as consumers are believed to be largely under-bought, it is not unlikely the price may again advance. This is, perhaps, only to be expected, as the fall of 20s. per ton which has taken place since February is far more than proportionate to the fall in pig iron. The price of ordinary plates is now £6 to £6 5s. at Middlesbrough, according to quantity and specification. Boiler plates are £1, £2, and £3 per ton more, according to quality, and best plates for bridges are 10s. more. Angles and bars for shipbuilding are £5 10s. per ton, and superior qualities at proportionately increased prices. Puddled bars are in demand, on account of the hot weather, and realise about £3 15s. per ton.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE pig iron market has been quiet during the week. On the whole the demand is good, and the shipments compare favourably with those of this time last year; but the large stocks and heavy production retard speculation. This is, perhaps, an advantage to the trade, as a whole, although not a cheering state of matters, as far as speculators are concerned. Indeed, very little speculative business has been done in the course of the week, and the fluctuations in prices have been very slight. There are 120 furnaces in blast, producing several thousand tons weekly more than is wanted, and so swelling the stocks. About 1500 tons have been added to the stock in Messrs. Connal and Co.'s Glasgow stores, which now aggregates 569,000 tons, the past week's shipments amounted to 13,095 tons, as compared with 10,977 in the preceding week, and 12,527 in the corresponding week of last year ; while the imports of Cleveland pigs have been 6061 tons against 6307 in the preceding week, and 5979 in the corresponding week of 1880. The foreign inquiry is good for the season, but the prices obtained cannot show very much profit. The increase of stocks in Cleveland during the past month has had a flattening effect upon our market.

Business was done in the warrant market on Friday at 46s. 10d. On Monday the tone was dull, although a slight improvement took place in the course of the day. Business opened in the forenoon at 46s. 9d., and advanced to 46s. 10d. cash, and from 46s. 10½d. to 46s. 11½d. one month, the afternoon quotations being 46s. 10d. to 46s. 10½d. cash and 46s. 11½d. one month. The market was flat on Tuesday, at 46s. 10d. cash, and 46s. 11½d. one month to 46s. 9d. cash, and 46s. 10½d. one month. The market improved slightly on Wednesday on account of a report that concerted action was proposed for curtailing production, and to-day—Thursday—has been firm, with business at 46s. 10d. to 47s. cash.

The prices of marked brands are a shade easier, although the alterations in quotations are inconsiderable :—Gartsherrie, f.o.b. at Glasgow, No. 1, is quoted at 54s. 6d. per ton ; No. 3, 48s. 6d.; Coltness, 56s. and 49s.; Langloan, 56s. and 49s.; Summerlee, 54s. 6d. and 47s.; Calder, 54s. 6d. and 48s.; Carnbroe, 51s. and 47s.; Monkland, 47s. and 45s.; Quarter, 47s. and 45s.; Govan, at Broomielaw, 47s. and 45s.; Shotts, at Leith, 55s. 6d. and 49s.; Carron, at Grangemouth, 52s. 6d. (specially selected, 56s.) and 51s. 6d.; 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 trade is well employed, and some new orders are reported. There has been a brisk demand for plates and angles, the latter at full, and the former at slightly advanced prices. The various branches of the manufactured iron trade are active, engineers being busy, and finding new work steadily dropping in. The different departments of the trade are apparently in a healthy state, with fair prospects as regards the future.

The coal trade likewise continues in a satisfactory position. Owing to the activity in the factories there is a steady demand for furnace coals. The domestic consumption is good for the season of the year, and the shipping demand quite encouraging. The shipments from Glasgow Harbour in the course of the past week were close upon 14,000 tons, and taking the returns from all the shipping ports of the country, east and west, they show an increase on the preceding week of about 10,000 tons. Prices do not seem to have materially changed since last report. Main coal sells f.o.b. at 5s. 6d. to 6s.; splint, 6s. 3d. to 6s. 4d.; and steam at 6s. 6d. to 7s.

At the collieries all is quiet, the miners being steadily working in view of the holidays, which are close at hand.

The judges of the Second Division of the Court of Session have affirmed an interlocutor by Lord Rutherford Clark interdicting the Shotts Iron Company from calcining ironstone or iron ore, or burning blaze on any part of the lands of Penicüik, within one mile of the Glencorse estate, which belongs to Lord President Inglis. His lordship averred that the fumes from the calcining materials destroyed his plantations. The judgment, it may be explained, was not unanimous, Lord Young differing from the opinions of the Lord Justice-Clerk and Lord Craighill. If the law of Scotland should turn out to be in accordance with this decision, the present is not likely to be the last case of the kind that will be heard of.

The Lord Provost of Glasgow stated at a meeting of the Clyde Navigation Trustees, on Tuesday, that the revenue of the Trust for the past financial year showed a large increase, and was by far the greatest on record.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

PROSPECTS last week in the coal trade showed such a decided brightening up that at the meeting on Saturday of the South Wales Coalowners' Association held in Cardiff it was agreed to concede an advance to the colliers of 2½ per cent., dating from 1st July. I believe that I am right in stating that the report of the accountants for the last four months would scarcely justify an advance, according to the principle of the sliding scale ; but considering the large exports, the strengthening tone of trade altogether, and improving prices of late, this advance is justified in an anticipatory sense, and doubtless the quarter's business now running will confirm it. The act has been received with marked satisfaction by the colliers, as it shows them that the sliding scale is not a hard-and-fast measure, but elastic, and guided by discriminating hands. Its prospective action, as in this case, is a noticeable feature.

I am glad to see that the great exports of coal continue, and that prices are decidedly looking up. Large coal is sold now at Swansea for 8s. to 8s. 6d. f.o.b., but this coal is inferior to the best samples shipped from Cardiff. For the best kinds at Cardiff 10s. 6d. f.o.b., and even more has been obtained. Seconds are also looking up, and I fully expect in my next to be able to report a general advance all around.

There is no change of note to record in the iron and steel trades. Tin-plates remain dull.

The Britannia Ironworks and Foundry Company, Newport, is in bankruptcy, and this week the whole of the plant, modern engineering tools, &c., will be dispersed by auction.

There is more colliery plant going to the hammer this month —all the plant of Tyn Filkins, both pits, and Hope Colliery, Monmouthshire. At the last sale of colliery plant at Llancaiach, Mon., coal wagons went for £10 each, a price suggestive of being worn out. Colliery wagons are looking up in price. I heard of a large purchase at £60 each.

A collier was fined £1 for smoking in a Rhondda pit this week.

DEATH OF MR. INMAN.—Mr. William Inman, founder of the Inman line of trans-atlantic steamers, died on Sunday at his residence, Upton Manor, Cheshire, at the age of fifty-six years. He had been in ill-health for some time, but his death was not anticipated, and has caused universal regret in Liverpool, where he was held in high esteem for his enterprise, his integrity as a merchant, and his generous support to benevolent institutions. A sketch of Mr. Inman and his work as pioneer in the emigration trade was published in the *Times* of Friday, January 26th, 1877.

MR. JAMES ASHWELL.—The father of the Institution of Civil Engineers, and one of the six founders, or, as he used to express it, "the cadet" of the founders, has just died at an advanced age. Cradled among minerals and in our national industries of coal and iron, he, when a young man, was sent to Edinburgh as a student in the natural sciences under Fairbairn and Leslie. In 1835 he reported upon the Blaenavon property and works in South Wales, and, on the formation of the company, assumed the position of resident director, from which he retired in 1841. He had then just entered his two sons at Cambridge, and he selected the quiet, studious occupations of the University for himself, and duly graduated. In 1845 he returned to active life, and reported upon the survey and project of the Great Luxembourg Railway Company for a line through the Ardennes from Brussels to the frontier near Metz, and was the resident director and legal representative of the company in Belgium for several years. He was also associated with the projected line between Antwerp and Rotterdam, and during the last three years of his active life—from 1857-60—he was engaged upon negotiations connected with that undertaking.

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.

28th June, 1881.

2819. Extract of Coffee, C. Paul, Vienna.
2820. Floor Cramp, H. Fabian, Erith.
2821. Supplying Air, C. W. Torr, Birmingham.
2822. Drawing Liquids, E. Woolf.—(*G. Woolf U.S.*)
2823. Secondary Batteries, A. P. Laurie, Edinburgh.
2824. Ratchets, C. Geddes and P. Sword, Liverpool.
2825. Separating Iron, E. Hunt.—(*J. King, Chili.*)
2826. Electric Fuses, D. Johnson, Chester, and E. Spon, London.
2827. Felted Materials, W. H. Beck.—(*La Société A. Ruffin et Cie, Paris.*)
2828. Ventilating Steamships, J. Colling, Sunderland.
2829. Hulling Rice, J. Halliday, London.
2830. Knife and Fork, W. Wiley, Wolverhampton.
2831. Lamps, H. J. Haddan.—(*E. S. Piper, Toronto.*)
2832. Smoothing Irons, F. A. K. Cook, Londonderry.
2833. Electric Lamps, G. G. André, Dorking, and E. Easton, London.
2834. Reverberatory Furnaces, G. Fenwick, Gateshead, and B. Cochrane, Durham.
2835. Band Saws, J. H. Johnson.—(*H. Tuyssuzian, Paris.*)
2836. Removing Hairs from Fur, W. R. Lake.—(*F. Lambert and J. Kokesch, New York, U.S.*)
2837. Dyeing, W. E. Gaine, Hammersmith.
2838. Coal Gas, C. F. Claus, London.
2839. Screw Bolts, W. R. Lake.—(*C. H. Denison and E. F. Mead, New York, U.S.*)
2840. Treatment of Grain, W. R. Lake.—(*A. Jebb and W. T. Jebb, Buffalo, U.S.*)

29th June, 1881.

2841. Plain and Mixed Repps, J. Horrocks, Bolton.
2842. Motive Power Engine, G. Topham, Maida Vale.
2843. Indicating and Recording, J. M. Jones, London.
2844. Checking Postage Stamps, F. S. Willoughby, Heaton Chapel, Lancaster.
2845. Heating Water, T. Drake, Huddersfield.
2846. Transmitting Sounds, E. J. Paterson, London.
2847. Collecting Fares, W. Lake.—(*J. Greenough, U.S.*)
2848. Treatment of Carbon for Electric Lighting, J. G. Lorrain, Savoy, London.
2849. Purifying Coal Gas, J. G. Hawkins, Wigan.
2850. Treating Fish, S. D. Cox, Woolwich.
2851. Electric Lighting, W. Lake.—(*J. Wood, U.S.*)
2852. Violins, W. Lake.—(*E. Berliner, Boston, U.S.*)
2853. Starting Tram-cars, A. Piffard, Felden, and H. Gimmingham, Camden-square, London.

30th June, 1881.

2854. Baths, L. Brode and R. Muir, Glasgow.
2855. Tenoning Machine, G. H. Couch, Croydon.
2856. Spindles, L. Groth.—(*W. Schmid, Italy.*)
2857. Pumps, &c., K. W. A. Leverkus, Manchester.
2858. Lamps, F. Cheesbrough.—(*C. Fritz & Co., Vienna.*)
2859. Treating Gas, J. Dowson, Westminster.
2860. Ingots of Steel, A. Longsdon.—(*F. A. Krupp, Essen, Germany.*)
2861. Steam Boilers, F. Engel.—(*A. Schultze and G. Meyer, Hamburg, Germany.*)
2862. Felting Hats, G. Atherton.—(*G. Yule, U.S.*)
2863. Dye-Products, A. M. Clark.—(*C. Collin, Paris.*)
2864. Sharpening Saws, F. Myers, New York, U.S.
2865. Purifying Coal Gas, C. F. Claus, London.

1st July, 1881.

2866. Looms, F. O. Tucker, Huddersfield.
2867. Telephonic Apparatus, W. E. Potter, Liverpool.
2868. Printer's Ink, P. Jensen.—(*H. Günther, Berlin.*)
2869. Gas Lamps, F. W. Clark, London.
2870. Condensing Steam Engines. J. Chapman, Leith.
2871. Breech-loading Small-arms, W. Tranter, Birmingham.
2872. Paper for Cheques, F. Nowlan, London.
2873. Locking Nuts, H. Wedekind.—(*L. Imperatori, Milan, and C. Buclowius, Bochum.*)
2874. Centrifugal Extracting Machines, F. Wolff.—(*Burmeister & Wains Maskin & Skibsbyggeri, Denmark.*)
2875. Calculating Exchanges, E. Walford, London.
2876. Cleansing Sugar, H. E. Newton.—(*La Compagnie de Fives-Lille, Paris.*)
2877. Castors, H. B. Harding, Birmingham.
2878. Wagon Axles, S. Bradley. Kidderminster.
2879. Railway Signalling, E. Tyer, London.
2880. Ornamental Glass, T. D. Farrall, Bermondsey.

2nd July, 1881.

2881. Crushing Stone, &c., A. H. Elliott, London.
2882. Preparing Vegetable Substances, R. G. Perry, Rathdowney, Ireland.
2883. Decorating Tiles, H. Dunnill, Ironbridge.
2884. Raising, &c., Boats, L. C. Niebour, Kingston.
2885. Cranes, W. D. Bruce, London.
2886. Making Casks, F. Scott.—(*J. Stark, Canada.*)
2887. Dressing Reels, J. Thornton, Worksop.
2888. Raising Beer, J. K. J. Foster, Bolton.
2889. Combined Bed, &c., C. W. Torr, Birmingham.
2890. Bleaching Fibres, W. A. Barlow.—(*L. Naudin and J. Schneider, Paris.*)
2891. Separating Solid Bodies, H. J. Smith, Glasgow.
2892. Scribbling Machine, A. Barker, Leeds.
2893. Railway Carriages, F. C. Kinnear, London.
2894. Clasp Knives, C. Carter, London.
2895. Tricycles, &c., G. Lowry, Salford.
2896. Wheels, W. H. Carmont, Manchester.
2897. Safety Fastening, A. E. Parkes and F. Westwood, Birmingham.
2898. Extinguishing Fires, F. Grinnell, U.S.
2899. Discharge of Liquids, C. H. von Ullmer, London.
2900. Cases for Packing Eggs, W. J. Young, Bristol.
2901. Card-setting Machines, J. Haley and J, Pinder, Cleckheaton, York.

4th July, 1881.

2902. Horseshoe, J. Balbi, Paris.
2903. Perambulators, G. B. Lovedee, Birmingham.
2904. Polishing Compound, W. Moore, Lyminge, Kent.
2905. Purifying Feathers, J. Martin, Liverpool.
2906. Pianoforte Action, J. Maas & J. Browne, London.
2907. Cut Nails & Tacks, B. Mills.—(*D. Farmer, U.S.*)
2908. Growing Watercress, G. Pimbury, Cheltenham.
2909. Crushing Mills, W. N. Nicholson and W. Mather, Newark-upon-Trent.
2910. Clippers, J. Trickett, Newark-upon-Trent.
2911. Mechanical Stokers, T. B. Kay, Bolton-le-Moors, and R. Heywood, Salford.
2912. Vertical Steam Boilers, G. Kingdon, Kingswear.
2913. Ornamental Glass, T. D. Farrall, Bermondsey.
2914. Compound Resembling Wood, C. D. Abel.—(*B. Harris, Bohlen, Germany.*)
2915. Breech-loading Small-arms, C. D. Abel.—(*F. Mannlicher, Vienna.*)
2916. Glove Fastenings, C. D. Abel.—(*H. Peyser, U.S.*)
2917. Thread Bobbins, G. W. von Nawrocki.—(*A. Englisch, Basle, Switzerland.*)
2918. Displaying Collars, E. Barton, Tottenham.
2919. Exploding Gases, W. Watson, Leeds.
2920. Screw Apparatus, W. W. Hewitt, Swanscombe.
2921. Roads and Pavements, H. J. Haddan.—(*J. Salvat, Morceux, France.*)
2922. Combination Furniture, L. Bonduel, Paris.
2923. Locomotive Arrangements, T. Morgan.—(*D. McIntosh Reid, Assensole, India.*)

Inventions Protected for Six Months on deposit of Complete Specifications.

2774. Supplying Steam for Heating, A. M. Clark, Chancery-lane, London.—A communication from B. Holly, Lockport, U.S.—25*th June*, 1881.
2776. Supplying Steam for Heating, A. M. Clark, Chancery-lane, London.—A communication from B. Holly, Lockport, U.S.—25*th June*, 1881.
2804. Attachments to Cages, &c., F. Haddan, Strand, London.—A communication from S. Henrard, Spain.—27*th June*, 1881.
2836. Removing Hair from Fur, W. R. Lake, Southampton-buildings, London.—A communication from F. Lambert and J. Kokesch, New York, U.S.—28*th June*, 1881.
2852. Violins, W. R. Lake, Southampton-buildings, London.—A communication from E. Berliner, Boston, U.S.—29*th June*, 1881.

