VISITS IN THE PROVINCES.

THE ELSWICK ORDNANCE AND ENGINE WORKS.

No. III.

It is desirable to give a few illustrations of designs from the Elswick Ordnance Works before leaving the subject altogether. We will commence with the breech-closing arrangement now in use, as exemplified by the 43-ton gun—*vide* Figs. 6, 7, and 8, page 77. The breech-closing arrangement, which is common to many guns with slight modification, may be taken first, the gun itself being afterwards taken on its own merits. In THE ENGINEER of October 8th, 1880, we gave a description of the same system of breech closing, with the same obturating cup as applied to the breech-loading 13-pounder supplied to our own service by the gun factories. It differs chiefly from Palliser and French breech-loading arrangements in the system of obturation or closing the joint. Fig. 6 shows the breech end of a charged gun. S is the powder charge with central tube R, A the steel obturating cup, which fits closely into the mouth of the powder chamber inside the copper breech bush O O, being fixed on to the breech block by the screw spindle C. The face of the breech block is slightly convex, so as to leave the surface of the obturating cup gradually towards the circumference of the disc—*vide* Fig 6. On firing, the pressure of the gas forces the obturating cup against it, at the same time tightly closing the joint between the edge of the cup A and O. The fitting of A is, in fact, a most important matter. The firing arrangement consists of a needle E and the primer L, which are carried in a steel cylinder B, which has an interrupted screw so as to admit of being very quickly entered and tightened. The needle is held back by a spiral spring G until struck by a lever hammer H, which is raised to full cock and made to fall by the pull of a lanyard attached to the shorter arm U, and the needle then drives its point into the primer firing the gun. The slide bar guard K prevents this taking place when the breech is not home. The stud T, moving in the groove Q, holds the slide-bar end sufficiently far in over the vent to prevent the hammer striking the end of the needle until the stud reaches the portion V, which carries it sufficiently far out to cause the bar to be drawn clear of the vent. The carrier N, with its catch P, resembles closely that on similar guns.

The gun itself is shown in section in Fig. 7. Compared with the 43-ton gun made in the Royal Gun Factories—*vide* ENGINEER, April 1, 1881—and now mounted at Shoeburyness it is seen to differ in the general shape in which the work is done and the metal distributed along the piece. The Woolwich gun has a chamber 15·5in. in diameter and 58·35in long against corresponding dimensions of 14·3in. and 87·43in. Consequently the longitudinal strain on the Woolwich gun is much greater for the same pressure, it is obvious, however, that that breech is specially strong.

To pass on to another 43-ton gun. In Fig. 9 is shown one strengthened with coils of steel riband. The whole of the gun from breech to trunnion hoop is made of steel; the portions which are made of wrought iron or steel riband are so marked in section, the unmarked parts being steel. We have used the word "trunnion hoop" to describe the part known to artillerymen by that name. This gun, however, has no trunnions, being held in a saddle by the square cut rings shown on the lower surface. This gun is a much larger one than those of which we have just been speaking—the bore is 13in. against 12in. diameter. 13in. and 12in. projectiles of similar proportions fired with the same velocity would have stored-up work in the proportion of five to four, roughly speaking. The details as to charges, projectiles, and velocity have not yet been worked out practically, but the following is an approximate estimate. The 12in. gun, with a charge of from 315 lb. to 325 lb., and a projectile of 700 lb., will have a muzzle velocity of from 1950ft. to 1970ft., implying an energy of about 18,650 foot tons. The 13in. gun, with a 500 lb. charge and a 1000 lb. projectile, may attain an initial velocity not far short of 2000ft. per second, having about 27,460 foot tons stored up energy. Such results would argue greater proportional power for the 13in. gun than the 12in., and far exceed the estimate made in France that steel wire bears to solid steel in the same quantity strength in the proportion of four to three.

As to proportions, the riband 13in. gun has a length of bore of 390, or 30 calibres, against about 312, or 26 calibres length in the 12in. gun. The chamber of the former is 8 calibres long against about 7½ in the latter. As to the arrangement of the riband coil, it will be seen that it is only carried out to a certain extent; there is no longitudinal application of riband in this gun.

The 100-ton guns, muzzle and breech-loading, made for the Italian Government for the vessels Duilio, Dandolo, Italia, and Lepanto, and all their working machinery, form an undertaking of such magnitude that it would appear strange to avoid all reference to it. The first guns made in 1875 still remain the most powerful pieces in the world, with the exception of their 100-ton successors of rather larger calibre, made also at Elswick. To enter into a discusion of them, however, is here impossible. We may refer to THE ENGINEER of December, 1876, and January, 1877, for account of first trials, and August, 1879, for later ones; also February, 1879, for the system of mounting breech-loading guns on board the Italia.

Figs. 10 and 11 show the Elswick 100-ton gun muzzle-loader as mounted for Malta and Gibraltar—*vide* ENGINEER September 24th, 1880. This is the largest example of a muzzle-loading gun firing *en barbette* and loaded under cover by bringing it round parallel to the parapet, on the system advocated by Mr. George Rendel. The principle of keeping the centre of gravity of the mass nearly over the traversing centre is observed, while the employment of the gun as an inclined plane for running the shot up to its seat in the bore is applied to considerable purpose in the case of a projectile weighing 2000 lb. It may be seen in Fig. 10 that the gun can be loaded with less exposure of men than in the case of a breech-loader. The gun itself would be a difficult object to strike from a point far below, such as the deck of a vessel engaging with the 100-ton guns at the Ragged Staff Battery at Gibraltar, or the battery between Sliema and Tigne at Malta, from 70ft. to 90ft. above the sea-level, nor would it be very feasible from a vessel to injure the detachments by curved fire.