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

2598. Drilling Rocks, M. Macdermott, London, and G. W. Elliott, Altrincham, Chester.—28*th June*, 1878.
2718. Bark Mills, E. V. Brown, Exeter, Devon.—6*th July*, 1878.
2946. Sewing-machines, S. Mort and G. Browning, Glasgow.—24*th July*, 1878.
3380. Finishing Cotton Cords, &c., J. Worrall, Manchester, & J. Kershaw, Halifax.—27*th August*, 1878.
2607. Spindles, A. Ogden, T. Marsh, and J. Clayton, Ashton-under-Lyne, and A. Mills, Dukinfield.—29*th June*, 1878.
2624. Gun-carriages, C. M. Sombart, Magdeburg, Germany.—1*st July*, 1878.
2627. Blast Furnaces, C. D. Abel, Southampton-buildings, London.—1*st July*, 1878.
2612. Grain-binders, O. S. Gage, London.—29*th June*, 1878.
2667. Decorating Tin, &c., L. Q. Brin, London.—3*rd July*, 1878.
2622. Closing Windows, B. Banks. Bradford.—1*st July*, 1878.
2656. Sugar-cane Mills, R. Bartlett, London.—3*rd July*, 1878.
2645. Drying Machines, J. Stevenson, Barnsley.—2*nd July*, 1878.
2687. Coverings for Ricks, W. Brenton, St. Germans, Cornwall.—5*th July*, 1878.
2813. Sewing-machines, S. Pitt, Sutton, Surrey.—13*th July*, 1878.
2638. Tramways, J. Gowans, Edinburgh.—2*nd July*, 1878.
2666. Carding Embroidery, J. W. Mason, London.—3*rd July*, 1878.

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

2308. Cigarettes, J. Schloss, London.—2*nd July*, 1874.
2299. Privies, A. M. Fowler, Salford.—2*nd July*, 1874.
2344. Combing Wool, &c., H. W. Whitehead, Leeds.—4*th July*, 1874.
2277. Steering Propellers, E. T. Hughes, London.—1*st July*, 1874.
2291. Weavers' Harness, G. Haseltine, London.—1*st July*, 1874.
2478. Telegraphic Signalling W. H. Davies and F. H. W. Higgins, London.—15*th July*, 1874.
2306. Distributing Manure, R. Willacy, Preston.—2*nd July*, 1874.
2340. Nuts, J. Scattergood, and B. Wilkes, West Bromwich.—4*th July*, 1874.
2376. Dressing, &c., Silk Fibres, J. T. Wright and W. H. Laidler, Poplar.—7*th July*, 1874.
2429. Grinding Needles, A James, Redditch.—10*th July*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 22nd July, 1881.

803. Dynamic Motors, R. Waller, Leeds.—25*th February*, 1881.
820. Testing Milk, F. Wirth, Frankfort-on-the-Main.—A com. from F. Heeren.—25*th February*, 1881.
822. Socket Pipes, B. C. Cross, Dewsbury.—26*th February*, 1881.
829. Boring Machines, F. Wirth, Germany.—A com. from I. Liefmann.—26*th February*, 1881.
835. Carrying Milk, &c., E. J. Gaskell and W. T. Jackson, Wirral, Chester.—28*th February*, 1881.
836. Joining Leather Belting, B. J. Gibney, Nottingham.—28*th February*, 1881.
841. Dyeing Hanks, J. Conlong, Lancaster, and J. Robertshaw, Manchester.—28*th February*, 1881.
846. Locks, W. H. Crispin, Stratford, Essex.—28*th February*, 1881.
860. Cleaning Knives, L. Appleton, Brecknock-crescent, London.—1*st March*, 1881.
865. Safety Lamps, W. P. Thompson, Liverpool.—A communication from C. He inzerling and V. Hanmerau.—1*st March*, 1881.
867. Combined Gas and Air Engine, F. H. Wenham, London.—1*st March*, 1881.
897. Safety Guards, A. M. Clark, London.—A com. from F. Folacci fils.—2*nd March*, 1881.
921. Shaving, &c., Skins, A. M. Clark, London.—A com. from La Société Anonyme des Brevets Réunis.—3*rd March*, 1881.
952. Pumps, D. McLachlan, Glasgow.—5*th March*, 1881.
971. Packing Cases, D. Grey, Maesteg, Glamorgan.—7*th March*, 1881.
975. Ordnance, J. H. Johnson, London.—A communication from N. B. Clark.—7*th March*, 1881.
1024. Treating Grain, M. Benson, London.—A com. from O. Oexle.—10*th March*, 1881.
1046. Hydraulic Apparatus for Punching, &c., J. Blair, Glasgow.—11*th March*, 1881.
1067. Breaking Double Twist, A. M. Clark, London.—A com. from C. Maillard.—11*th March*, 1881.
1097. Voltaic Batteries, J. H. Johnson, London.—A com. from La Société Anonyme la Force et la Lumière Société Générale d'Electricité.—14*th March*, 1881.
1139. Feed-water Regulators, A. M. Clark, London.—A com. from C. H. Kuhne.—16*th March*, 1881.
1140. Handles for Shovels, A. M. Clark, London.—A com. from W. H. Johnson.—16*th March*, 1881.
1228. Condensing Steam, T. Elcoate, Liverpool.—21*st March*, 1881.
1241. Breech-loading Small Arms, J. Deeley, jun., Birmingham, and J. S. Edge, jun., Yardley.—21*st March*, 1881.
1419. Reservoir Pen-holders, T. A. Hearson, Greenwich.—31*st March*, 1881.
1472. Steam Steering Gear, G. W. Robertson, Glasgow.—5*th April*, 1881.
1530. Cement, J. E. J. Smith, Northfleet.—7*th April*, 1881.
1907. Insoles of Boots, W. H. Stevens, Leicester.—5*th May*, 1881.
2056. Driving Tacks, W. R. Lake, London.—A com. from G. J. Capewell.—11*th May*, 1881.
2060. Window Cleaning Chair, A. M. Clark, London.—A com. from A. Dornitzer.—11*th May*, 1881.
2211. Buffer Gearing, I. A. Timmis, London.—20*th May*, 1881.
2373. Combing and Dressing Machine, S. C. Lister, Manningham, York.—30*th May*, 1881.
2479. Stippling on Lithographic Stones, W. R. Lake, London.—Com. from J. Gast.—7*th June*, 1881.
2772. Cigar Lighters, A. M. Clark, London.—A com. from W. W. Batchelder.—24*th June*, 1881.
2774. Supplying Steam for Heating, A. M. Clark, London.—A com. from B. Holly.—25*th June*, 1881.
2776. Supplying Steam for Heating, A. M. Clark, London.—A com. from B. Holly.—25*th June*, 1881.

Last day for filing opposition, 26th July, 1881.

694. Tool Holder, W. Timms, West Hartlepool.—17*th February*, 1881.
855. Working Railway Signals, J. C. Brush, Dublin.—1*st March*, 1881.
859. Erecting Telegraph Wires, J. W. Fletcher, Stockport.—1*st March*, 1881.
861. Hanging Doors W. Morgan-Brown, London.—A communication from E. Prescott.—1*st March*, 1881.
871. Rowlocks, S. S. Hazeland, St. Sampson's, Cornwall.—1*st March*, 1881.
872. Steam Engine Attachment, W. Green, Birmingham.—1*st March*, 1881.
877. Gas Lighting Apparatus, W. R. Lake, London.—A com. from J. M. Foster.—1*st March*, 1881.
879. Electric Light Signalling, A. Shipley, London.—1*st March*, 1881.
893. Sizing Machines, T. Singleton, Over Darwen.—2*nd March*, 1881.
906. Stoves, G. L. Shorland, Manchester.—3*rd March*, 1881.
915. Boxes or Cases, A. W. Rooke, London.—A communication from W. G. Parry.—3*rd March*, 1881.
925. Telephone Transmitters, C. Moseley, Manchester.—4*th March*, 1881.
936. Umbrella Boxes, J. B. Seel, Davyhulme, Lancashire.—4*th March*, 1881.
945. Playing Pianos, J. Imray, London.—A communication from L. Thibouville-Lamy.—5*th March*, 1881.
946. Lithographic Printing, J. Imray, London.—A communication from F. Champenois and E. Missier, Paris.—5*th March*, 1881.
977. Electric Signalling, E. de Pass, London.—A com. from H. Leblanc & E. Loiseau.—5*th March*, 1881.
980. Bracelet Fastenings, E. F. Griffin, Birmingham.—8*th March*, 1881.
1001. Velocipedes, R. C. Fletcher, Preston.—9*th March*, 1881.
1044. Curing Smoky Chimneys, R. Douglass and J. J. Douglass, Coventry.—11*th March*, 1881.
1101. Bricks, M. E. Dearnaly, Mirfield, York.—14*th March*, 1881.
1123. Driving Rollers, P. V. Gelder, Liverpool.—15*th March*, 1881.
1124. Steam Engines, F. J. Burrell and T. T. Burall, Thetford.—15*th March*, 1881.
1128. Locomotive Engines, F. W. Webb, Crew.—16*th March*, 1881.
1135. Umbrellas, &c., W. E. Gedge, London.—A com. from MM. Revel, Père et Fils.—16*th March*, 1881.
1148. Coal Gas, F. J. Bolton and J. A. Wanklyn, London.—16*th March*, 1881.
1164. Sewing Machines, B. Hunt, London.—A com. from J. Bond and C. M. Swaim.—17*th March*, 1881.
1210. Baths, J. Bernard, London.—19*th March*, 1881.
1287. Hides and Skins, A. M. Clark, London.—A com. from C. J. P. Desnos.—23*rd March*, 1881.
1437. Knives and Forks, W. H. Stokes, Birmingham.—1*st April*, 1881.
1790. Diving Costumes, S. J. Woodhouse, Leeds.—26*th April*, 1881.
1838. Horse Food, E. J. T. Digby, London.—25*th April*, 1881.
1871. Velocipedes, A. G. Meeze, Redhill, and N. Salamon, London.—30*th April*, 1881.
1901. Umbrellas, H. Davis, London.—7*th May*, 1881.
2085. Spaces for Gas, S. and J. Chandler, London.—13*th May*, 1881.
2086. Steam Pumps, F. and S. Pearn and T. Addyman, Manchester.—13*th May*, 1881.
2263. Electrical Measurements, J. C. Cuff, London.—24*th May*, 1881.
2341. White Yarns, A. Empis, Belfast, Ireland.—27*th May*, 1881.
2485. Spinning Machinery, P. Smith, jun., and S. Ambler, Keighley.—8*th June*, 1881.
2491. Tin-plate, W. Elmore, London.—8*th June*, 1881.
2492. Retorts, W. Grice, Birmingham.—8*th June*, 1881.
2557. Expansion Gear, T. English, Dartford, and D. Greig, Leeds.—13*th June*, 1881.
2569. Looms, R. Hall and J. Hobson, Leeds.—14*th June*, 1881.
2573. Supporting Wires, H. Newton, London.—Com. from C. A. Hussey and A. S. Dodd.—14*th June*, 1881.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 28th June, 1881.*)

1477. Material to Imitate Ivory, R. Brandon, Paris.—5*th April*, 1881.
1525. Fastenings for Belts, W. R. Lake, London.—7*th April*, 1881.
1584. Couplings for Railway Vehicles, W. R. Lake, London.—12*th April*, 1881.
1660. Boiler Furnaces, A. W. L. Reddie, London.—14*th April*, 1881.
1743. Clarifying Apparatus, W. R. Lake, London.—22*nd April*, 1881.
1751. Actinometers, F. Hurter, Widnes.—23*rd April*, 1881.
1762. Electric Insulators, J. A. Fleming, Cambridge.—23*rd April*, 1881.
1773. Sighting Aim in Rifle Drills, R. Morris, Lewisham.
1808. Utilising Liquid, W. R. Lake, London.—26*th April*, 1881.
1847. Extracting Copper from its Ores, W. W. Hughes, Bayswater.—28*th April*, 1881.
1863. Clipping Horses, &c., A. M. Clark, London.—29*th April*, 1881.

List of Letters Patent which passed the Great Seal on the 1st July, 1881.

13. Lithographic Machines, G. Newsum, Leeds.—3*rd January*, 1881.
17. Brewer's Yeast, S. Fulda, London.—3*rd January*, 1881.
30. Revolving Seats, W. H. Blain, Liverpool.—4*th January*, 1881.
31. Cleansing Metallic Screens, P. van Celder and T. Apisom, Liverpool.—4*th January*, 1881.
32. Straining Paper Pulp, D. Bentley, Church-road, Lancaster.—4*th January*, 1881.
43. Washing Compound, A. Watt, Lewisham.—4*th January*, 1881.
44. Artificial Leather, T. E. Hardy, Battersea.—4*th January*, 1881.
53. Venetian Blind Actions, H. Tylor, London.—5*th January*, 1881.
54. Metal Steam Traps, H. Lancaster, Pendleton.—5*th January*, 1881.
61. Actuating Sewing Machines, J. Holden, Swindon.—5*th January*, 1881.
62. Inkstands, R. G. Chipperfield, London.—5*th January*, 1881.
65. Electric Lighting, P. M. Justice, London.—6*th January*, 1881.
66. Blind Rollers, J. E. Ditchfield and K. Hothersall, Manchester.—6*th January*, 1881.
67. Bale Ties, E. Hale, Wigan.—6*th January*, 1881.
71. Feeding Bottles, T. Marshall, London.—6*th January*, 1881.
73. Dynamo-electric Machines, J. E. H. Gordon, Dorking.—6*th January*, 1881.
103. Ventilating Coal-mines, J. W. Hackworth, Darlington.—8*th January*, 1881.
108. Mop Wringer, J. Wittingham, Nantwich.—8*th January*, 1881.
150. Propelling Carriages, R. C. Nicholl, Streatham.—12*th January*, 1881.
197. Treatment of Saccharine Liquids, W. R. Lake, London.—14*th January*, 1881.
295. Refrigerating, J. Gwynne, Hammersmith.—22*nd January*, 1881.
341. Rock Crushers, J. T. King, Liverpool.—26*th January*, 1881.
374. Drawing on Stone, W. L. Wise, London.—27*th January*, 1881.
403. Ventilating Pots, T. Bate, Kilburn.—29*th January*, 1881.
564. Injectors, W. L. Wise, London.—9*th February*, 1881.
851. Street Paving, E. A. Brydges, Upton.—28*th February*, 1881.
869. Lifts, D. Edwards, Cardiff.—1*st March*, 1881.
880. Platforms of Harvesting Machines, H. Andrews, Little Langford.—1*st March*, 1881.
1084. Self-governing Gas-burners, J. B. Fenby, Sutton Coldfield, Warwick.—14*th March*, 1881.
1247. Ice Machines, H. J. Haddan, London.—22*nd March*, 1881.
1407. Permanent Way of Railways, C. Bergeron, London.—30*th March*, 1881.
1449. Fire-grates, A. MacPhail, London.—2*nd April*, 1881.
1710. Aerial Balloons, G. E. Vaughan, London.—20*th April*, 1881.
1836. Hardware, F. C. Glaser, Berlin.—28*th April*, 1881.

(*List of Letters Patent which passed the Great Seal on the 5th July, 1881.*)

5369. Combing Machinery, A. Smith, Bradford.—22*nd December*, 1880.
5374. Treatment of Mineral Phosphates, J. J. Knight, Widnes.—22*nd December*, 1880.
93. Telephonic Apparatus, J. Imray, London.—8*th January*, 1881.
95. Locking Railway Sidings, W. Pinkerton, Larne, Ireland.—8*th January*, 1881.
96. Metal Fencing, R. R. Main and J. Dick, Glasgow.—8*th January*, 1881.
98. Steam Generators, S. and J. Dawson, Mossley.—8*th January*, 1881.
109. Lowering Ships' Boats, J. H. Barry. London.—8*th January*, 1881.
110. Perforating Jacquard Cards, T. G. Lomas, Withington, Lancaster.—10*th January*, 1881.
132. Building Harbours, &c., S, Lake and T. W. Taylor, London.—11*th January*, 1881.
133. Supporting Caissons, S. Lake and T. W. Taylor, London.—11*th January*, 1881.
177. Obtaining Motive Power, J. Imray, London.—14*th January*, 1881.
178. Sifting Apparatuses, C. Pieper, Berlin.—14*th January*, 1881.
201. Grinding Mills, H. J. Haddan, London.—15*th January*, 1881.
220. Production of Cold, J. H. Johnson, London.—18*th January*, 1881.
222. Purifying Hydrochloric Acid, W. Weldon, Burstow, & W. Strype, Murrough.—18*th January*, 1881.
225. Electric Lamps, G. L. Fox, Rushmore, Wilts.—18*th January*, 1881.
239. Compressing Ground Coffee, C. Pieper, Berlin.—20*th January*, 1881.
292. Brushes, J. Worrall, J. Lawrence, Salford, and J. Lea, Eccles.—22*nd January*, 1881.
309. Cultivating Land, F. Brütschke, Berlin.—24*th January*, 1881.
367. Starting, &c., Sewing Machines, J. H. Johnson, London.—27*th January*, 1881.
455. Signal Buoys, F. Barr, New York, U.S.—3*rd February*, 1881.
480. Shackles, H. Bezer, London.—4*th February*, 1881.
509. Kilns, A. S. Tomkins, F. M. Courage, and F. A. Cracknall, London.—7*th February*, 1881.
644. Heating, &c., G. E. Pritchett, Bishop's Stortford, Herts.—15*th February*, 1881.
1049. Pickling Metal Plates, D. P. G. Matthews, Newport.—11*th March*, 1881.
1325. Indicator Locks, A. M. Clark, London.—24*th March*, 1881.
1343. Magazine Guns, P. Mauser, Wurttemberg, Germany.—25*th March*, 1881.
1441. Furnaces for Heating Tubes, W. Dutton and M. Croft, Walsall.—1*st April*, 1881.
1543. Electric Lamps, G. L. Fox, London.—8*th April*, 1881.
1582. Holding Hanks, W. Graham, Monk Bretton.—10*th April*, 1881.
1636. Producing Motions, G. L. Fox, London.—14*th April*, 1881.
1853. Propelling Ships, J. I. Thornycroft, Chiswick.—29*th April*, 1881.
1918. Perforated Cylinders, W. R. Lake, London.—3*rd May*, 1881.
1915. White Zinc Pigment, W. R. Lake, London.—3*rd May*, 1881.
1955. Rotary Engines, H. Thibalt and T. Hawkins, San Francisco.—5*th May*, 1881.
1995. Breaking Stones, W. R. Lake, London.—7*th May*, 1881.
2011. Car Wheels, E. L. Taylor, Philadelphia, U.S.—9*th May*, 1881.
2039. Gathering Cut Crops, G. A. Walker, Sutton, Nottingham.—10*th May*, 1881.

List of Specifications published during the week ending July 2nd, 1881.

2801,* 4d.; 1935, 6d.; 3471, 4d.; 3850, 4d.; 4247, 6d.; 4372, 6d.; 4396, 6d.; 4456, 2d.; 4466, 6d.; 4482, 6d.; 4484, 6d.; 4494, 6d.; 4496, 2d.; 4513, 6d.; 4517, 4d.; 4568, 6d.; 4580, 6d.; 4682, 4d.; 4725, 6d.; 4731, 6d.; 4747, 6d.; 4750, 8d.; 4755, 6d.; 4762, 6d.; 4774, 8d.; 4779, 4d.; 4782, 6d.; 4799, 6d.; 4800, 6d.; 4815, 6d.; 4833, 6d.; 4836, 6d.; 4837, 10d.; 4839, 6d.; 4855, 6d.; 4858, 6d.; 4861, 6d.; 4864, 8d.; 4869, 6d.; 4881, 6d.; 4885, 6d.; 4886, 8d.; 4887, 8d.; 4889, 8d.; 4902, 10d.; 4914, 8d.; 4915, 6d.; 4917, 10d.; 4920, 6d.; 4921, 4d.; 4925, 8d.; 4926, 6d.; 4927, 6d.; 4928, 6d.; 4930, 6d.; 4931, 4d.; 4939, 6d.; 4947, 6d.; 4948, 6d.; 4951, 4d.; 4954, 6d.; 4956, 6d.; 4962, 4d.; 4963, 10d.; 4965, 6d.; 4968, 6d.; 4972, 6d.; 4974, 6d.; 4975, 2d.; 4976, 2d.; 4977, 6d.; 4978, 2d.; 4979, 4d.; 4980, 2d.; 4981, 1s.; 4982, 2d.; 4983, 6d.; 4984, 4d.; 4986, 8d.; 4987, 2d.; 4992, 2d.; 4995, 2d.; 4996, 6d.; 4999, 6d.; 5002, 2d.; 5009, 8d.; 5012, 2d.; 5020, 4d.; 5022, 2d.; 5024, 2d.; 5025, 4d.; 5026, 4d.; 5027, 6d.; 5028, 4d.; 5030, 2d.; 5031, 2d.; 5032, 2d.; 5033, 2d.; 5035, 6d.; 5036, 2d.; 5037, 2d.; 5038, 4d.; 5042, 4d.; 5043, 2d.; 5053, 2d.; 5054, 6d.; 5056, 6d.; 5057, 2d.; 5058, 2d.; 5059, 6d.; 5063, 6d.; 5066, 4d.; 5067, 2d.; 5068, 2d.; 5071, 2d.; 5076, 4d.; 5086, 6d.; 5089, 4d.; 5094, 4d.; 5095, 4d.; 5102, 6d.; 5103, 6d.; 5117, 6d.; 5138, 6d.; 5209, 4d.; 5210, 4d.; 5351, 6d.; 545, 6d.; 858, 6d.; 1175, 6d.; 1395, 6d.; 1401, 4d.; 1537, 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.*

1401. String Attachments for Pianos, &c., *H. J. Haddan*.—30*th March*, 1881.—(*A communication from J. Bennert.*—(*Complete.*) 4*d*.

This relates to a friction peg or strain pin consisting of a lower part capable of being turned in a corresponding socket of a pin board without a screw thread, an upper part adapted to be turned by a key and collar separating the upper from the lower part.

1537. Locks and Staples, *H. J. Haddan*.—8*th April*, 1881.—(*A communication from G. M. Hathaway and B. S. Taylor.*)—(*Complete.*) 6*d*.

This relates to a spring hasp having a lock chamber and keeper chamber combined with a permutation book and a keeper.

1935. Checking and Registering Fares in Omnibuses or Tramway Cars, *G. H. Manton*.—11*th May*, 1880. 6*d*.

This consists of a die punch to date each ticket issued, a register or dial numbered up to 1000, and a bell, which is sounded each time a ticket is registered

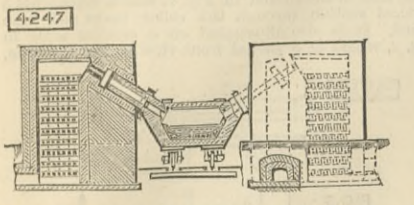
3471. Separating Ferrocyanides of Iron from Liquids Containing the Same, *W., T., and J. Chadwick and J. W. Kynaston*.—27*th August*, 1880. 4*d*.

This relates mainly to improvements on patent No.

4078, A.D. 1879, and consists in adding to the blue precipitate resulting from the treatment of aluminous solutions in order to produce sulphate of alumina (as described in above patent), a minute proportion of a metallic salt, when the blue precipitate subsides, and is collected, washed, and by treatment with lime, is re-converted into ferro-cyanide of calcium for subsequent use for the removal of a further quantity of iron.

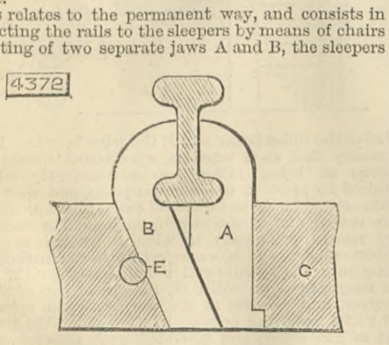
3850. EXTRACTING OILY AND FATTY MATTERS FROM WOOL, &c., *T. Williams.—23rd September*, 1880.—(*Void.*) 4d.
This relates to a special form of apparatus to be used for extracting oily and fatty matters from wool and other substances by the use of carbon bisulphide or other similar solvents.

4247. IRON AND STEEL, *W. L. Wise.—18th October*, 1880.—(*A communication from K. V. Berg.*) 6d.
A bath of molten crude or pig iron is provided on the hearth of a furnace, and rich gas, together with the air necessary for its combustion, is caused to enter the furnace with great velocity, and in such a manner that a sharply limited flame—the focus flame—is formed, which is directed against the surface of the molten iron. By its velocity the focus flame removes the slag from the surface of the molten crude or pig



iron, and owing to its concentrated heat and oxydising power, causes the conversion of such crude or pig iron—under the phenomenon of boiling—to steel or malleable iron, and this may be effected without any manipulation or admixture, unless such be for some special reason desirable.

4372. RAILWAYS, *R. Punshon.—26th October*, 1880. 6d.
This relates to the permanent way, and consists in connecting the rails to the sleepers by means of chairs consisting of two separate jaws A and B, the sleepers



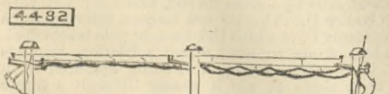
C being perforated to receive the jaws. In the jaw B a groove is formed, and through it passes a taper pin to the end of which is screw-threaded to receive a nut.

4396. CARPET SWEEPERS, *A. C. Herts.—28th October*, 1880.
A brush with hairs arranged spirally revolves by a cord and pulley, and is adjustable within a box with an opening along the bottom, through which the brush projects.

4456. HOLDERS FOR EMBROIDERY, LACE, &c., *A. G. Duncan.—1st November*, 1880.—(*A communication from L. Reichenbach.*)—(*Void.*) 2d.
This relates to a holder to enable the lace to be removed without destroying the wrapper, and it consists of folding covers containing a central wooden frame, provided on opposite sides with recesses to receive a spindle attached to the card holding the lace, so that it may be rotated and allow the lace to unwind.

4466. CLEANING, SCOURING, AND BLEACHING TEXTILE FABRICS, *G. Macaulay-Cruickshank.—2nd November*, 1880.—(*A communication from V. Cauzique.*) 6d.
This consists in the use of carbonic acid gas, either at a high or low temperature, for cleaning, scouring, and bleaching all textile fabrics, &c.; and also in a rotating apparatus with a false perforated bottom in which the operations are carried on.

4482. CABLES FOR TELEPHONIC PURPOSES, *E. George and J. B. Morgan.—3rd November*, 1880. 6d.
This invention has for its object the obviation of the effects of induction, to effect which the inventors cover the telephone wires with an ordinary insulating substance, and imbed or combine with this insulator wires or metals. These wires or metals, or the outside surface of the insulating substance, is connected to earth by conductors at intervals. The non-induction insulated or open wires or metal may be laid around,



parallel to or otherwise in connection with each insulated conductor, so that when placed together such conductors form a cable; this is strengthened by a metallic core in the centre, and is surrounded by a network or riband of metal. It is carried on supports or standards. The drawing shows the system of suspending the cable.

4484. COLLAPSING SIGNAL BALL, *J. H. Shoebotham.—3rd November*, 1880. 6d.
A number of metal rings are jointed together at top and bottom so as to readily collapse one within the other, and when opened out serve to distend a canvas or other case placed over it, thus forming a signalling ball. The rings may be secured in position by a suitable fastening.

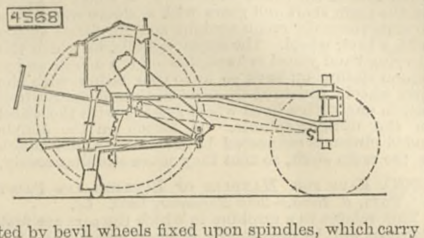
4494. PRESERVING FERMENTED LIQUIDS, &c., *W. R. Lake.—3rd November*, 1880.—(*A communication from G. W. Ramsay.*) 6d.
In order to destroy the yeast cells or other living organism without injuring the liquid, it is first vaporised or atomised, and then subjected to violent shocks or concussions.

4496. EXTRACTING METALS AND SULPHUR FROM ORES, &c., *W. W. Hughes.—3rd November*, 1880.—(*Void.*) 2d.
The ores are placed in a furnace and reduced to a molten state, the sulphur or gases escaping through suitable flues, and the molten metal and slag running into the converter furnace placed on a lower level, from whence it passes through an opening in the wall into a separating or refining furnace.

4513. SUBSTITUTE FOR LEATHER, *O. Wolff.—4th November*, 1880.—(*A communication from G. L. Lippold.*) 6d.
Cane is split into strips of suitable section, which are glued together, so as to form a board or plate, both sides of which are then covered with web, strong canvas, cloth, or other suitable material; and when dry used as a substitute for leather.

4517. CHAFF-CUTTERS, *C. P. Spangberg.—4th November*, 1880.—(*Not proceeded with.*) 4d.
The object of this invention is to reduce the friction of the machine and the wear on the edge of the cutting blade by the use of an improved feed motion, which holds the straw firmly during the passage of the knife.

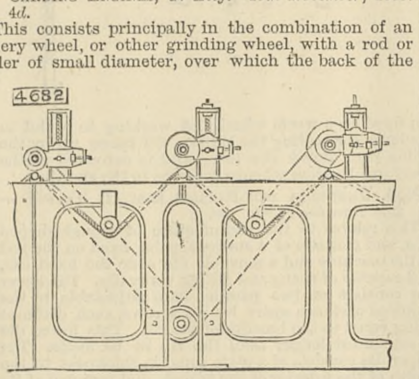
4568. AGRICULTURAL DRILLS, *L. W. Gatward.—6th November*, 1880. 6d.
The usual frame is dispensed with, and a suitable beam is employed placed at right angles to and connected with the main and fore axle beds. For steering the fore carriage from the hinder part of the drill, chains or ropes are provided, one end of such chains being attached to the fore carriage, while the other ends wind upon a roller or equivalent, which roller is regu-



lated by bevil wheels fixed upon spindles, which carry at their other ends a hand wheel or its equivalent, or instead of chains or ropes rods may be employed, which would be operated by the roller spindle or its equivalent. For raising and lowering the coulters in and out of their work the lever bed or bar is made so that it can turn on its centre in suitable bearings or arms fixed to the drill; upon this lever bed are fixed at any required distance apart coulter levers made of steel, iron, or wood.

4580. ELEVATING AND LOWERING DRAWING BOARDS, SLATES, &c., *E. Hill.—8th November*, 1880. 6d.
A longitudinal bar with level or rough edge is capable of being elevated and lowered parallel with the board or slate. Adjustable, semi-rotating, or radiating, connecting supporting bars are connected at one end to the longitudinal bar and at the other to the back of the board, so that by shifting the supporting bars the height of the elevation of the back may be varied.

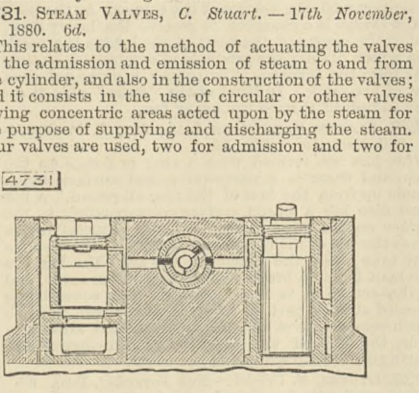
4682. GRINDING AND SHARPENING WIRE CARDS IN CARDING ENGINES, *G. Etty.—13th November*, 1880. 4d.
This consists principally in the combination of an emery wheel, or other grinding wheel, with a rod or roller of small diameter, over which the back of the



card passes, and a guard or shield, which is capable of adjustment, and which holds the teeth of the cards at the required angle against the emery wheel.

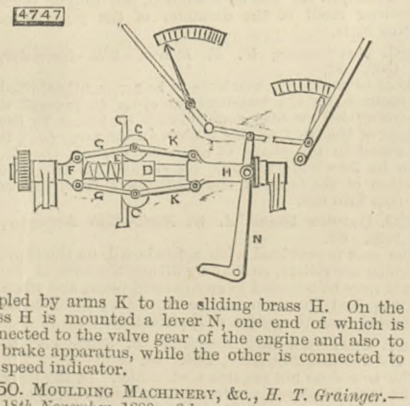
4725. PIANOFORTES, &c., *A. Capra, J. B. Rissone, and S. Detoma.—16th November*, 1880. 6d.
This relates to the application of a pin barrel below the key-board of an ordinary piano (such barrel being interchangeable for different tunes), so that the piano may be played either on the keys in the ordinary manner or by turning the barrel.

4731. STEAM VALVES, *C. Stuart.—17th November*, 1880. 6d.
This relates to the method of actuating the valves for the admission and emission of steam to and from the cylinder, and also in the construction of the valves; and it consists in the use of circular or other valves having concentric areas acted upon by the steam for the purpose of supplying and discharging the steam. Four valves are used, two for admission and two for



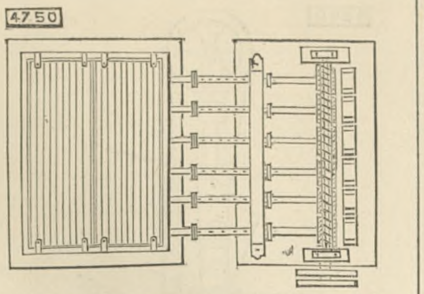
emission, and they are placed in chambers in the jacket of the cylinder. Between them passes a tube with openings, in it for the steam to pass through to or from the valve chambers. In this tube is placed the expansion cylinder or movable tube, with the theoretical curve of expansion formed thereon, and to it a reciprocating rotary motion is imparted.

4747. GOVERNING, &c., MOTIVE POWER ENGINES, *C. W. Wardle.—18th November*, 1880. 6d.
The invention is chiefly applicable to tramway engines, the object being to so govern and indicate the speed that at any time when the engine attains a defined limit of speed the steam will be shut off and the brakes applied. The governor balls C are free to rotate so as to ride on the cross bar D fixed to the central spindle, and are held in position by a spring E acting on them through the sliding brass F, to which they are coupled by arms G. The balls are also



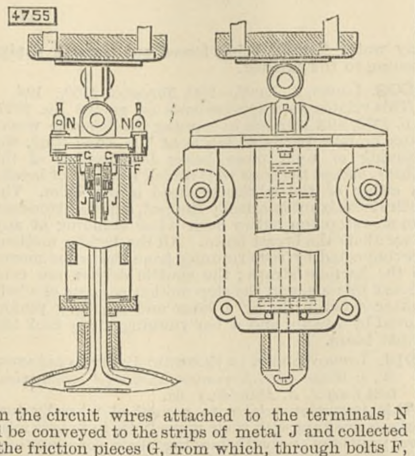
coupled by arms K to the sliding brass H. On the brass H is mounted a lever N, one end of which is connected to the valve gear of the engine and also to the brake apparatus, while the other is connected to the speed indicator.