In both figures the gun is shown traversed in the direction for loading—that is, pointed with its muzzle towards the loading hole of an iron cylindrical chamber B termed a "cage." In position at Malta or Gibraltar there would be two such cages at opposite sides of the traversing circle of the gun, the parapet extending from cage to cage, the gun loading at the most convenient one. The angle through which the gun can thus fire is 146 deg. The accumulator and engine are to be below ground. The accumulator in the Arsenal has a weight of about 71 tons, and is worked by an ordinary steam sapper of 6-horse power, working up to 70 lb. to the inch. It can be pumped up by forty men with hand-pump gear, in which case it is calculated that the gun can be fired at about the rate of one round in seven and a-half minutes; while if man power is used without an accumulator, it can only fire twelve rounds in about fifteen minutes. The general direction of the hydraulic gear connections are shown. Traversing, elevating, and depressing are effected by means of a handle at D, washing and loading by one near L in the cage. The charge is singularly well kept under cover throughout. The magazine and shell rooms are designed to be below ground, the projectile and charge being lifted on a truck and run into the cage and brought round on the turntable and presented towards the muzzle of the gun. The loading hole is habitually kept closed. The noise and shock inside the cage must be considerable when the gun is fired nearly over it. Colonel Inglis, R.E., however, made trial of it himself on one of the first rounds fired in the Royal Arsenal to ascertain if there was any serious objection to be made on this score.

For land service mounting, this system obviously possesses greater advantages than generally accompany its use on board ships, where toothed gearing, &c., have to be employed everywhere, to provide against the effects of rolling. Probably, however, most of our readers are aware that the Ajax and Agamemnon, as well as the Inflexible and Dreadnought, furnish examples of this system of loading at the muzzle in turrets. The same system was applied to greater advantage in the case of gunboats, where a gun in the bows can be depressed and loaded without any revolution, the gun being fixed, and the vessel with its twin screws affording the means of traversing. In THE ENGINEER of August 22nd, 1879, we gave a cut, and on August 1st, 1879, a description of the Epsilon gunboat, which was one of eight first supplied by Elswick to the Chinese Government, carrying powerful 35-ton guns, the vessels themselves being each only 440 tons.

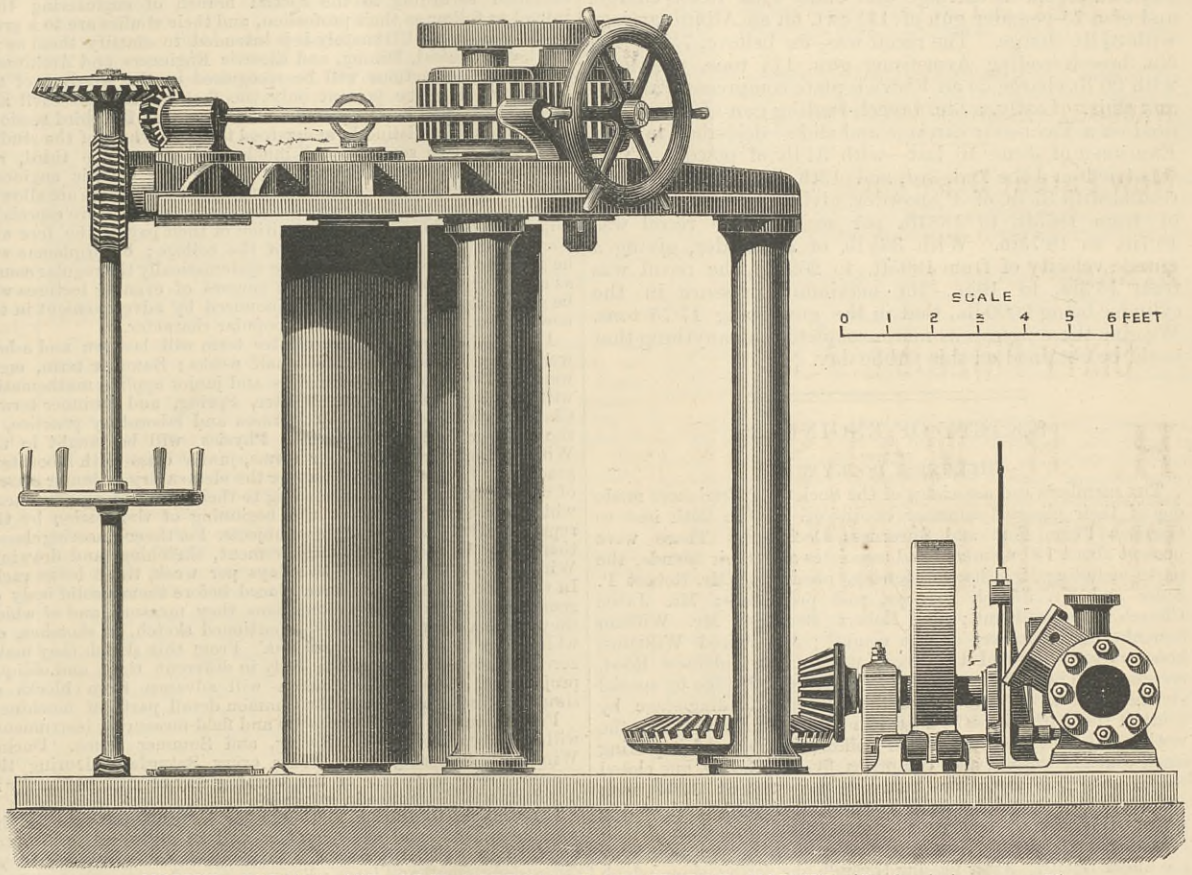
Before concluding, one other design of a very original character, made to meet a suggestion of its desirability being thrown out by Colonel Le Mesurier, R.A., should be mentioned, namely, a mountain gun unscrewing into two parts at the trunnion ring—*vide* ENGINEER of November 22nd, 1878. This device, it will be noticed, enabled a field gun of considerable power to act as a mountain gun, instead of the short, feeble weapon previously used. It is not necessary now to repeat all that we said of this gun when it was first brought out. We may sum it up by saying that, at the cost of an extra mule to each gun, and the operation of screwing and unscrewing the parts, a hard-hitting piece, firing a projectile with 1500ft. velocity, is obtained. These guns have abundantly proved their value in Affghanistan. Sir F. Roberts has, we believe, the highest opinion of them, having taken care to have them as an accompaniment to his force on every expedition he undertook.

THE ANNUAL VISIT TO SHOEBURYNESS.

ON Wednesday, July 20th, the Secretary of State for War, accompanied Sir John Adye, Surveyor-General of Ordnance, with the Director-General of Artillery and the Adjutant-General, visited the School of Gunnery at Shoeburyness. As many of our readers are aware, an occasion of this kind is rather valuable as bringing out a selection of designs which have arrived at a certain stage of perfection and trustworthiness than as exhibiting anything really novel or in the full sense experimental. On this occasion there was hardly anything that was striking in a popular way, but there were certain features of great importance illustrated. The following were the principal matters to record:—(1) An 8in. howitzer—70 cwt.—mounted on a siege carriage fitted with hydraulic buffer; charges 3 lb. 8 oz. and 11 lb. 8 oz. R.L.G. powder. This was an admirable design. The howitzer is one which recoils so violently when free as to be quite unmanageable. The siege carriage is not suited to take a buffer of the ordinary kind, but it has one in this case attached and made to act by tension, the front end of the cylinder being fastened to a holdfast at the foot of the parapet. By this means the recoil is decreased from about 30ft. to 3ft. or 4ft. The carriage with its buffer can easily be detached and taken from place to place. Here then by very simple means an unmanageable gun and carriage are brought under perfect control. No doubt a severe shock is experienced by the holdfast in the parapet, but this is a difficulty that must be met. There was a 6·6in. rifled muzzle-loading gun on Moncrieff's hydro-pneumatic siege carriage, but it was not fired.

The muzzle-loading and breech-loading 13-pounder guns were next fired side by side. Ring shell, common shell, and shrapnel were used. The breech-loading gun was worked with a friction brake on the naves of the wheels. Both these guns shot well. The unchecked recoil of the muzzle-loading gun was rather an inconvenience, but the brake on the breech-loading gun was only lightly applied. Good practice was made at some fieldworks with dummy detachments, which were cut to pieces.

A trial of machine guns then took place: the 5-barrelled, 2-barrelled, and 1-barrelled Gardiner, and 10-barrelled Gatling, and a 4-barrelled Nordenfelt. The firing, however, was hardly so good as it was recently at Shoeburyness in the competitive trials which we have reported. The Nordenfelt, steel, inch, bullets at 200 yards riddled a ½in. plate, and might have pierced one double as thick. Next followed heavy and medium rifle breech-loading guns, commencing with the new breech-loading 12in. 43-ton gun, from which three rounds of common shell were fired, fuzed with Pittman general service fuzes, at targets at 500 yards range, this short distance being selected to show the action of the shell as clearly as possible. The chief question of interest was the behaviour of the gun itself on its carriage. The loading at the breech was effected with ease, the charges being made up of prismatic powder, contained in flat-ended bags, resembling closely those employed at Meppen. The gun was fired both by electricity and by hand: there appeared to be no escape from the vent, which is in the axis, and is completely closed on firing. A still more important question, however, is the management of the recoil, which was checked by means of a yoke frame fixed in the structure round the port through which the gun fires, according to a design of Colonel Inglis, R.E. The yoke frame is a powerful rectangular girder frame, A A B B, page 77, whose horizontal limbs—the top A A and bottom of the frame—are bent into the arc of a circle concentric with the points on which the gun traverses, so as to run by means of rollers with vertical axes in grooves in the roof and floor of the casemate. This frame is capable then of moving round the traversing centre so as to enable the gun when attached to it to pivot properly



MESSRS. SCRIVEN AND CO.'S VERTICAL PLATE-BENDING MACHINE—(*For description see page* 83).

The gun-carriage is very simple. Its brackets are cut from armour plates—in each is fixed longitudinally a cylindrical water buffer C, whose piston rod is attached to the corresponding vertical limb of the yoke frame. In this way the gun carriage holds on to the yoke frame through which it fires, by means of its two buffers, like two arms, one on each side. These are but little below the trunnions, so that the resistance is brought more nearly opposite to the seat of pressure than usual. The buffer, of course, acts in tension. Its behaviour is admirable. The recoil is under 4ft., and the movement steady and easy, and the running up beautifully easy. It is possible that some less ponderous new design might be found to act equally well, but with the means already at hand this plan is excellent. The breech closing arrangement resembles that employed at Elswick; the breech lever is caused to move round by a lever and pinion at D, and the breech block is withdrawn by means of a winch handle and screw E. Probably many of the officers who stood round this gun and saw the ease and celerity with which it was worked, compared it mentally with the far less powerful 38-ton muzzle-loading gun, which had been worked in the same casemate on a public occasion on June 22nd, 1876, by detachments at the rate of a little over a minute and a-half per round, but with great exertion. An imperfect comparison of time is unreliable. It was said that the breech-loading gun could be fired at the rate of one round per minute, but we cannot expect stress to be laid on this as a matter of time; although we do not doubt if a fair trial were made the detachment working the breech-loading gun would very easily distance their rivals, their labour being comparatively light.