4750. MOULDING MACHINERY, &c., *H. T. Grainger.—18th November*, 1880. 8d.
The moulding machine is constructed of one or several benches or tables, one or more of which is fixed or stationary, and one or more is constructed to slide or move parallel on grooved or flanged wheels running on rails for the purpose of carrying the patterns to and fro to be moulded by motion given or transmitted by pulley, drum, spur-wheel, pinion, rack, and fly-wheel, or other mechanical motion. The moulding box or boxes are constructed, not as ordinary iron or brassfounders' boxes are, with top box part and drag (or bottom) part, but the top, bottom, sides, and ends can be made in one piece or otherwise, and they are sometimes constructed with open or loose ends and



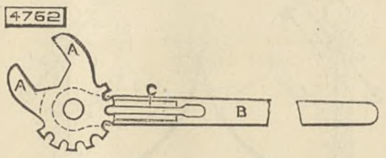
top, and in some instances with ends and tops partially left open to be subsequently fitted or otherwise.

4755. IMPROVEMENTS IN ELECTRIC LAMPS AND APPARATUS CONNECTED THEREWITH, *J. A. Berly and J. D. Hulett.—18th November*, 1880. 6d.
This invention relates to an apparatus for suspending electric lamps so as to enable the said lamps to be pulled down, detached, &c., to be regulated or attended to, and pushed back into their former position whilst alight. Fig. 1 is an elevation, and Fig. 2 a longitudinal section of the apparatus. In whatever position the sliding portion of the apparatus may be, the currents



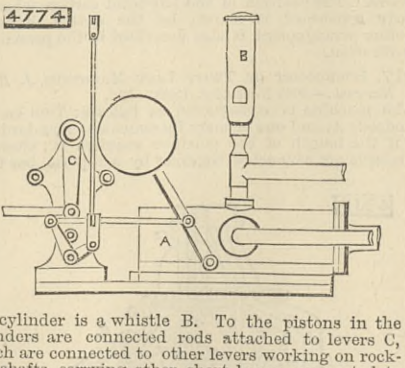
from the circuit wires attached to the terminals N will be conveyed to the strips of metal J and collected by the friction pieces G, from which, through bolts F, to which they are electrically connected, the second currents will be conveyed to the lamps by means of the conducting wires attached to the heads of the bolts F. The whole apparatus being enclosed, is free from dust and not liable to be damaged, which ensures regularity of working.

4762. SCREW-KEYS OR SPANNERS, &c., *W. Thomson.—18th November*, 1880. 6d.
The tool is formed in two parts, the gripping jaws or box A, and the arm or lever B, connected together by a swivel joint, and capable of being set at any angle to each other by shifting the jaw A to the required position, in which it is secured by means of a locking lever or bolt C entering one of the recesses



formed in the rear end of the jaw A. The bolt is pivotted to the lever and one end is formed with a thumb piece, by which its locking end is removed from the recess in the jaw, a spring under the thumb piece tending to keep it in its locked position.

4774. SIGNALLING APPARATUS, *M. C. and T. J. Denne. 19th November*, 1880. 8d.
Alongside the line of rails at suitable distances are placed two cylinders A side by side, each closed at one end and fitted with pistons. The closed ends each have a pipe leading to the signal box and attached to a disc valve. A pipe is fixed to the middle of each cylinder and also proceeds to the signal box, and is connected to an indicator or tell-tale. On the top of



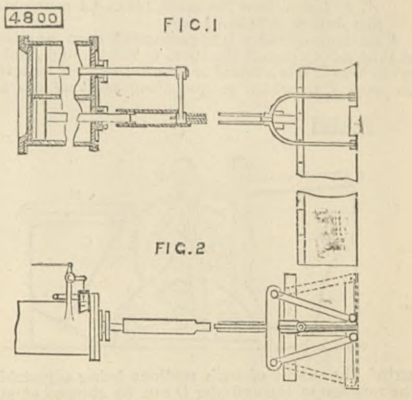
the cylinder is a whistle B. To the pistons in the cylinders are connected rods attached to levers C, which are connected to other levers working on rocking shafts, carrying other short levers connected to bridge pieces at one end. The apparatus is worked by compressed air and enables the signalman to communicate with the driver of an engine by causing the whistles to sound.

4779. AN IMPROVED ELECTRO-MAGNETIC APPARATUS FOR TABLE SERVICES, OFFICES, AND WAREHOUSES, *F. Harmont.—19th November*, 1880. 4d.
This invention refers to a line of rails and carriages actuated solely by electricity or in conjunction with mechanical aid, such as a chain, &c., but where electricity plays the principal part. Hot or cold liquids for table service can be placed in a train of carriages which can be set in motion and stopped at will. The invention may be employed in breweries, warehouses, &c., where long distances have to be traversed.

4782. AUTOMATICALLY COUNTING THE NUMBER OF LETTERS IMPRESSED WITH OBLITERATING STAMPS, &c., *H. Ferguson and H. R. Kempe.—19th November*, 1880. 6d.
Either the pad for inking the stamp, or the pad on which the letter is placed, is mounted on spring supports and electrical contacts provided, so that when such pad receives the pressure of the stamp a current is transmitted to an electrical counter of any known construction.

4799. VELOCIPEDES, &c., *Sir T. G. A. Parkyns.—20th November*, 1880. 6d.
This relates, First, to apparatus for propelling the vehicle by steam power; and Secondly, to forming the tires of the wheels of iron or steel tubes of U or V section, and placing within them an india-rubber tire.

4800. PROPELLERS, &c., *E. G. Brewer.—20th November*, 1880.—(*A communication from R. Smith.*) 6d.
This relates to that class of propellers in which a pair of hinged blades are opened to be forced against the water for propulsion and then closed to be drawn through the same without obstruction preparatory to the next stroke. It has more special relation to the form of propeller in which two reciprocating shafts are used, one being connected to the hinge of the blade and the other, by means of a cross bar and connecting rods or links, to the backs of said blades. The former shaft is, preferably, hollow, and the latter slides within it. The function of the inner shaft is to open and close the blades; the function of the outer shaft is to move said blades back and forth in the water and to aid in closing them. The shafts are constructed and combined

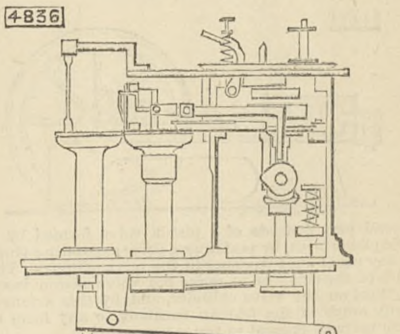


so that each of them operates to force the opened blades against the water, the one when the motion is forward, the other in backing; they are also connected in such manner that neither can move longitudinally beyond a certain limit without communicating similar motion to the other. Fig. 1 represents a top view of the mechanism partly in horizontal section, and Fig. 2 represents a side elevation of the same, also partly in section, omitting the greater portion of the cylinders.

4815. PRESSING AND TENTERING WOOLLEN FABRICS, &c., *G. H. Nussey and W. B. Leachman.—20th November*, 1880. 6d.
This relates to improvements on patents No. 2585, A.D. 1869; No. 2370, A.D. 1872; and No. 242, A.D. 1876, in which plates of metal and sheets of paper or woven fabrics having finely glazed or polished surfaces are used to press the fabrics, and it consists in combining with these plates apparatus for the operation of tentering, which operation has the effect of stretching and drying the material previous to and simultaneously with its being passed round and between the pressing plates. A hollow box is fixed to the machine under or over the plates, and is capable of expansion telescopically, so as to give the required tension to the material, which is attached to hooks on travelling chains, whereby the lateral strain is obtained and the material carried forward.

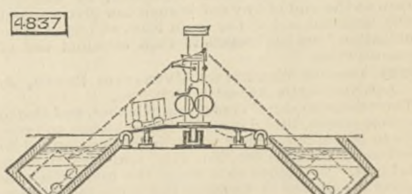
4833. DETECTING AND MEASURING SMALL QUANTITIES OF INFLAMMABLE GAS IN COAL MINES, &c., *E. H. T. Liveing.—22nd November*, 1880. 6d.
This relates to the use of platinum wires connected to a magneto-electric machine so as to be raised to a red heat. The wires are arranged at either end of a wooden rod, and one is enclosed in an air-tight case, partly of glass, and the other in a cap, partly of wire gauze and partly of glass. The air or gas to be tested has access to the latter wire, and in presence of an inflammable gas gives out a brighter glow than the other. The wires are specially prepared to measure small quantities of inflammable gas by heating them to a red heat in an atmosphere containing inflammable gas of low igniting point. A scale is placed within the chamber of the instrument. The magneto-electric machine is formed so as to avoid the danger of sparks produced by the ordinary form of break or commutator.

4836. WHIP-STITCH SEWING MACHINES, *C. Necker and R. Horstmann.—22nd November*, 1880. 6d.
This relates to improvements on patent No. 814, A.D. 1877, and consists in mechanism to be added to the machine therein described so as to obtain a whip-stitch. To the thread catcher motion is imparted in three different directions, a sliding motion towards and from the shuttle race, a vertical up-and-down motion, and a swinging motion in the horizontal plane. This is effected by means of two eccentric



sheaves on the driving axis, one imparting to the thread catcher the sliding motion, and the other the vertical and swinging motion. The thread catcher takes hold of the tight shuttle thread, which is carried from the left to the right side of the needle. The needle then pierces the fabric on the left side of the shuttle thread, which is then released from the catcher, and while the shuttle is moving to the right, the thread forms with the needle thread a second loop on the fabric, which is then caught and drawn on the back by the returning needle thread.

4837. MACHINERY FOR HEATING, PICKLING, AND SWILLING METAL PLATES, &c., *R. J. Hutchings, H. F. Taylor, and W. P. Sturvé.—22nd November*, 1880. 10d.
This consists essentially of one or more pairs of baths containing pickling or swilling liquor arranged



at a convenient angle, and in which the cradles, crates, or racks are reciprocated or otherwise moved and guided and supported by rails or other guiding appliance whilst they are under treatment.

4839. PROPULSION OF BODIES IN AIR AND WATER, *F. Hime.—22nd November*, 1880. 6d.
This consists in the application of the wave motion of flexible surfaces to the propulsion of bodies in air, or of vessels in water. The wave motion is produced

by the successive vibration of a series of levers connected by a flexible material through arcs in planes at right angles to the direction of the wave, and actuated by levers connected to cranks on a shaft revolved by steam or other power.

4855. Ventilating Ships' Cabins, &c., *W. R. Lake.—23rd November, 1880.—(A communication from P. Miham.)* 6d.

This relates, First, to a peculiar form of injector by which pure air is introduced into the space to be ventilated; and, Secondly, in combination therewith of an exhaust or outlet through which the foul air is expelled by the introduction of pure air.

4858. Breaking or Scutching Flax, Hemp, &c., *W. R. Lake.—23rd November, 1880.—(A communication from G. Milliken.)* 6d.

A rotating cylinder D is perforated, open or spaced at intervals to permit the shive to fall through, and in contact with it is a fluted or grooved roller K mounted on arms J, to which reciprocating motions are imparted,

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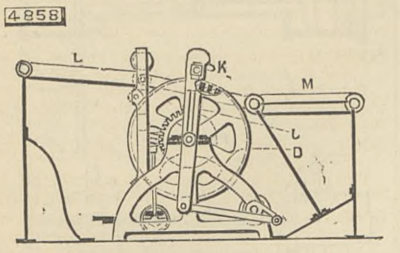

the extent of such motions being adjustable. The rotation of the cylinder D can be stopped at any point without stopping other parts of the machine. The flax is carried forward by an endless apron L, and after passing between the cylinder D and roller K, is discharged by the endless apron M.

4861. Filtering Water, *C. G. Pfander.—23rd November, 1880.* 6d.

A vertical metal case contains four radial partitions, which divide it into compartments connected by passages alternately at top and bottom, so that the water which is admitted at the bottom of one compartment must traverse the other compartments in succession. All the compartments are charged with filtering material.

4864. Sharpening or Dressing Millstones, *P. Jensen.—23rd November, 1880.—(A communication from P. Graham.)* 6d.

One or more toothed, ribbed, ridged or pointed discs or rings of steel or other suitable material, are mounted so as to rotate with or upon, or between the millstone or stones to be sharpened, or with one or more spindles extending from a ring at the eye of the stone, and so arranged that when the stones are rotated, or the apparatus caused to rotate between the stones, and necessary pressure applied, the teeth, ribs, ridges, or points of the discs are pressed into the stones, and thus dress the grinding surfaces.

4869. Sulphates of Soda and Potassa, *J. Hargreaves and T. Robinson.—24th November, 1880.* 6d.

This relates to the manufacture of sulphates of soda and potassa by the direct action on the chlorides of soda and potassa of sulphurous acid gas, air, and water vapour, and it consists, First, in order to obtain a larger quantity of sulphuric acid in the sulphurous acid gas obtained by the combustion of sulphur or pyrites, and at the same time provide means for removing dust carried off in suspension from the pyrites, the sulphurous acid gas mixed with air and water is caused to pass through a filter consisting of a chamber filled with metallic oxides. Secondly, the heat developed by chemical reactions, and the combustion of pyrites or sulphur in the production of sulphates of soda and potassa, as above described, is, when loss of heat by radiation is prevented, in excess of that required to maintain the contents of the converting chamber at the requisite temperature, and such excess is utilised to heat the circulating gases.

4881. Gas Motor Engines, *L. Simon and F. Wertenbruch.—24th November, 1880.* 6d.

The First part consists of a cylinder, preferably open at one end except when grooves are used, in which a piston of any convenient construction works in the usual manner by means of a connecting-rod, crank, and fly-wheel. This cylinder is jacketted so that it may be kept cool by circulating cold water, or that the surplus heat may be used to generate steam. At any suitable part of the closed end of the cylinder is placed a valve to admit air and gas, and one which may be a part of the first to ignite the mixture. The

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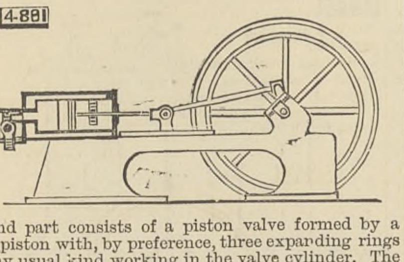

Second part consists of a piston valve formed by a solid piston with, by preference, three expanding rings of any usual kind working in the valve cylinder. The office of the rings is to make the valve piston work air-tight on the valve cylinder, and by this arrangement much of the friction incident to any form of slide valve at present in use is prevented.

4885. Driving Screw Propellers, *C. Maw.—24th November, 1880.* 6d.

The screw propeller shaft is enclosed within a tube attached at its outer end securely to the screw propeller. In case of the shaft breaking, the two parts will be held together by the tube surrounding them, and so be prevented from injuring the skin of the vessel, while the propeller will be retained by the tube and prevented from dropping off. At the inner end of the tube next the driving engines provision is made for coupling the tube to the engine shaft so that it may drive the propeller should the propeller shaft be broken.

4887. Speaking Tubes, *G. Jennings and E. G. Brewer—24th November, 1880.* 8d.

A speaking tube leads from the basement to the several floors above, at each of which a branch pipe leads off, and by other branches are connected to the several rooms. At the junctions of the different branches and the main flap valves are placed, and are combined with an electrical apparatus, by which a person at the end of any one branch can give a signal to the terminal end of the main tube, and open communication from his branch to such terminal end of the main tube.

4889. Lifting Weights by Hydraulic Power, *A. Lafargue.—24th November, 1880.* 8d.

This relates to ships' cranes and winches, and also to portable cranes, lifts, hoists, and turn-tables, and consists in the application of the apparatus described in provisional specification, No. 2122, A.D. 1880, to these machines. As applied to a crane the invention consists of a cylinder A forming the crane pillar above deck, and attached to a cubical chamber forming part of a hollow cylindrical casting B, constituting the crane pillar below deck, and which revolves with the upper crane portion. The water is conducted to the cylinder without using an accumulator. For single power lifts a valve allows the pressure to pass to the upper and lower surfaces of the piston, when by reason of the area of the upper surface being less than the lower, the piston is forced up and load raised. To lower the load the lower chamber is exhausted, the water passing into the hollow pillar. For a double power lift the water is cut off from the upper chamber,

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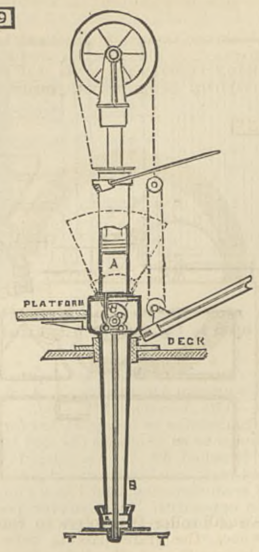

any water therein being forced out through a pipe leading to the exhaust.

4902. Looms, *J. Lyall.—25th November, 1880.* 10d.

This relates to improvements on patent No. 3377, A.D. 1872, and consists in forming the loom to weave three or four pieces of fabric at the same time, the weaving of each piece being independent of the others, except that one weft thread runs out or breaks in either of the fabrics grouped in one loom. The entire loom is automatically stopped, and the attendant can also stop the entire loom when standing at any place along the breast beam. All the heddle motions are connected by rods running from the prime mover to the harness straps; the shuttle drivers are connected by rods, and the stop motion consists of a belt shifter acted upon by a lever and crank, a pinion moved by a sector and a bar running along near the breast beam.

4914. Improvements in Electric Light Apparatus, *W. L. Wise.—25th November, 1880.—(A communication from J. A. Mandon.)* 8d.

This invention relates to a method whereby two carbons are kept with their upper poles in proper relative positions, notwithstanding their consumption, &c. One arrangement is that each carbon is formed as an arc of a circle, each carbon being carried and balanced by apparatus arranged so that in proportion as the carbon is consumed it will automatically move upward in a circular path about a centre coincident with that of the circle whereof it represents an arc. The figure is a side elevation of the apparatus. In operation the carbon is carried by the adjustable balance lever X supported in its insulated axis D. This axis has connected to it the second balance lever G, to which is connected by the circularly curved arm I the

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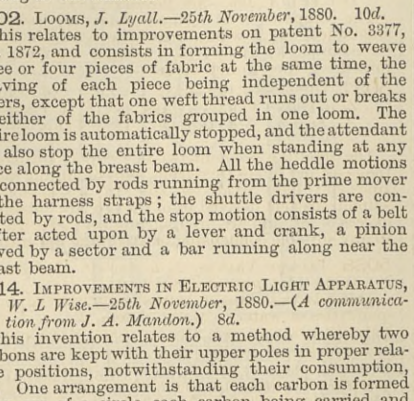

float J immersed in the bath of mercury, which is insulated and traversed by the current. The curved arm I is so proportioned and arranged that as the carbon is consumed and reduced in weight the float gradually ascends in the mercury and the curved arm emerges from the liquid, so that the loss of carbon will be correctly compensated for by a proportional upward movement thereof. The axis of the balance levers has cone centres. It works in insulated bearings. The current is conducted first to the mercury bath (itself insulated at the under part), thence through the float stem, oscillating axis, and balance levers, to the carbons. The position of the left-hand carbon when nearly consumed is shown by the dotted lines. Another arrangement is also described in the present specification.

4917. Bobbin-net or Twist Lace Machines, *J. R. Hancock.—26th November, 1880.* 10d.

The machine is constructed as follows: Two end standards A, and one or more intermediate standards B, if the length of the machine requires it; these standards are connected together by a top tie bar C

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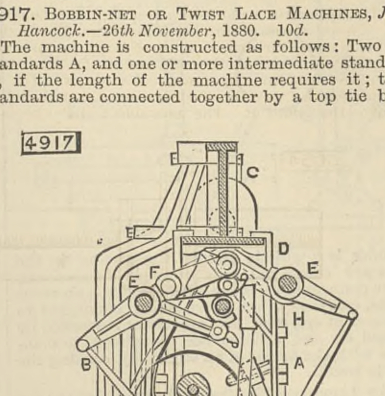

and a bottom tie bar. In addition to the standards there are four or more brackets D, which, with the standards, either form bearings for or bearings are secured to them for two rocking shafts E; the upper ends of the brackets clip the lower flange of the top tie bar, to which they are secured by screw bolts; the rocking shafts carry the levers for operating the point bars. Under the top tie bar is a cam shaft H, which revolves in bearings, forming part of or being carried by the standards and brackets; this shaft carries the cams for operating the several parts of the machine.

4915. Steam Steering Gear, *W. Clarke and J. B. Furneaux.—25th November, 1880.* 6d.

This relates to improvements on patent No. 1558, A.D. 1878, and the objects are to simplify the reversing mechanism, obtain a more economical use of the steam, with less liability to injurious strains, and facility for being repaired at sea. A bed plate carries the cylinders fitted with slide valves and link reversing gear. Two upright frames carry the main shaft and above it a spindle. On the crank shaft of the engine is a worm gearing with a wheel on the main shaft, and having on it a sliding clutch to engage with a corresponding clutch on a spur wheel keyed to a boss on a chain wheel free to revolve on the main shaft. On the other side of the chain wheel a scroll wheel is keyed on the main shaft and gears with a sleeve worm free to slide vertically on an upright spindle fitted at top with a bevil wheel. The upper spindle, to which the steering hand wheel is fixed, has on it a double ended pinion sliding on keys so as to gear either with the spur wheel on main shaft or with a small spur wheel cast in one with a bevil wheel gearing with the wheel on the upright spindle. A clutch on the double ended pinion is connected by levers with the clutch on the main shaft, so that they move simultaneously.

4920. Ears for Handles of Buckets and Paint Pots, *R. Read.—26th November, 1880.* 6d.

This relates to a machine in which the ears are first stamped out by dies from a sheet of metal, then the holes are punched out, and finally they are bent to shape by other dies, the blank formed by the first dies passing automatically forward to the punch and then to the shaping dies.

4921. Lubricating Main Shafting, &c., *T. Monk and J. Anderton.—26th November, 1880.* 4d.

This relates to self-acting lubricating apparatus for lubricating heavy shafting at intervals. The oil-box A has apertures B, and within it are spoons or ladles C working on a stud, and caused to reciprocate by a

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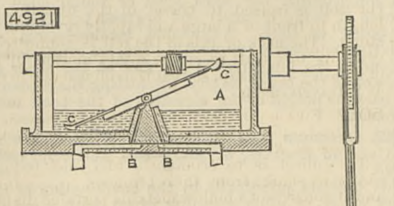

pin fixed on a worm wheel and working in a slot in the lever connecting the ladles. Oil taken up by the ladles runs down the lever and is delivered to the apertures B, from whence it passes to the shafting.

4925. Umbrella and Parasol Ribs, *T. Warwick.—26th November, 1880.* 8d.

This relates to the manufacture of trough-shaped ribs, and consists of a stationary die fixed on the bed of the machine and a movable die over the fixed die, and capable of rising and falling vertically. The lower die consists of two parallel bars adjustable to the required distance apart by set screws, such distance being equal to the breadth of the rib. This lower die is somewhat longer than the rib to be made. The upper die consists of a plate equal in thickness to the width of the interior of the trough, and rounded at its lower edge. It is connected by rods to cranks on a shaft, so as to cause the die to rise and fall.

4926. Coppers for Boiling Worts, *T. Bloom.—26th November, 1880.* 6d.

The body of the "setting" of the copper is of brickwork. Air is conducted by two flues from the exterior to below the grate to keep the bars cool. Within the furnace is an arch to direct the current of air to within a short distance of the top of the bridge at the opposite end of the grate, thereby heating the air before coming in contact with the bottom of the copper. At the back of the bridge is a chamber to receive the heavy dust, and at the centre of the back of the bridge is a partition which divides the products of combustion as they pass from the furnace. The copper is arranged on a seat of fire-brick. In front of the "sturr" pipe is an arch to protect it from the heavy fire.

4927. Closing Stoneware Jars, &c., *H. Doulton.—26th November, 1880.* 6d.

The jars are formed with a ring or flange on the neck, and there is a narrower raised surface which stands up from the face of the ring all round. A flat cover also has a raised surface corresponding to the surface on the jar. A narrow band of metal passes across the top of the cover, and is bent at its ends so as to take under the flange on the jar. The band is also bent inwards beneath the edges of the cover, and in the centre it is bent upwards, the cover being recessed at such part so as to receive a ball, through which passes a pivot attached to the forked arms of a lever, the ends of the arms being cam-shaped and bearing on the top surface of the cover.

4928. Gloves, *H. Urwick.—26th November, 1880.* 6d.

This consists in forming the slit for the introduction of the hand, and that to receive the thumb-piece in one, that part to receive the base of the thumb-piece being at an angle across the palm of the glove, whilst the slit in the wrist is in a line with the length of the glove. By this means the hand can more readily be introduced into the glove.

4930. Pliers, Nippers, and Smiths' Tongs, *W. McI. Cranston.—26th November, 1880.—(A communication from J. F. Cranston.)* 6d.

One jaw of the pliers is curved, and to it is pivotted a tongue piece so shaped that articles of an inclined or tapered, and also articles of a parallel form, may be held between it and the other jaw. The tongue piece has a cutting edge, with which wire may be severed, the cutting edge in such case being caused to impinge against the fixed jaw. The back of the tongue piece is roughened, and also the inner portion of the curved jaw, to act in conjunction with the roughened face of the fixed jaw for use as a wrench, the tongue piece adjusting itself to the diameter of the pipe to be turned by it.

4931. Mattresses, *W. E. Brown.—26th November, 1880.* 4d.

So as to enable the mattress to be constantly shifted in position on the bedstead, in order to prevent it becoming hollow and consolidated in places by the weight of the body resting always on the same part, it is formed in the shape of an endless band—that is, with its two ends united. By slightly shifting the position of the folds of the mattress a fresh part is brought into use.

4939. Garden Seats, *A. W. Noel.—27th November, 1880.* 6d.

The seat is provided with a footboard, on the front of which are rollers, so that by lifting the back of the seat it may be wheeled to any desired place, and when not required the seat may be tipped up so as to be protected from the action of the weather.

4947. Charcoal Box Irons, *T. B. Salter and G. Asher.—27th November, 1880.* 6d.

The iron does not require a chimney. In the body of the iron is placed an inner body with a space all round it, through which the heated air circulates. Air enters at holes in the body of the iron and through a slot in the lid, and the products of combustion escape through openings in the edge of the sides of the lid.

4948. Velocipedes, &c., *W. H. Thompson and F. G. Henwood.—27th November, 1880.* 6d.

This relates to improvements on patent No. 2372, A.D. 1879, and consists, First, of a novel framing of metal in two parts joined together; Secondly, of an arrangement of rowing levers and mode of steering; and Thirdly, of an improved arrangement of brake to be actuated by the feet instead of by the hands, but if desired may also be arranged to work by the latter.

4951. Music Seats and Receptacles, *H. B. Fox.—27th November, 1880.* 4d.

The combined seat and receptacle for music has the appearance of an ottoman, the top being stuffed, and having in it one or two seats which screw up like ordinary music stools.

4954. Facing, Tipping, and Suspending Billiard Cues, &c., *C. F. Hengst.—29th November, 1880.* 6d.

The cue is suspended by inserting its end into a conical clip in two parts, each suspended from a pair of links, and having a lateral movement. Between the ends of the links are two levers, on one side of each of which is a cam bearing against the clips, the other end of the lever being attached by links to a gudgeon working in guides fitted with a screw to raise and lower it, the end of the screw bearing on a horizontal bar. When thus held the cues can be acted upon by a rotary cutter so as to face it to receive the tip.

4956. Spinning and Doubling Cotton, &c., *B. Brown.—29th November, 1880.* 6d.

The First part relates to the wire boards, to which are fixed the wire guides, through which the threads pass, and is illustrated in Fig. 1, which represents a vertical section through the roller beam and wire board. It is also illustrated on a smaller scale in Fig. 2, which is a partial front view of the machine,

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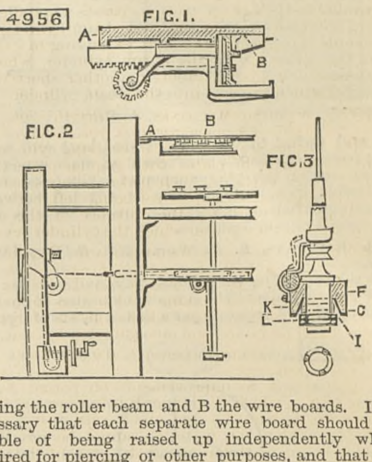

A being the roller beam and B the wire boards. It is necessary that each separate wire board should be capable of being raised up independently when required for piercing or other purposes, and that the whole series should be capable of being raised or otherwise moved out of the way for doffing. The Second part relates principally to what is known as the rabbett spindle, and more especially to the method of fixing into the spindle rail F (as shown in Fig. 3) the long sleeve or collar G, in which the spindle revolves, and consists in the use below the spindle rail F of a loose ring or hoop I fitting round the lower part of the collar, and provided with chisel-shaped teeth or projections K on its upper side. The hole in the spindle rail F is bored out rather larger than the diameter of the lower part of the collar G, so that the latter can be adjusted in any direction till the spindle is absolutely perpendicular and in the centre of the ring. The loose ring or hoop I is then placed on the lower part of the collar G and screwed up by means of one or two nuts L, which will force the teeth or projections K to take a firm hold of the lower side of the spindle rail F; and thus holding the collar G firmly in position.

4962. Chests or Cases for Screw Stocks and Dies, &c., *W. T. Eades.—29th November, 1880.* 4d.

The blocks or fittings to be secured in the chest are cast or formed in moulds either from metal or any plastic material.

4963. Ploughs, &c., *J. Howard and E. T. Bousfield.—29th November, 1880.* 10d.

This relates to means for lifting ploughs and other tilling implements out of work and increasing their efficiency. A A are the land and furrow wheels mounted on a crank axle capable of rocking in bearings

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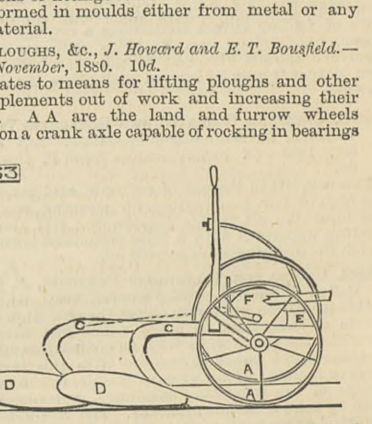

carried by the plough beams C, which are braced at their front ends by a cross tie rod, and are fitted with plough bodies D. The tie rod forms a fulcrum for a rocking frame E, to which the draught pole is attached. To the hub of one running wheel a friction brake is keyed, the strap to act upon it being operated by a short rock shaft F, which passes through a frame mounted on the crank of the axle, and is attached to the opposite ends of the brake strap. On the rock shaft is a treadle to operate the brake, when the further traverse of the implement will cause the brake wheel to rock the crank shaft in its bearings and lift the plough out of work.

4965. Heel Stiffeners for Boots and Shoes, *H. H. Lake.—29th November, 1880.—(A communication from S. L. Bailey.)* 6d.

This relates to improvements on patent No. 4211, A.D. 1879, in which the stiffeners are made in two pieces, and it consists, First, in turning over the upper edge of a metal stay so as to form a beaded edge that will not cut the counter or lining of the boot, nor irritate the heel of the wearer; Secondly, in corrugating the sides of the support so as to give greater strength and permit the use of lighter metal; Thirdly, the combination of a metal counter stiffener with a counter made of strips of leather; and Fourthly, in making a stay or support of two or more thicknesses of metal united by turning over the edges.

4968. Apparatus for Dissolving and Filtering in Chemical and Metallurgical Processes, *J. F. N. Macay.—29th November, 1880.* 6d.

Within a cylinder of wood is enclosed an inner cylinder of hard wood or hard earthenware, an annular space being left between the two, and the inner one perforated and covered with a filtering medium, kept in place by divisions of wood, which divide the space into a number of compartments. The matter to be treated is placed in a pulverised state in the inner cylinder with the reagents or solvents and a number of earthenware balls, and the whole rotated, the liquid passing into the annular space when at the bottom, but passing back again to the cylinder as it reaches the top.

4972. Fire-grates, *A. C. Engert.—29th November, 1880.* 6d.

So as to prevent the formation of smoke the coal is first heated in a partially closed chamber before being delivered into the open grate, such chamber being formed at the back of the grate.

4974. Motive Power and Pumping Engines, *T. and G. Wilson.—30th November, 1880.* 6d.

This relates to the valves by which steam is distributed to the steam cylinder, and it consists of a main slide or double piston valve enclosed within a valve chamber. C is the double-ported slide valve, the inner steam spaces D of which communicate through openings at each side of the valve with the steam space of the valve chest or casing E, and through ports F conduct the steam to cylinder G through ports H, whilst the steam is exhausted through the ports H and ports I of the valve into the common exhaust. On the valve spindle J a valve driving piston is

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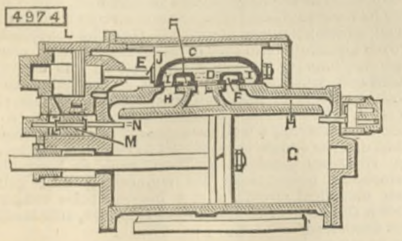

secured and works in a chamber L formed with steam and exhaust ports, and with a port communicating with steam chest E, and having a common slide valve M. The exhaust port of chamber L communicates with the main exhaust. Through valve M, and parallel to the line of motion, passes a spindle N, one end of which projects into the steam cylinder. This spindle is connected to a rod extending to a chamber at the other end of the steam cylinder, where it is connected in like manner to another short rod, one end of which projects into the steam cylinder.

4975. WASHING MACHINES, *J. Mitchell.—30th November, 1880.—(A communication from J. Storey.)* 6d.

The clothes are placed in a revolving cylinder made up of a number of plates with angular projections on their inner surfaces, such plates being separate but overlapping, a side aperture being left between the ends of the plate for the entrance of the washing liquid from the tank in which the cylinder revolves.

4976. ROLLERS FOR WRINGING AND MANGLING MACHINES, &c., *W. Fox and G. Brown.—30th November, 1880.—(Not proceeded with.)* 2d.

This consists in making such rollers from what is known as "setting," and which consists of brimstone and flue dust mixed and amalgamated by heat.

4977. HYDRAULIC PRESSES, *J. Watson.—30th November, 1880.* 6d.

This relates to improvements on patent No. 3123, A.D. 1869, in which the material being pressed is forced between the bars of a grid, and it consists in so shaping the teeth that the material cannot be forced down between the teeth far enough to prevent the material being readily removed.