The firing of this gun was the feature of the day. There followed that of a 25-pounder breech-loading gun of 22½ cwt. on naval carriage and slide with 15 lb. charge, and of a 25-pounder gun of 13½ cwt. on an Albini carriage with 3¼ lb. charge. The recoil was, we believe, 7½in. An 8in. breech-loading Armstrong gun, 11½ tons, was fired with 90 lb. charge on an Elswick plate compressor carriage and slide. Lastly, a 6in. breech-loading gun of 4 tons was fired on a Vavasseur carriage and slide—described in The Engineer of June 16 last—with 34 lb. of powder. This was tried on June 2nd, 3rd, and 13th last with excellent results with 37 lb. of P_2 powder, giving a muzzle velocity of from 1875ft. to 1884ft. per second; the recoil was 18·7in. to 18·75in. With 36½ lb. of P powder, giving a muzzle velocity of from 1995ft. to 2020ft., the recoil was from 18·3in. to 19in., the maximum pressure in the cylinder being 3000 lb., that in the gun being 17·75 tons. We give these figures as more complete than anything that could be obtained on this public day.

SOCIETY OF ENGINEERS.

SHEERNESS DOCKYARD.

The members and associates of the Society of Engineers made one of their pleasant summer excursions on the 20th inst. to Garrison Point Fort and Sheerness Dockyard. There were present about 120 members and associates and their friends, the party including Mr. Charles Horsley, president; Mr. Robert P. Spice and Mr. Joseph Bernays, past presidents; Mr. Jabez Church, vice-president; Mr. Robert Berridge, Mr. William Schönheyder, members of the council; Mr. Alfred Williams, honorary secretary and treasurer; and Mr. Bartholomew Reed, secretary. The party proceeded from London Bridge by special steamer, and were received on the dockyard landing-stage by some of the authorities, by whom they were conducted over the works. The dockyard is used for building, fitting, and repairing small cruising vessels, and comprises five dry docks, one closed basin, and two open or tidal basins. About 1700 men are employed on the general work of the yard, and at the present time there is one vessel—the Satellite—in course of construction, one—the Caroline—in course of fitting out, and four are under repair. After passing through the fitting shop, which is provided with galleries, one devoted to light fitting work, and the other to pattern-making, the brass foundry and coppersmiths' shop were next inspected, after which two Cornish engines of 50-horse power each were shown. These engines are used for pumping out the docks, and have been on the establishment for sixty years. In the boiler shop the visitors found a number of boilers under repair for the various vessels in course of re-fitting, among them being those of the Sylvia, surveying vessel. The yard smithy contains sixty forges, several steam hammers of various sizes, and gives employment to 170 hands. A considerable number of wood-working machines of different kinds, was seen in operation preparing ships' timbers. The Satellite, to which we have already referred, is a composite sloop, intended to carry eight Armstrong guns of the new pattern. She is 200ft. in length, with an extreme breadth of 38ft., and a moulded breadth of 37ft. Her draught of water is 12ft. 9in. forward and 15ft. 9in. aft, with a displacement of 1420 tons. She will be propelled by a single screw driven by engines of 900-horse power. The building of the Satellite was commenced on the 4th of October, 1880, and she is to be launched on the 13th of next month.

There are, it may be admitted, many technical Government departments whereat the lessons to be learned may be very useful and worth remembering. It is to be feared, however, that time is so often disregarded in Government workshop operations that, at Sheerness for instance, there is not much to be seen that need be remembered—in fact a visitor feels sometimes inclined to ask an operative if he really does not know better than his pace indicates. One may for instance see holes about $\frac{5}{8}$in. diameter drilled through thin iron by a drill running at about sixty revolutions a minute. Great fear that grindstone spindles should wear out too soon is displayed by the annoyingly slow speed at which these tools run, and men may be seen bending sheet iron plates, two at a time it is true, by means of a fine set of rolls about 10ft. in length, and large in diameter, and run at a speed suitable for thick plates, perhaps the whole width of the rolls, instead of about 24in. Again, these narrow plates or sheets are evidently always passed through the rolls at mid length, instead of varying the position. Some of the members visited the cable testing department, where they saw cables up to 4in. in diameter tested. A considerable portion of the work of this machine consists in re-testing cables that have been some time in use. It transpired that these old cables are not annealed before re-testing with the ordinary test of 8 tons per circular inch. It is of course difficult to say how much smaller the percentage of breakage would be if this annealing were done, but it may be certainly said that the expenditure on annealing would be well laid out. The members spent a good deal of time in an inspection of the fort, and were much interested in the 9in. and 10in. muzzle-loading guns with which the lower and upper casemates are provided. These guns, the shields, and the armour have all been illustrated in The Engineer, so it is unnecessary to re-describe them here. This fort mounts forty-four guns, ranging from the 9in. gun of 8 tons to the 12·5in. gun of 38 tons, and including the 10in. gun of 18 tons. In leaving the dockyard the steamboat steamed round the Hydra turret-ship, which carries four 18-ton guns, and a few went on board the guard ship lying near it.