4978. CANDLE-HOLDER AND SAVE-ALL, *A. N. Hopkins.—30th November, 1880.—(Not proceeded with.)* 2d.

This consists in forming a false socket piece for candlesticks, in which the candle is clipped, by forming corrugations in its sides, so as to give it a certain amount of elasticity. The false socket can be withdrawn by means of a projecting thumb piece.

4979. CIRCULAR SAWS, *H. J. Haddan.—30th November, 1880.—(A communication from J. Kitz.)* 4d.

This relates to the mode of mounting circular saws on their shafts, and has for its object to cut grooves of variable width with the same blade. For this purpose the saw is mounted between two annular discs, which turn on pivots placed perpendicularly to the shaft and attached to the circumference of the nave, which is rigidly mounted on the shaft. The blade can be placed oblique to the shaft by means of a screw.

4980. HUSKING RICE, &c., *J. H. C. Martin.—30th November, 1880.—(Not proceeded with.)* 2d.

A drum provided with an elastic covering revolves horizontally in combination with a plane or curved frictional surface of stone, emery, or roughened steel placed in tangential contact with the surface of the drum.

4982. UMBRELLA CLOTHS, *W. Critchley.—30th November, 1880.* 2d.

The cloth is formed entirely of cotton, but has the same appearance of a cloth with cotton and worsted weft. This is effected by weaving the cloth a double or split twill.

4983. LAMPS FOR ILLUMINATING INSCRIPTIONS, *G. Day.—30th November, 1880.* 6d.

The lamp frame has grooves near the middle to receive the plates bearing the inscriptions, which are placed back to back and lighted from the front or sides.

4984. TREATING JUTE, HEMP, &c., *C. F. Cross.—30th November, 1880.* 4d.

This relates, First, to the treatment of fibrous materials with water or steam at a high temperature in contact with sulphites or with salts of equivalent chemical action, with or without an alkali, to fit them for use in the manufacture of textile fabrics or paper; Secondly, to impregnating vegetable fabrics or fibres which are to be subjected to a high temperature with sulphites, so as to prevent injury to the fabrics.

4986. REGULATING AND CONTROLLING THE FLOW OF WATER, &c., *W. Morris and F. P., J. T., and E. J. Preston.—30th November, 1880.* 8d.

This relates mainly to flushing cisterns which have to be emptied by means of a syphon, the short leg of which dips into a cistern holding the water for one flushing, and the long leg connected to an apparatus with a piston operated by a handle. The piston moves in a cylinder with an inlet from the syphon at one end and the outlet to the closet at the other end, the piston being actuated by a weight or spring or other suitable means.

4987. MANUFACTURE OF COMPOUNDS OF SUGAR AND LIME FROM MOLASSES, &c., *C. D. Abel.—30th November, 1880.—(A communication from J. Drucker and L. Steffen.)—(Not proceeded with.)* 2d.

Molasses, or solutions of cane sugar, are brought together with lime, either in the form of calcium oxide or hydrated, and water, in such manner and such proportions that an intimate and rapid mixture and combination of the particles of sugar and lime is effected, resulting in the formation of a solid precipitate consisting of saccharate of lime, which can readily be separated from the mother liquid.

4992. SINK TRAP, *J. Harsant.—30th November, 1880.—(Not proceeded with.)* 2d.

A bell-shaped chamber is covered by a grating, and has a curved partition dipping into the water in the trap, a ventilating pipe communicating with the space enclosed by the partition and with the outer air. The waste pipe communicates by a side opening in the trap with the enclosed space, and being thus in direct communication with the ventilating pipe, prevents the accumulation of sewer gas in the trap.

4995. STEAM ENGINES, &c., *R. Sunyé.—1st December, 1880.—(A communication from H. B. y Ureta.)—(Not proceeded with.)* 2d.

This relates to an apparatus for guiding the piston rod crosshead in a straight line, and consists of two equal triangular levers in the same plane opposite to one another on each side of the piston rod, and hinged at the lower backward angles to some fixed part. The meeting angles of the levers have toothed segments gearing together, and to the upper backward angles are hinged two links connected at their further ends to the piston rod crosshead.

4996. COCKS AND TAPS, *J. Walker.—1st December, 1880.* 6d.

This relates to means for keeping the cocks tight without removing them from the piping. The cock has a gland at top and bottom with fixing plug for both. The plug has three tapers—(1) the usual taper in the water way; (2) taper from water way towards the top; and (3) taper from water way towards the bottom, these three tapers equalising each other and preventing jamming.

4999 GROOVED PULLEYS OR WHEELS, *J. V. Hope.—1st December 1880.* 6d.

The object is to form the pulley so that the bottom or wearing face of its groove is composed of a separate ring capable of being replaced when worn.

5002. CLEANING DRAINS, *G. W. Murray.—1st December, 1880.—(Not proceeded with.)* 2d.

This relates to linked metal rods or bars, and consists of connecting the rods by a close eye and an open hook, and forming on them near their ends jointed prongs or barbs.

5009. GRINDING MACHINERY FOR MANUFACTURE OF CHILLED ROLLS, &c., *F. Wirth.—1st December, 1880.—(A communication from C. H. Haubold.)* 8d.

According to one arrangement the roll or cylindrical object is mounted in a slightly elastic manner in adjustable bearings on pendant arms formed or fixed

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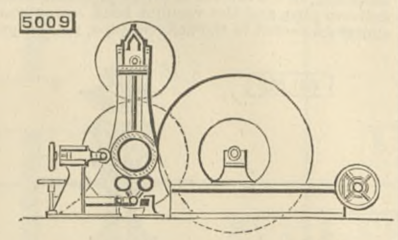

on a sleeve or slide that can be caused to travel by means of a screw spindle along a horizontal beam fixed on standards, so that by imparting motion to the slide the roll is caused to travel in the direction of its length in front of a large and rapidly revolving grindstone. The neck or axis of the roll is connected by a coupling to a shaft receiving rotary motion by means of a pulley and strap, so that the roll is made to revolve as it travels along.

5012. FIRE-BOXES OF BOILERS AND FURNACES, *A. D. Street.—2nd December, 1880.—(A communication from G. K. Street.)—(Not proceeded with.)* 2d.

The object is to economise fuel and reduce the escape of smoke from the chimneys to a minimum, and it consists of a hollow metallic portable diaphragm mounted within the fire-box and of the same radius as the top half of the fire-box door, immediately over which it fits and extends inwards and upwards to the vertical centre line of the box. The diaphragm is supplied with water from the boiler. A second diaphragm extends the full width of the fire-box.

5020. SETTING THE BRIMS OF FELT AND SILK HATS, *T. L. Sutton.—2nd December, 1880.* 4d.

This relates to the ordinary screw press and the "he" and "she" frames, and consists in cutting the lower portion of the "he" frame exactly to the curve of the upper side of the rim, and the upper side of the "she" frame is formed somewhat to correspond with the under side of the brim, but slightly hollowed out where the brim rests, where it is fitted with a thick piece of india-rubber bedded into it, and has a sheet of india-rubber strained over it.

5022. INDICATING THE HEAT OF BEARINGS IN STEAM ENGINES, &c., *H. W. Wimshurst.—2nd December, 1880.—(Not proceeded with.)* 2d.

A plug of easily fusible metal is inserted in the journals and on it bears one end of a weighted lever, which, when the plug fuses through the heating of the bearing, is released and acts upon a gong and operates a whistle or establishes electric contact so as to signal the heating of the bearing.

5024. GAS ENGINES, *E. W. Horne and E. and S. Tweedale.—2nd December, 1880.—(Not proceeded with.)* 2d.

This relates to tram car engines, and consists in utilising compressed coal or other explosive gases, in addition to the use of such gases explosively.

5025. CLEARING THE FLUES OF STEAM BOILERS, *R. Sutcliffe.—2nd December, 1880.* 4d.

This relates to improvements on patent No. 828, A.D. 1874, in which a perforated steam pipe is used to clean the flues, and it consists in covering such pipe with a cast iron cover with openings at top, so as not to impede the full blast of steam, the cover serving to prevent the pipe being acted upon by hot slag cinders and fuel forced over the bridge upon it.

5026. SPIRIT LEVELS, *R. Sutcliffe.—2nd December, 1880.* 4d.

This relates to a spirit level for indicating the degree of inclination of surfaces being graduated, and having a screw adjustment whereby such degree may be compensated for and recorded, and consists in forming a tube with a vertical branch at each end bearing a graduated scale, so that the different levels of the spirit in the two branches shows the degree of inclination.

5027. FIRE AND BURGLAR PROOF SAFES, *R. Sutcliffe.—2nd December, 1880.* 6d.

The safe consists of two concentric cylinders, the space between which is filled with a heat-resisting packing. The inner and outer cylinders have doors, and the inner one can be turned after the doors are locked, so that the two doors are not opposite.

5028. POLYCHROMATIC PRINTING MACHINES, *W. L. Wise.—2nd December, 1880.—(A communication from A. H. Payne.)—(Not proceeded with.)* 4d.

This relates to improvements on patent No. 468, A.D. 1879, in which an impression cylinder and a plate or colour cylinder of unequal diameters revolve in contact, both having the same velocity at their peripheries, and it consists in forming the perimeter of the impression cylinder in the same proportion to that of the plate cylinder as the number 2 is to an uneven integral number corresponding with the maximum number of colours to be employed at one time, if such number is uneven, and exceeding it by one if it is even, and neither the length nor the breadth of the area to be printed upon must exceed the semi-perimeter of the impression cylinder.

5030. MANURE, *W. R. Lake.—2nd December, 1880.—(A communication from E. Koch.—(Not proceeded with.)* 2d.

This consists in an improved method of mixing tar and lime so as to obtain immediately a mixture of impulverulent form.

5031. TOY-SPINNING TOPS, &c., *J. C. Biggs.—2nd December, 1880.—(Not proceeded with.)* 2d.

This consists in forming vanes on the discs to be applied to chameleon tops, which, as the top revolves, cause the discs to revolve excentrically to the top.

5032. COLOUR PRINTING WITH ANILINE, &c., *W. G. and R. A. A. White.—3rd December, 1880.—(Not proceeded with.)* 2d.

The required dies are dissolved in any suitable solvent, and a solution of gum or albumen added to fix the dyes, after which they pass into glass or earthenware trays and are placed in a heated chamber to evaporate the moisture. The dyes, when dry, are pulverised and ground up with a composition consisting of 50 parts sheep fat, 7½ parts bleached beeswax, 7½ parts sperm wax, 4 parts paraffine, 40 parts Venetian turpentine, 5 parts poppy or moss oil, and 9 parts boiled linseed oil. The dyes are mixed with the composition in a molten state, and when cool it is moulded or cut into any required design.

5033. IMPROVEMENTS IN ELECTRIC LAMPS, *J. H. Johnson.—3rd December, 1880.—(A communication from A. de Meritens.)—(Not proceeded with.)* 2d.

This invention has for its object the production of light by means of iron rendered incandescent by electricity. The ends of two conductors are connected with two iron wires, terminating in small balls, and supported by two insulated and adjustable supports placed upon a table. The iron balls soon become red-hot, and afterwards incandescent at a white heat, but do not melt.

5035. COMBINED GRAIN-BRUISING AND CHAFF-CUTTING MACHINE, *F. T. Turner.—3rd December, 1880.* 6d.

The driving-wheel A carries the chaff-cutting knives B, its periphery being smooth, made broader than

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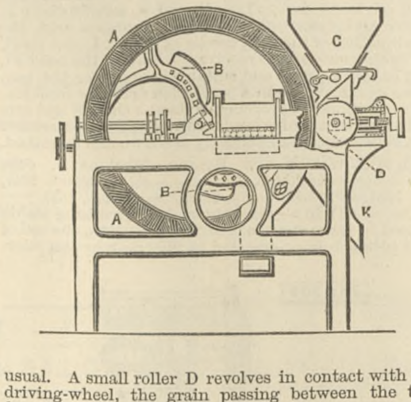

usual. A small roller D revolves in contact with the driving-wheel, the grain passing between the two from the hopper G, and after being bruised passes out through the shoot K. The bearings of the roller D are adjustable so as to regulate the pressure.

5036. COMPOSITION FOR PREVENTING INCRUSTATION IN BOILERS, *A. Jay.—3rd December, 1880.* 2d.

The composition is formed of leather (reduced to small pieces of powder), treacle, and an alkali, such for example as caustic soda, which ingredients are mixed together in hot water.

5037. OBTAINING SULPHATE OF ZINC AND OXIDE OF ZINC FROM CUPREOUS ORES, &c., *E. A. Parnell and A. French.—3rd December, 1880.—(Not proceeded with.)* 2d.

The smelting is conducted in a cupola furnace, and the gases and fumes therefrom, and containing metallic zinc and light oxide of zinc in suspension and sulphurous acid derived from the ore, are mixed with excess of air, and are brought into contact with water in any suitable condensing or absorbing apparatus.

5038. TAPS OR VALVES, *J. L. Corbett.—3rd December, 1880.—(Not proceeded with.)* 2d.

This relates to taps or valves for delivering uniform quantities of water to water-closets, &c., and it consists of a two-way cock fitted in a seat at the inlet pipe, and which may be turned to close the inlet pipe, or to admit water to either of two short pipes, one on each side, leading to a cylinder set transversely and fixed to them, and which has a discharge nozzle near its centre on the side opposite the inlet tube. A partition divides the cylinder, and through it passes a piston rod with a piston at each end having a rubber fitting to close on a seat in the partition. A small hole is pierced through each piston to allow the water to pass from one side to the other in a fixed time.

5042. WEAVING GAUZE LENO, &c., *G. Hargreaves and T. Bracewell.—3rd December, 1880.* 4d.

This consists in the regulation of warp threads by means of tappets, so that the crossings of the said threads are divided or opened at the time a change is taking place from the doup to the slip or the slip to the doup.

5043. TERMINAL ORNAMENTS OF METALLIC BEDSTEADS, &c., *A. and R. F. Heath.—3rd December, 1880.—(Not proceeded with.)* 2d.

The spherical part of the ornament is made of two hollow hemispheres, joined by burnishing the edges of one of the hollow hemispheres over the edge of the other. The hollow hemisphere, which in the finished ornament is presented to the bulbous top of the pillar, is provided with a neck having the figure of the upper half of the neck of the finished ornament. The bulbous part of the ornament, which fits on the top of the pillar, is made by stamping and spinning; a disc of sheet metal is first formed by stamping into a cup having a half neck similar to the half neck on the spherical part of the ornament, and by the process of spinning the cup is formed into the required bulbous part.

5053. FOOT WARMERS FOR RAILWAY CARRIAGES, &c., *T. O. Greenstreet.—4th December, 1880.—(Not proceeded with.)* 2d.

A circular foot warmer made of zinc or other suitable material for the retention of heat generated by hot water is made with an upper and under cap forming a compartment between them, and admitting the feet of persons sitting opposite to each other while travelling.

5054. APPARATUS FOR DIVIDING CARD-COVERED SURFACES OF DRUMS OF CARDING MACHINES, *P. Pingard.—4th December, 1880.* 6d.

The apparatus consists of a rectangular prismatic bar A of wood or iron of suitable dimensions. The U-shaped slide B clasps the bar A on three sides, and is adapted to slide to and fro thereon, and to be fixed in any required position by means of a screw. The fixed guide check C is either fastened to or cast in one piece with the slide B. The movable guide check D is

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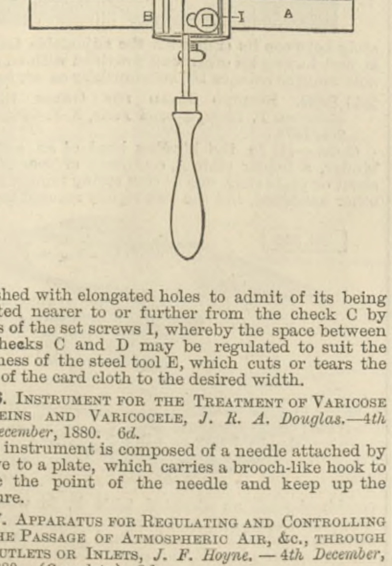


furnished with elongated holes to admit of its being adjusted nearer to or further from the check C by means of the set screws I, whereby the space between the checks C and D may be regulated to suit the thickness of the steel tool E, which cuts or tears the wires of the card cloth to the desired width.

5056. INSTRUMENT FOR THE TREATMENT OF VARICOSE VEINS AND VARICOCELE, *J. R. A. Douglas.—4th December, 1880.* 6d.

The instrument is composed of a needle attached by the eye to a plate, which carries a brooch-like hook to secure the point of the needle and keep up the pressure.

5057. APPARATUS FOR REGULATING AND CONTROLLING THE PASSAGE OF ATMOSPHERIC AIR, &c., THROUGH OUTLETS OR INLETS, *J. F. Hoyne.—4th December, 1880.—(Complete.)* 2d.

The apparatus is a tube of suitable shape and dimensions, which is filled with pieces of coke, asbestos, pumicestone, fire-clay, or other suitable substance, through the interstices of which air can freely pass, while at the same time a strong current is broken up.

5058. ARTIFICIAL TALLOW, *M. de la Vega.—4th December, 1880.* 2d.

The tallow is composed of castor oil, solid animal fat, and other vegetable oil and wheat flour.

5059. WATER-TIGHT DOORS FOR SHIPS, *S. Crawford.—4th December, 1880.—(Not proceeded with.)* 2d.

The main improvement consists in the application of new disengaging apparatus for throwing out of or into gear the screw or worm which is commonly used for raising and lowering water-tight doors.