MASON COLLEGE, BIRMINGHAM.

The following excellent programme of the course of education in civil and mechanical engineering to be given at Mason College has just been prepared by the professor of engineering of the college, Mr. Robert H. Smith.

The programme of study is arranged so that any one year of it may be taken with advantage by a student properly prepared for the work of that year. But the benefit that may be derived from the study of any one year is very much greater for the student who follows out the whole three years' course than for one who omits any part of it. Students entering the first year's course must not be less than sixteen years of age. It is recommended that those intending to serve an apprenticeship in a workshop or office should endeavour to arrange to serve one year of the apprenticeship before beginning the college course, and the remainder after finishing their college studies. At the end of the first year ordinary class certificates of attendance and proficiency alone will be given. At the end of the second year a Junior Engineering Diploma will be given to those students who have earned it. At the end of the third year a Senior Engineering Diploma will be given to those attaining the required degree of proficiency. No student will receive a Senior Engineering Diploma who has not either obtained a Junior Engineering Diploma in the Mason College, or else produced a written certificate proving that he has elsewhere acquired equivalent knowledge to that to which the Junior Engineering Diploma of the Mason College testifies. The instruction of the first two sessions is such as all engineers ought to receive in order to be well educated. In the third session the students are classified according to the special branch of engineering they intend to follow as their profession, and their studies are to a great extent distinct. Ultimately it is intended to classify them as:—Civil, Mechanical, Mining, and Electric Engineers and Architects, and these distinctions will be recognised in the wording of the diplomas. For the present only the first two classes—Civil and Mechanical—will be recognised in the work of the third session; but it should be distinctly understood that the whole of the studies of the first two sessions, and much of those of the third, are important and even necessary for mining and electric engineers and architects as well as for other engineers. Students are allowed to attend any particular classes they may deem more especially important for themselves on condition of their paying the fees and obeying the general regulations of the college; but diplomas will be given to those only who pursue systematically the regular course as stated in the calendar. Short courses of evening lectures will be given, at times that will be announced by advertisement in the newspapers. These will be of a popular character.

During the first year, the Winter term will last ten and a-half weeks; Spring term, ten and a-half weeks; Summer term, eight weeks. Junior pure mathematics and junior applied mathematics will be taught during the Winter, Spring, and Summer terms. Chemistry will be taught by lectures and laboratory practice, in the Winter and Spring terms. Physics will be taught in the Winter, Spring, and Summer terms, junior class with laboratory practice. The students will enter the elementary or junior classes of chemistry and physics according to their state of preparedness, which will be judged of at the beginning of the session by the representative professors of these subjects. For the engineering classes there will be mechanical measurement, sketching, and drawing. Winter and Spring terms—two days per week, three hours each. In this class the students have placed before them a solid body of geometrical form, whose dimensions they measure, and of which they make a clear and fairly-proportioned sketch, or sketches, on which they mark all its dimensions. From this sketch they make correct scale drawings of the body in different right and oblique projections. The subjects taken will advance from blocks of simple geometrical form to the common detail parts of machines.

Practice in the use of workshop and field-measuring instruments will be given in Winter, Spring, and Summer terms. During Winter and Spring three hours every Saturday. During the Summer term the whole of the working day of each Saturday is devoted to field practice in surveying.

Lectures on measuring and drawing instruments used in the workshop, field, and drawing-office will be given in the Winter term, three lectures per week. Instruments for measuring linear dimensions, small and large; linear units and scales; instruments for measuring angles and areas; measurement of cubic contents, mass, weight, time, speed, energy, rate of working, flow of fluids, stress, strain, and flow of solids; drawing instruments and the art of preparing drawings of various kinds, *e.g.*, of machines, survey plots and sections, topography.

Lectures on, and practice in, practical methods of calculation will be given in the Spring term to the end of February. Two lectures per week, and two exercise days per week of about two hours each. Abbreviation and systematic method in arithmetic; use of tables; the meaning and usefulness of formulas; graphic arithmetic; graphic kinematics, statics, and kinetics; graphic tabulation on sectional paper of the results of formulas, rules, and experimental observation; elimination and distribution of errors of observation, method of least squares, graphic methods.

Descriptive lectures on tools and driving machinery, and on workshop and field practice will be given in the Spring term from the beginning of March to end of Summer term, four lectures per week. Hand and machine tools of the workshop; punching, shearing, rivetting, and hammering machines, lifting machinery and tackle; steam, air, gas, and electric motive engines; water wheels, turbines, wind mills; contractor's plant.

In the second year the engineering classes will deal with machine measurement, sketching and drawing, Winter, Spring, and Summer terms, two days per week, about four hours each. The work of this class is similar to that of the first year's drawing class, except that machines instead of machine parts are now the subjects of copy. Besides drawing on paper the pupils will have some practice in "marking-off" on metal and woods. In the last—Summer—term, they will design detail parts of machines and structures. The engineering laboratory will be open in the Winter and Spring terms, three days per week, about two hours each. Several of the following will be subjects of experiment each year:—Testing the strength and stiffness of materials; strength of struts and pillars, flat plates, tubes, beams, and of plate and spiral springs; testing strength of soldered, brazed, screwed, rivetted, pin, and other joints; experiments on hardening and annealing steel and other metals; experiments on surface friction of solids and liquids; tests of lubricative qualities of oils; measurement of horse-power of driving engines; measurement of horse-power required to do various kinds of work; experiments on wind pressure, and on resistance to the motion of solids through liquids; flow of liquids through pipes; conduction of heat through surfaces and through plates; condensation of steam and evaporation of steam; slip of driving belts and of screw propellers; leakage of steam past pistons and valves.

Lectures on workshop treatment of constructive material will be given during the first five weeks of Winter term, three lectures per week. Seasoning, preservation, and reduction of timber; rolling, forging, casting, cutting, and hardening of metals; preservation of ironwork; cutting of stone; preparation of concrete; mortars and cement; brick manufacture.

Lectures on calculated strength, stiffness, and durability of constructive materials will be given in the last five weeks of Winter term, three lectures per week. Torsion, tension, compression, bending, fatigue of metals, wear, corrosion, factors of safety, the relative necessity of strength, stiffness or pliability in the different parts of machines and structure.

Lectures on principles of mechanics will be given during the first five weeks of Spring term, three lectures per week. Energy and its sources in combustion and gravity; work, force, acceleration of momentum, strain; loss of useful effect by dissipation of energy; hydrostatics; hydrokinetics; elementary thermodynamics; frictional efficiency of machines and of modes of transmitting power; storing up energy; governing the supply of energy.

The lectures on principles of mechanism; the elements of design; on the general principles of economy of material, labour, and machine work, and on static designs, will also be given. During the third year none but strictly engineering classes are taken, with the exception of the Senior Geology, which should be taken by certain sub-classes of civil engineers, by mining engineers, and by architects; and with the exception of the metallurgical lectures and laboratory work under the professor of chemistry taken by mining engineers. All the third years students with the exception of architects must attend and be examined on the lectures given during the Winter term, upon thermodynamics and the generation and utilisation of heat. Only the mechanical students, however, need be examined on the subsequent lectures on the detailed design of steam boilers and engines. The students of each of the five main classes must attend the lectures of all the five classes; but they are not required to take notes or to be examined on any but those of the class to which they belong. The fee for the lectures on one class of studies gives admission to all the third year's engineering lectures. No student will receive a diploma for more than one of the five main classes in any one year. Throughout the session, two lectures per week will be given to each of the five main classes of engineering students. They will treat of the detailed design of selected classes of structures and machinery. The special subjects selected will be varied from year to year, and will be announced at the end of each session for the ensuing session. The following sub-divisions of the five main classes of engineering will be ultimately recognised and provided for:—

Civil Engineering.—Roads and railways; canals, rivers, irrigation, drainage, sanitation, and town water supply; harbours, lighthouses, and coast works; surveying.

Mechanical Engineering.—Land engines, pumping and hydraulic machinery; road and railway locomotives; marine engines and ship-building; agricultural machinery; machine tools and implements; mill work and factory machinery.

Mining.—Coal mines; iron, copper, gold, silver, and lead mines; mineral and other wells.

Electric Engineering.—Telegraphy and telephony; electric lighting, electric transmission of power, and electric driving machinery.

Architecture.—

So far as lectures and examinations are concerned, the students of all the sub-divisions of any one of the five main classes are expected to do the same work; there are no separate lectures or class examinations for each sub-division. But the private work and course of reading is prescribed for each student in accordance with the sub-division or sub-divisions to which he belongs. The bulk of the work of each student will be private (*i.e.*, not class work), but will be done under the direction of the professor. The merit of each student's study in the sub-division of his subject will be judged, not from ordinary class examination, but by the quality and amount of his private work throughout the session, and by a thesis given in at the end of the session. The diploma will mention in which sub-division or sub-divisions of the main class the recipient has specially studied.

Arrangements will be made for the civil engineering students for field practice in surveying and setting out, and for the examination of works in progress. Similar arrangements will be made, as far as possible, for the mechanical engineering students for the examination and testing of engines, boilers, and other machinery in an near Birmingham. Similar opportunities will be sought to advance the practical knowledge of the other classes of students.

Facilities will be given to the students of the third year wishing to make original experimental investigations of special engineering subjects, and the professor will do all in his power to encourage this sort of work, and to give assistance in it.

Grain Elevator.—The largest grain warehouse, or elevator, as it is called in America, is now in operation adjoining the Columbia store, South Brooklyn. This elevator has cost its owner, Mr. David Dow, nearly 2,000,000 dols. It has a capacity of 2,500,000 bushels for storage, besides extra transfer facilities, and dockage for half a dozen vessels or more which can load at a time, differing from all other elevators hitherto built. It has three enormous towers as high as the building on which they rest. These, with the engine house, contain all of the machinery, leaving the warehouse proper fire-proof, without an opening for a belt or shaft, consisting of a large number of separate fire-proof stores.