5063. APPARATUS FOR BOTTLING AERATED LIQUIDS, *F. Foster and S. Barnett, sen.—4th December, 1880.* 6d.

When it is desired to obtain a cork with a champayne head, a bottling apparatus is employed consisting of a cork guide and compressor of funnel-like form, and which is made in two parts hinged together so as to open longitudinally from top to bottom. One of these parts is fixed upon a convenient support, and the other is movable about the hinge joint. By a locking lever or screw, the movable part of the cork compressor can be forced closely up to the fixed part.

5066. MANUFACTURE OF SUGAR, &c., *M. de la Vega and L. D'Oliveira.—4th December, 1880.* 4d.

This consists in separating the sugar from the water of the liquid by freezing the liquid and drying the sugar.

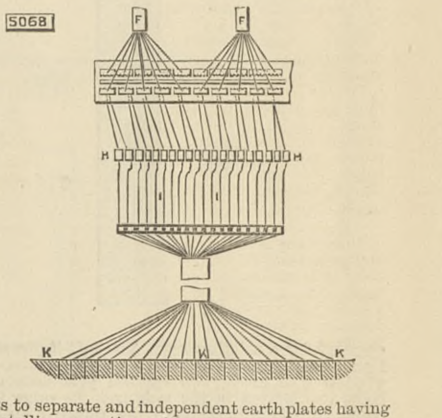
5067. OIL CANS, *L. Field.—4th December, 1880.—(Not proceeded with.)* 2d.

This consists in the construction of the oil can for lubricating, whereby the supply may be regulated.

5068. IMPROVEMENTS RELATING TO TELEPHONIC AND OTHER SYSTEMS OF ELECTRICAL COMMUNICATION, *J. N. Culbertson and J. W. Brown.—6th December, 1880.* 6d.

The object of this invention is to avoid the heavy insulation necessary where telephones or other lines are bunched or cabled together, rendered necessary by the fear of induction. To do this provision is made at the central station for coupling each wire through the call instrument, with which it is connected to a separate earth, and also at the opposite or outer end of the cable, where the wires are led away to various stations; several wires are coupled through instru-

5068



ments to separate and independent earth plates having no metallic connection with one another. The commutator at the central station is also so arranged that when any one wire is coupled to any other wire they may also be coupled to an independent earth plate, preferably through a resistance coil. In the figure F F are cables of wires from different stations; G are lightning protectors; H are electro-magnet call instrument apparatus; I, wires from such apparatus to one or other of the bars A of the commutator; C C are the separate earth connections; K K are the separate and independent earth plates.

5071. LIGHT-PRESERVING COMPOSITION FOR ARTISTIC PURPOSES, *N. Chevalier.—6th December, 1880.* 2d.

This consists in mixing together benzine, benzoline, or paraffine, india-rubber or gutta-percha, and beeswax, stearine, or spermaceti, until of proper consistency for use either as a solid or in a fluid form.

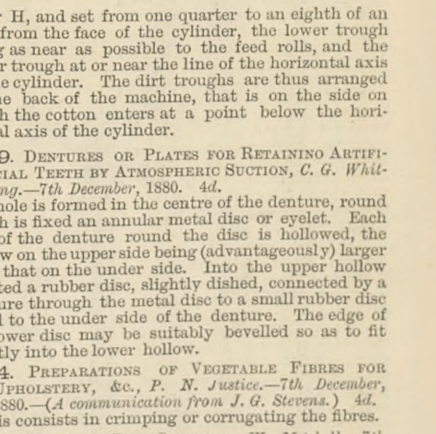
5076. TOOTH GEARING, *H. J. Haddan.—6th December, 1880.—(A communication from Delooy-Petit.)* 4d.

This relates to mechanism for transmitting motion in a similar manner to that of an endless screw and worm wheel.

5086. CARDING MACHINES, *H. H. Lake.—6th December, 1880.—(A communication from The Whitehead and Atherton Machine Company.)* 6d.

This relates to a novel arrangement of the parts of carding machines, and it consists in placing the lap C near the floor, so that the cotton can be fed to the cylinder B well under it or near its vertical axis instead of on or about the line of its horizontal axis. Beyond the feed rolls E in the direction of revolution of the main cylinder, and below the axis of the cylinder, a series of dirt troughs G are arranged on a

5086



cover H, and set from one quarter to an eighth of an inch from the face of the cylinder, the lower trough being as near as possible to the feed rolls, and the upper trough at or near the line of the horizontal axis of the cylinder. The dirt troughs are thus arranged on the back of the machine, that is on the side on which the cotton enters at a point below the horizontal axis of the cylinder.

5089. DENTURES OR PLATES FOR RETAINING ARTIFICIAL TEETH BY ATMOSPHERIC SUCTION, *C. G. Whiting.—7th December, 1880.* 4d.

A hole is formed in the centre of the denture, round which is fixed an annular metal disc or eyelet. Each side of the denture round the disc is hollowed, the hollow on the upper side being (advantageously) larger than that on the under side. Into the upper hollow is fitted a rubber disc, slightly dished, connected by a ligature through the metal disc to a small rubber disc fitted to the under side of the denture. The edge of the lower disc may be suitably bevelled so as to fit exactly into the lower hollow.

5094. PREPARATIONS OF VEGETABLE FIBRES FOR UPHOLSTERY, &c., *P. N. Justice.—7th December, 1880.—(A communication from J. G. Stevens.)* 4d.

This consists in crimping or corrugating the fibres.

5095. QUILT OR BED COVERING, *W. Mitchell.—7th December, 1880.* 4d.

This consists principally in the combination of felted or other cloth with a "batt" of unfelted wool or other suitable fleecy material or mixture of materials.

5102. PIPE JOINTS, *N. Talard.—7th December, 1880.* 6d.

This consists in the combination of links pivotted to the one half point with levers having cams that are caused by turning the levers to bear upon the forks of the other half joint, so as to draw the two halves close together.

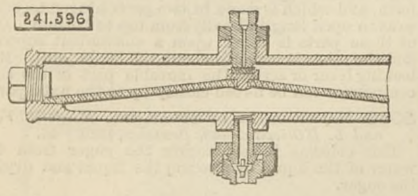
SELECTED AMERICAN PATENTS.

From the United States Patent Office Official Gazette.,

241,596. AUTOMATIC AIR VALVE, *James H. Blessing Albany, N.Y., assignor to the Albany Steam Trap Company, same place.—Filed December 22nd, 1879.*

Claim.—(1) The combination in an automatic air valve, of a valve which is caused to seat and close by the expansion due to heat, and an independent check valve located in a passage connecting with the chamber in which the expansion valve is placed, and operating to prevent the return of air, substantially as described. (2) In an automatic air valve, the combination of a tube or pipe containing a strip of expansible material carrying a valve which is arranged

241,596

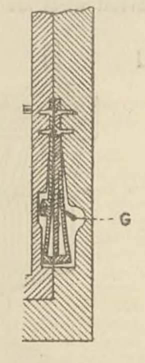


to seat against the side of said tube, and an independent check valve located in a passage connecting with the chamber in which the expansion valve is placed, substantially as described. (3) An automatic air valve provided with an independent check valve having a slot or slots upon its upper surface, whereby the air is enabled to escape through such slots without wearing the lower surface of the valve, substantially as described.

241,616. SASH FASTENER, *Walter P. Chamberlin, Hartford, Conn., assignor of one-half to J. C. Mead, same place.—Filed December 13th, 1880.*

Brief.—Two pendulous spring bolts, one in the casing and the other in the sash, are simultaneously

241.616



operated by a rotating key. The bolt in the sash is forced back by the one in the casing. *Claim.*—In a window sash catch, two opposed pendulous spring bolts, one located in the sash and the other in the casing, in combination with the rotating operating key *g*, substantially as described.

241,628. ELECTRIC LAMP, *David W. De Forest, Brooklyn, assignor to William Buchanan, New York N.Y.—Filed December 6th, 1880.*

Brief.—Two carbon discs or annular carbons mounted on shafts, one of which is made adjustable toward or from the other, are rotated by clock-work acting through a screw and gear wheel. *Claim.*—(1) The circular carbons A and A^1, the shafts A and A^1, and the gear wheels B and B^1, in combination with the

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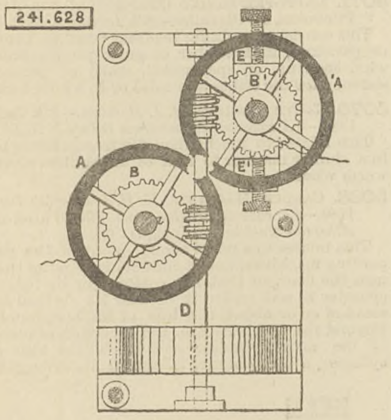

worm wheels C and C^1, the shaft D, and a mechanism for slowly rotating the shaft D, substantially as and for the purpose described. (2) The circular carbon A^1, shaft A^1, and adjustable bearings E and E^1, in combination with the circular carbon A, shaft A, provided with stationary bearings and mechanism for rotating the same, substantially as and for the purpose described.

241,705. PERCUSSION DRILL, *Frank H. Ober, Denver, Colo.—Filed February 21st, 1881.*

Claim.—(1) In a percussion drill, a revolving hub having a hammer attached thereto by an elastic rod,

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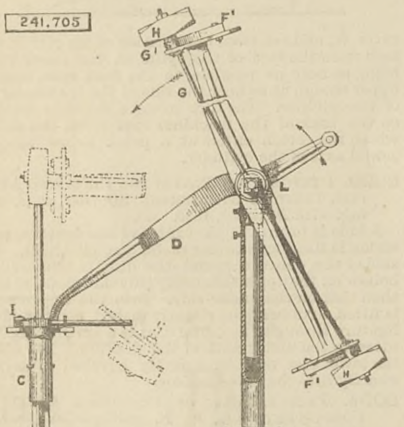

substantially as shown and described. (2) In a percussion drill, the combination, with a suitable support, of a shaft, a hub bearing an arm provided with a slotted head, and a rod provided with a hammer, substantially as shown and described. (3) In a percussion drill, the combination of the rod G, having a knob, a conical hollow clamp G^1, constructed in two sections for receiving the knob, the hammer H, and a nut, all arranged and operating substantially as shown and described. (4) In a percussion drill, the combination of a hub having depressions F^1 F^1, with a rod G, having an upset end, a washer L, having depressions, and a shaft with a nut, substantially as shown and described. (5) In a percussion drill, a vertical cylinder, in combination with an adjustable centre post bearing a series of rotating hammers, and a drill-holding device, substantially as shown and described. (6) In a percussion drill, the combination of the shaft E and suitable supporting devices with the frame D, drill carrier H, socket I, and pawl K, substantially as shown and described. (7) In a percussion drill, the combination of the drill carrier C, socket I, and pawl, extending outward to receive the blow of the head F^1, and having a finger and suitable springs, for the purposes specified. (8) In a percussion drill, the combination of suitable supporting devices, a shaft E and arm F, having an angular head, with the pawl and ratchet of a drill socket, substantially as shown and described.

241,706. GAS MOTOR ENGINE, *Nicolaus A. Otto, Deutz-on-the-Rhine, Germany.—Filed March 28th, 1881.—Patented in England January 5th, 1881.*

Claim.—(1) In a gas motor engine, a working piston caused to make strokes of different lengths, the rod of said piston being connected to the crank by the inter-

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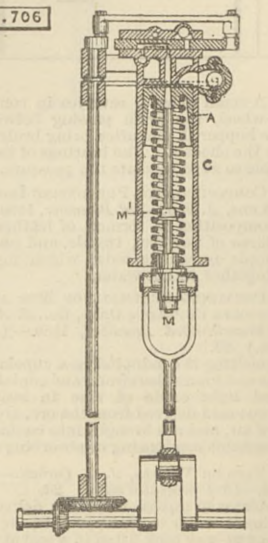

vention of a spring, all constructed and arranged for operation substantially as and for the purpose specified. (2) The combination of the cylinder C, piston A, rod B, with collars M M^1, cross-head D, connecting rod E, and crank shaft F, arranged and operating as herein set forth.

241,744. SPRING TOOTH HARROW OR CULTIVATOR, *Henry Springer and George L. Ives, Vicksburg, Mich.—Filed October, 1880.*

Claim.—(1) In a cultivator, the combination of three rock shafts carrying the spring teeth, the middle one arranged above the plane of the other two, and having

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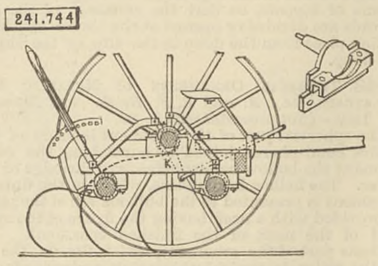
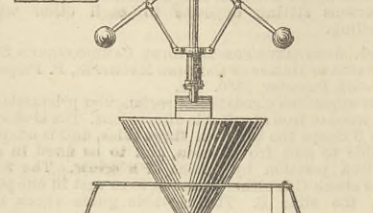


its teeth extending over the back of the rear shaft. (2) The box F, having the top piece E, and lower piece F, side flange G, and axle K, the latter three parts made in one piece.

241,797. MILL FEED REGULATOR, *William Frederick, jun., Uniontown, Pa.—Filed December 30th, 1880.*

Claim.—In a mill feed, the combination, with the governor A, of the regulating arm D, having one end pivotted to the casing at D^1 and connected intermedi-

241,797



ately between its ends with the adjustable feed tube B, and having its other end provided with an adjustable counter balance D^2, substantially as set forth.

241,869. BINDING HEAD FOR GRAIN BINDERS, *Sylvanus D. Locke, Hoosick Falls, N.Y.—Filed April 9th, 1878.*

Claim.—(1) In the binding head of an automatic binder, a holder plate E, composed of two pieces of sheet or plate steel, one having spring temper and the other hardened, and the two rigidly secured together,

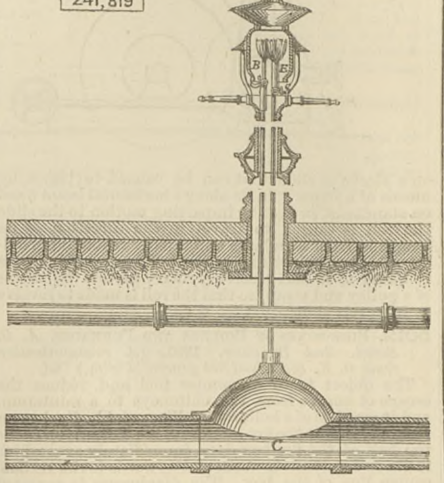
241,869

combined with an elevated table F, to which said holder is attached, as and for the purpose set forth. (2) Combined with the cutter and holder D and the elastic holder plate E, the elevated table F, erected upon the head B, as a seat whereupon to secure said elastic holder plate, as set forth. (3) The table or head B, provided with the lugs O P, integral with said head, combined with the vibrating cutter D, as set forth. (4) Combined with the shell A and the cutting and holding device, the sheet metal bridge piece or shield P, to cover the cutter and holder and prevent the entanglement of straw therewith. (5) Combined with the cutting and twisting devices mounted on plate B, the shell A, with the lateral extension or roof B^1, to cover the opening between said shell and plate B, as set forth. (6) Combined with the shell A and the cutting and twisting devices, the rigidly attached re-enforce ledger plate Z, with the shoulder C, as set forth. (7) The shell A and its twisting and cutting devices, and the shoulder C, to arrest the compressor, combined with the upward-projecting part P, as set forth.

241,819. APPARATUS FOR CONSUMING SEWER GAS, *William Henry Ogilvie, Brooklyn, N.Y., assignor of one-half to William L. Bennem, same place.—Filed June 9th, 1879.*

Claim.—(1) The section of sewer pipe and dome C, as hereinbefore described, in combination with a delivery pipe for the purpose of concentrating and delivering sewer gas to a gas jet E, substantially as set forth. (2) The combination, substantially as described, of the section of sewer pipe and dome, the delivery pipe, and the vacuum head sewer gas consumer connected to the delivery pipe, for the purpose

241,819



set forth. (3) The combination, substantially as described, of the section of sewer pipe and dome, the delivery pipe, the vacuum head sewer gas consumer, the stop cock, and the gas burner, or its equivalent, substantially as hereinbefore set forth, and for the purposes set forth. (4) The combination, substantially as described, of the delivery pipe, the vacuum head, the gas pipe, and the double stop cock, so arranged in connection with the delivery and gas pipes as to turn them on and off at one and the same time.

241,879. GEAR WHEEL CUTTER, *Edwin L. Parsons, Providence, R.I., assignor to the Brown and Sharpe Manufacturing Company, same place.—Filed March 23rd, 1881.*

Claim.—A gear wheel cutter having a line in the

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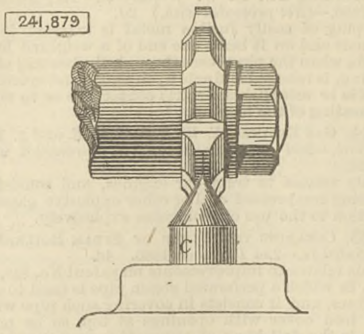
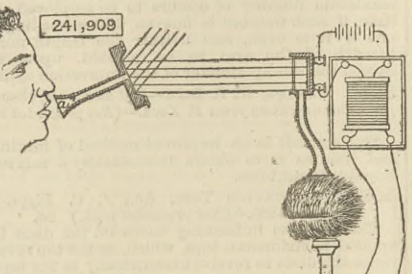


centre of the peripherical contour of one or more of its teeth as a guide in setting the cutter central in the gear cutting machine, substantially as described.