Trial of Portable Railways at Versailles.—The portable railways of Messrs. Decauville, of Petit-bourg, are no doubt pretty well known to our readers. Messrs. Fowler and Co., of Leeds, have done a good deal to make the world familiar with the principle involved. A local exhibition is being held at Versailles, and we have received from Messrs. Decauville the following description of the little line which the firm exhibits. We have felt that it would be vain to attempt to give an adequate translation, preserving the spirit of the original:—"L'exposition de machines qui vient d'avoir lieu au Concours régional de Versailles n'a jamais été aussi brilliante que cette année. Mais parmi les nouveautés qui y étaient présentées nous devons signaler en première ligne l'attrayante exposition de la Maison Decauville, inventeur des chemins de fer à voie étroite entièrement métalliques, qui a obtenu le premier prix (médaille d'or) dans le concours spécial de chemins de fer agricoles que le Ministère de l'Agriculture avait organisé à Versailles. C'est du resté la sixième fois que des concours spéciaux pour les chemins de fer portatifs ont lieu tant en France qu'à l'étranger, et M. Decauville aîné a obtenu tous les premiers prix sans exception. Le public se pressait en foule dans les wagons qu'une petite locomotive trainait d'un bout à l'autre de l'exposition. A l'époque où nous vivons, la question des transports à bon marché devient chaque jour plus importante, et il ne s'agit plus seulement d'aller économiquement de grande ville à grande ville, mais également depuis les stations de nos grandes lignes jusqu'aux villes qui en sont éloignées de quelques kilomètres. La vraie solution de ce problème nous parait trouvée par les ateliers de Petit-Bourg, et nous avons admiré le train-bijou fonctionnant sur une voie étroite de soixante centimètres. Rien de plus coquet et de plus mignon que ces délicieuses voitures de 1re, 2e, et 3e classe. Le compartiment de première classe, capitonné rouge et or, garni de glaces pour les voyageuses coquettes, est d'un luxe qui ne laisse rien à désirer. Ce train-bijou est la nouvelle création de M. Decauville aîné, mais nous devons rappeler que ses ateliers construisent aussi des quantités énormes de chemins de fer portatifs pour l'agriculture, les travaux publics et la guerre; et le chiffre d'affaires rien que pour ce matériel atteint actuellement cinq à six millions par année. C'est M. Decauville qui a fourni les cent kilomètres que le Gouvernement Russe emploie pour les transports de troupes dans la guerre du Turkestan, et il livre en ce moment le matériel nécessaire aux travaux du canal de Panama, des chemins de fer du Sénégal, des ports de Sébastopol, de Newhaven, &c. Rappelons aux personnes qui n'ont pu aller voir l'exposition du Concours de Versailles que les ateliers de Petit-Bourg ne sont qu'à 55 minutes de Paris, sur la ligne de Corbeil, et les visiteurs reçus de la façon la plus cordiale, y sont promenés à travers les ateliers et l'exploitation agricole tous les mardis et vendredis." Really!

RAILWAY MATTERS.

THE public opening of the first section of the Swindon, Marlborough, and Andover Railway took place on Tuesday.

IT is proposed to make subways under the railway embankment at Sittingbourne, to prevent a repetition of the fatal accidents which have occurred to people crossing the line.

INCREASED railway accommodation is desired by the manufacturers and trading classes of Heckmondwike. A meeting of the most influential of their number took place last week to consider a project for the extension of the Great Northern Railway to that place.

THE evidence before the Select Committee on Railway Charges is in some respects startling. For instance, the London and North-Western Company alone has spent two and a-third millions sterling for London goods stations alone, and nearly two millions in Liverpool.

ON the 20th inst. some men were loading timber trucks near the main line of the Midland Railway at Matlock, Bath, when the London express ran past. The balk being lifted was about 6ft. from the ground, and the man loading thought he could get it away before the express arrived, instead, apparently, of lowering it again. Two wide carriages of the train, however, caught it, and one occupant was killed.

THE Geneva correspondent of a daily contemporary writes that the boring of the Arlberg tunnel is proceeding with great rapidity. The length finished since June, 1880, is 1720 metres, and an average yearly advance of 2160 metres is confidently expected after awhile. The average of Mont Cenis and the St. Gothard was only 1112 and 1670 respectively. The St. Gothard tunnel, he says, will be completed by the end of September, but the lines of approach are not likely to be ready before next spring.

A MEMORIAL to the Manchester and Salford Corporations is in course of signature amongst influential people, strongly urging the taking of immediate action, in conjunction with the directors of the London and North-Western Railway Company, to cover the river between Victoria Bridge and the railway bridge over the Irwell at Hunt's Bank, "so that the whole site of this foul stream may thus become and form a useful and important additional area to the existing street, which is already burthened with traffic, secure two acres of land and a fine open space, and afford room for great increase of accommodation at the railway station."

A CORRESPONDENT informs the *Times* that Mr. George M. Pullman, the inventor of the Pullman car, is at present on a visit to this country, accompanied by his wife and family, and is at present residing in Edinburgh. It is well known that Mr. Pullman is the possessor of great wealth, and he has recently founded a city on the shores of Lake Calumet, near Chicago, which he proposes should be a model manufacturing town, constructed in accordance with the most scientific principles, and conducted in a manner equally enlightened. This town, which already boasts a population amounting to several thousands, is called after the name of its founder, who has embarked no less a sum than £450,000 in the enterprise.

IN concluding his report to the Board of Trade on the collision which took place on the North British Railway branch at Cameron Bridge on the 21st ult., Major Marindin says:—"In the absence of these appliances—block and lock signals and points—for safe working, which is much to be regretted, the least which the public have a right to expect is that the rules for working such lines as this should be adhered to with the most scrupulous exactitude, and that the servants of the company should not be permitted to use their discretion, and to deviate from these rules, even with the object—in itself praiseworthy—of expediting the traffic. If the driver had had at his command a continuous brake fitted to the whole of his train, he could, no doubt, have averted the collision."

WHILE we are in India returing to the healthy system of railway construction and working by private enterprise instead of State construction or nursing by subsidy, the Prussian Government purposes to extend its purchases of railways. To this end it has made proposals to the board of directors of the Bergisch-Maerkisch and Berlin-Anhalter Railway Companies, and summoned them to commence negotiations. Both railways are extensive, and are two of the most important in the kingdom. The new Anhalt station in Berlin of the second of these—as illustrated in THE ENGINEER of the 1st October, 1880—railways is one of the finest in the country or any country, and some very important extensions and improvements in this railway and in railway intercommunication in Berlin have been lately made.