241,909. PHOTOPHONIC RECEIVER, *Alexander G. Bell and Sumner Tainter, Washington, D.C.—Filed March 24th, 1881.*

Claim.—(1) In a photophonic receiver, the sound chamber for containing the sensitive medium, having a wall transparent to light or radiant energy, but opaque or less transparent to sound, substantially as described. (2) The combination of the sound chamber having a wall transparent to radiant energy, but opaque or less transparent to sound, with the sensitive medium therein contained, and a sound conveyor or opening communicating with the interior of said chamber, substantially as described. (3) In a photophonic receiver, the sensitive medium, composed of vibratory material in an open, porous, or subdivided condition, substantially as described. (4) In a photophonic receiver, a sensitive medium of lamp-black or similar material, substantially as described. (5) A photophonic receiver having as the sensitive medium a deposit of vibratory material in a loose, porous, subdivided, flocculent, or spongy condition, substantially as described. (6) In a photophonic receiver, the combination of a sensitive medium conductive of electricity, in a loose, porous, or subdivided condition, such as lamp-black, and conductors for including the same in an electric circuit, substantially as described, so that the radial vibrations can be thereby converted into electric vibrations, as set forth. (7)

241,909



The combination of the lamp black or other vibratory conducting material in loose particles, the rigid or substantially inextensible support of insulating material, and conductors by which the lamp-black can be included in an electric circuit, as set forth. (8) A cell comprising sheets, plates, or strips of conducting material, fixed or mounted upon a support of insulating material, with their edges opposite each other and separated by a suitable distance, and sensitive conducting material in the space or spaces between said edges, substantially as described. (9) A support of insulating material, having comb-shaped conductors fixed or mounted on said support, as indicated, so that the teeth of the combs intermesh but are not in contact with each oth.r, substantially as described. (10) A silvered plate having the silver film mechanically ruled or scraped, as described, so as to leave parallel lines or stripes of equal width, and with sharp, clean edges, substantially as set forth. (11) The insulating plate having on one or both sides a silver film ruled or scraped, as described, so as to divide the silver film into two or more conductors, in combination with binding posts connected with the parts of said film or films, substantially as set forth. (12) The combination of the insulating plate and ruled silver film with the lamp-black or sensitive medium included in the ruled or scraped spaces in said film, substantially as set forth. (13) The combination, with a galvanic circuit, of a photophonic cell, comprising a glass plate with ruled silver film thereon, lamp-black deposited in the ruled spaces in said film, and connections for completing the galvanic circuit through said cell, substantially as described. (14) The combination, with a photophonic cell, of an induction coil, electric connections for including said cell in one circuit of said coil, and a telephone circuit connected with the other circuit of said coil, substantially as described (14) A photophonic receiver comprising a sound chamber having a wall transparent to radiant energy, but opaque or less transparent to sound, a cell having a vibratory sensitive medium, such as lamp-black, electrical connections for connecting said cell in an electrical circuit, and a hearing tube connected with the interior of said sound chamber, substantially as described.

241,930. VALVE FOR AIR COMPRESSORS, *James Clayton, Brooklyn, N.Y.—Filed May 31st, 1880.*

Claim.—The combination with the disc-like valve seat A and the valve C, of one or more guard bolts F rigidly attached to the valve and working through the

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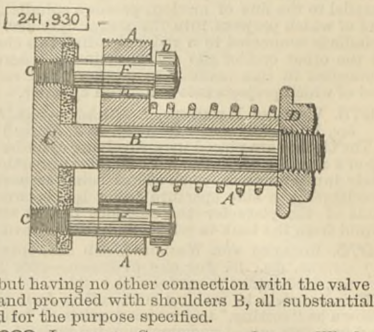

seat, but having no other connection with the valve or seat, and provided with shoulders B, all substantially as and for the purpose specified.

242,088. INJECTOR CONDENSER, *Jerome Wheelock, Worcester, Mass.—Filed April 14th, 1881.*

Claim.—(1) In a syphon condenser, a steam nozzle provided with a central aperture and one or more concentric annular apertures for the delivery of steam

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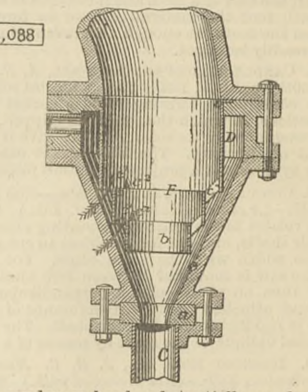

into the condenser head, substantially as described. (2) The combination of the exhaust pipe, water chamber, and conical chamber terminating at an ejector nozzle with the steam nozzle provided with the central delivery aperture and one or more annular delivery apertures, substantially as described.

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THE ENGINEER, July 8th, 1881.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending July 2nd, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 10,965; mercantile marine, building materials, and other collections, 4350. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 2156; mercantile marine, building materials, and other collections, 424. Total, 17,895. Average of corresponding week in former years, 18,042. Total from the opening of the Museum, 20,113,769.

MAP OF MACHINERY DEPARTMENT, ROYAL AGRICULTURAL SOCIETY'S SHOWYARD, DERBY.

Exhibitor.	Block	No
Aveling & Porter	X	1
Alexanders and Loveridge	J	41
Appleby	J	52
Anglo Tin Co.	J	60
Avery	C	76
Atkinson	B	91
Aylesbury Dy. Co	B	93
Atmospheric Churn Co.	C	95
Allway	C	96
Arnold	D	109
Ashworth	E	137
Albion Ironwks.	M	169
Aultman	S	198
Adams	W	209
Albion Ironwks.	M	273
Andrew	U	283
Allchin	N	293
Agri. & Horticul.	B′	316
Agricul. Press	A′	332
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Animal Photo Co	O	363
Bird & Co.	Q	9
Bamford	Q	10
Beeby & Hinton	P	16
Bentall & Co.	R	35
Bradford & Co.	I	56
Bellamy	I	57
Bennett	K	65
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Bury and Co.	C	79
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Ball and Son	F	122
Ball, G.	E	124
Bristol Wgn. Co.	D	125
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Baxter	H	260
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Barford & Perkins	T	277
Brown & May	U	282
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Barrett	N	301
Borwick	U	302
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Clay	Q	4
Coleman & Morton	P	5
Crossley & Co.	P	6
Carson & Toone	Q	13
Cottis	Q	21
Crump	J	40
Cowley	C	102
Chevin	C	106
Christy	D	110
Cooch	F	136
Corbett	K	147
Coultas	L	164
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Cradock & Co.	S	193
Clayton & Shuttleworth	S	207
Crowley & Co.	P	213
Cochrane & Co.	H	231
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Corbett & Son	O	237
Cottrell and Co.	V	247
Clarke's Crank Co.	O	251
Crossley Bros.	B′	281
City Oil Mills	U	304
Carter	W	340
Denton	P	29
Dairy Supply	I	36
Derwent Fndry.	K	44
Dickinson, Brown & Tait	J	62
Denning and Co.	L	172
Dairy Supply	I	220
Deakin, Parker, and Co.	I	225

Exhibitor.	Block	No
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Darby	V	249
Dodman	F	268
Durham Steam Cultivation Co.	U	290
Driffield Cake Co	U	303
Davis	B′	319
Day and Sons	B′	324
Day, Son, and Hewitt	A′	330
Down and Co.	A′	331
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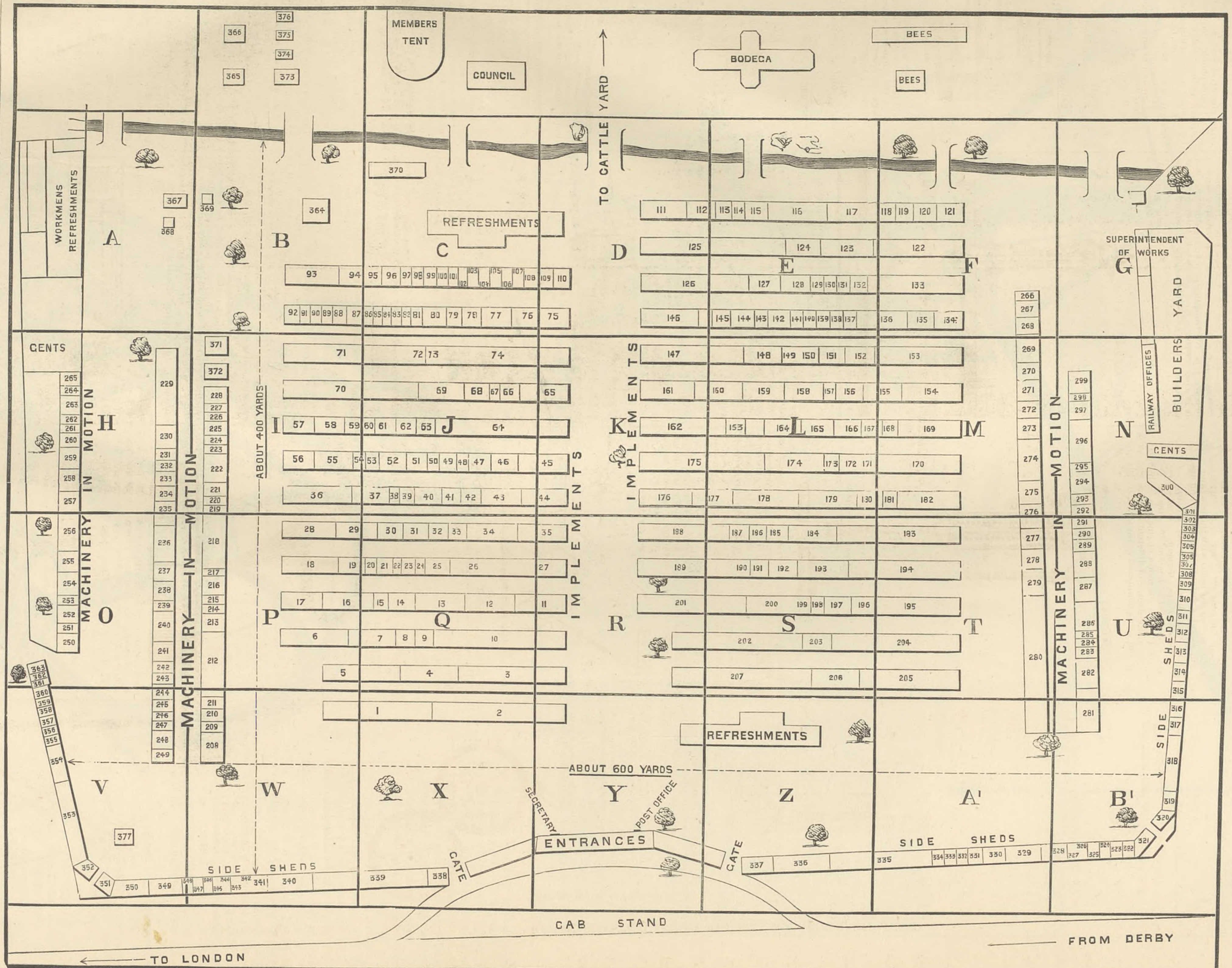
Hindley	N	294
Henri's Cattle Food Co.	U	309
Hope	U	311
Holdmein	B′	322
Harrison	Z	337
Hepburn & Gale	V	356
Henson and Co.	B	365
Hill and Smith	I	371
Horley	B	376
Inman	C	370
Jack and Son	E	127
James	L	149
Jeffrey & Blackstone	M	170
Johnstone Harvester Co.	L	180
Jeffrey & Blackstone	M	275
Jones	B′	328
Kent	J	37
Kirkstall Forge Co.	J	49
Key, J. & Co.	I	54
Keay	J	69
Kite and Co.	C	101
King, W.	F	121



Exhibitor.	Block	No
Kittmer	E	138
Kell, Meats, & Co.	K	162
Keyworth	S	185
Kearsley	S	187
King, H. & H.	S	200
Kaye, W.	I	226
Kaye	W	344
Larkworthy	Q	12
Thornton, Jos.	Q	22
Lloyd & Co.	Q	23
Lister	Q	25
Lyon, A.	I	59
Lawrence & Co.	C	85
Llewellin	C	100
Lampson and Theedam	C	103
Lloyd, Lawrence and Co.	C	108
Leicester Tricyle Co.	E	114
Linacre	L	167
Ley	O	240
Ladd	N	299
Murray & Co.	Q	7
McKenzie	J	67
Morton & Co.	I	70
Moule	C	82
Marsden, D.	C	86
Morgan	F	120
Malden Ironwks	L	148
Murton & Turner	L	163
McCormick	S	191
McLaren	W	208
Marshall, Sons, and Co.	H	229
Mason	H	262
Marsden, H. R.	H	265
Muller	U	285
Matthews	U	313
Morris, Little, and Son	A′	329
Mold	A′	334
Morris & Griffin	V	349
Matthews	A	367
Morton and Co.	I	372
McEvoy	B	375
Nottgham. Iron Co.	J	48
Nicholson & Sons	M	153
Notts, Fork & Co.	S	199
Newton, Chambers and Co.	W	210
Nicholson & Son	M	270
Nalder & Nalder	N	298
Nitro Phosphate Co.	V	350
Norris	V	357
Ord & Maddison	Q	33
Osmond	J	51
Orme	E	140
Osborne	S	190
Obell	O	254
Perkins & Sons	Q	14
Powell Bros. & Whittaker	P	18
Pickersgill and Frost	J	43
Phillips	J	53
Peirce	J	66
Plympton	C	81
Page	E	132
Perkins, Paternoster, & Co.	F	135
Peck	E	144
Penney and Co.	M	181
Picksley, Sims, and Co.	S	206
Pickering	O	242
Pinfold	H	259
Parkins & Paternoster	F	266
Powis	N	297
Phœnix Cake Co	U	307
Pearson	U	314
Pearson Bros.	U	315
Pettifer	B′	325
Procter & Ryland	V	351
Preller Leather Co.	V	358
Priestman Bros.	B	364
Reading Ironwk	R	11
Reeves & Jones	P	28
Rollins	K	45
Ransome, S. E.	J	63
Roes Timber Co.	J	73
Russell	C	78
Russell & Sons	C	80
Richardson, E.	C	98
Robinson, E.	C	99
Richardson and Son	E	139
Robinson, J.	L	151
Richmond and Chandler	M	154
Rainforth	L	159
Reid and Co.	L	160
Ratcliffe	L	166
Robey and Co.	P	212

Exhibitor.	Block	No
Riches & Watts	H	233
Raymond	S	186
Ransomes, Head and Jefferies	T	204
Rownson, Drew, and Co.	O	243
Roberts	V	248
Rhodes	O	250
Richmond and Chandler	M	272
Ruston & Proctor	M	274
Ragosine	V	355
Shanks & Son	P	17
Sinclair, J.	J	39
Spear & Jackson	J	47
Summerscales & Sons	I	58
Shiel & Crockett	C	84
Stone	E	117
Starey	F	118
Smith & Parfrey	E	128
Shepherd	E	130
Stubbs	E	131
Sainty	E	142
Smith and Son	L	152
Shaw and Williamson	L	157
Smyth and Sons	K	161
Smith and Grace	L	165
Samuelson	T	195
Spencer, J.	S	197
Shanks and Son	P	215
Slack's Emery Co.	V	245
Standard Emery Co.	V	246
Smedley Bros.	H	263
Samuelson	T	279
Sellers	U	306
Spencer and Son	U	308
Spratt's Patent	B′	318
Spencer, J.	B′	321
Sutton	A′	335
Sinclair	W	343
Sankey	W	346
Spong	W	348
Staynes	V	359
Schaffer and Budenberg	V	360
Symonds	B	366
Standard Manufacturing Co.	B	374
Thornton, John	Q	24
Thomas	Q	31
Thomas & Taylor	B	87
Thorn	D	112
Teasdale	L	178
Turner, E.R.&F.	M	182
Tuxford	P	21
Turner, W.	H	234
Thwaites Bros.	O	252
Taylor and Co.	H	264
Turner, E.R.&F.	M	276
Turner, F. W.	U	284
Tasker	N	292
Taylor, R. W.	N	295
Thorley, J.	B′	317
Tipper	B′	323
Tomlinson	B′	327
Unterilp	Q	15
Unite	D	146
Vipan & Headly	J	64
Victoria Foundry Co.	O	238
Walker, F.	Q	8
Wilder	Q	26
Woods & Long	R	27
Willacy	Q	32
William & Son	Q	34
Wagstaff	J	50
Walley, Smith, & Paget	I	55
Whiting & Co.	J	61
Waite	J	72
Waid	B	88
Whittaker	C	104
Wilkerson	C	105
Windover	D	111
Woolnough	L	179
Wood, W. A.	R	201
Wilson Engineering Co.	W	211
Willdigg Bros.	P	214
Williamson Bros	I	222
Weighell	O	239
Whitehead & Co.	O	256
Watson & Haig	U	291
Western and Co.	N	296
Waterloo Cake Co	B′	320
Woodward	B′	326
Wheeler	Z	336
Webb	X	339
Wilkinson	W	341
Westaway	W	345
White	W	347
Winter	O	361
Whittle	A	368
Wheeler and Co.	B	373

Superintendent of Works—G Secretary—Y. Post-office—Y.