THE Government of Jamaica seems to take a good deal of pride in its railway possessions. Improvements on the twenty-eight miles of existing railway line still continue to be prosecuted with vigour. Drainage works, new culverts, fencing, gates, the re-laying of rails, &c., are all going on. The old stations at Kingston and Spanish Town—the new and old capitals—have been rearranged, enlarged, and improved in respect of facilities for goods traffic as wsll as passenger accommodation. Two new brick stations are being erected at "Gregory Park" and "Old Harbour," the present Western terminus of the track; while new locomotives, carriages, and stock vans have been substituted for the disgraceful old ruins that used to rock over jerky and rickety lines. A correspondent of the *Colonies and India* says, "It is scarcely an exaggeration to say that before the Government purchased the railway it was nearly in the condition urged as a reason by a Western engine driver for resigning his situation—'things,' as he explained, 'having mighty near come to only two streaks of rust and a right o' way.' The extension to Porus, at the base of the Manchester Mountains, is being forwarded, work having actually commenced on different points of the route. The northern addition to the foot of Monte Diablo is also being cleared under a separate and active staff of engineers. This projection presents far greater difficulties than the other—the 'Gibraltar rock' alone in the famous pass of the 'Bog Walk' giving a chance for considerable engineering skill to overcome and get through."

A RECENT report by Signor Frescot, one of the engineers of the railways of Upper Italy, gives some interesting facts with regard to ventilation in the Mont Cenis Tunnel. The Mont Cenis Tunnel is 12,500 metres in length, and has a capacity of 500,000 cubic metres. The mean temperature is 25 deg. C. In winter this causes sufficient natural ventilation, aided by the difference of altitude of the two extremities—132·5 metres. But in summer the external and internal temperatures are often equal, and artificial means of ventilation have to be adopted. The passage of twelve trains per day, the *Times* says, may be assumed containing 2500 passengers, each passage through occupying half an hour. The locomotives burn anthracite, which produces less carbonic oxide than coke, and the combustion is rendered as complete as possible. Now it is estimated that the average total production of carbonic acid in the tunnel per day is 6987 cubic metres, of which 6930 cubic metres are attributed to the trains, the rest to servants, passengers, and lights. The normal proportion of carbonic acid in the atmosphere varies from 0·003 to 0·005. People can live in an atmosphere containing as much as 0·005. It has been proposed to attain in the Mont Cenis the same degree of purity as in our Metropolitan Railway, or 0·0015 of carbonic acid. With this view, a large centrifugal ventilator has been set up on the Bardoneche side; it is driven by water, which is abundant there. The entrance of the tunnel is closed by a door, which the trains open on passing under the arch, and close after passing. In winter, and also during some fresh nights in summer, the machine can be stopped, and any necessary repairs made. In addition to the ventilator, there is in use the compressing and aspirating apparatus that was employed in making the tunnel. Notwithstanding these means and care bestowed on the fires of the locomotives, there is reason to fear that the present ventilation would prove insufficient in case of even a small increase of the traffic.

NOTES AND MEMORANDA.

IT appears from a recent report that the total number of persons who sailed from Hamburg—nearly all Germans—in the year 1871, with the intention of permanently settling in America, was 18,009; in 1872 it was 36,948; in 1873, 40,068; in 1874, 19,979; in 1875, 18,527; in 1876, 15,832; in 1877, 11,867; in 1878, 12,718; in 1879, 12,294; in 1880, 32,489; and in 1881, up to June 30th, it was already 73,633.

PROFESSOR LAURENCE SMITH has observed that small detached fragments of the meteoric iron of Santa Cattarina (Brazil), not weighing more than 0·1 to 0·2 grains, were very weakly affected by a magnet; but on being flattened on a piece of steel, with a steel hammer, they become very sensitive to it. By heating red-hot, the particles were made to be still more easily attracted than by flattening. The meteoric iron contains 66 iron, 34 nickel.

THAT moist air conducts electricity has been denied on experimental grounds by Count Du Moncel and M. Gangain. The practical inference from their experiments is, that the losses on telegraph lines may be attributed mainly to such things as condensation of moisture, attachment of conductive dust, carbonaceous deposits, spiders' webs, or contact of branches of trees with the wire, the loss by conduction in moist air being probably very small.

THE following composition of an instantaneous silvering powder is given by the *Chemist and Druggist*:—Argenti chloridi, 3·0; potassii bitartratis, 20·0; sodii chloridi, 15·0. A portion of this powder is moistened with water, and with a piece of blotting-paper rubbed on the clean metallic object. The latter is thereupon rubbed with a piece of cotton, upon which precipitated chalk is dusted, then washed with water, and polished with a dry cloth.

VARIOUS reasons may appear sufficient to make it desirable to remove black ink from parchment. For this purpose the *Scientific American* gives the following:—Moisten the spots first with a strong solution of oxalic acid, then with a clear saturated aqueous solution of fresh chloride of lime—bleaching powder. Absorb excess of the liquids from the paper as quickly as possible with a clean piece of blotting-paper. Repeat the treatment if necessary, and dry thoroughly between blotting pads under pressure.

A RECENT parliamentary return shows that in the year ended 30th September, 1880, there were in England 44,420,847 bushels of malt charged with duty, the amount of duty charged being £6,024,574 15s. 6¾d.; in Scotland, 2,693,459 bushels—amount, £364,551 7s. 2¾d.; in Ireland, 2,783,211 bushels — amount, £377,461 16s. 9¼d. Total for the United Kingdom, 49,897,517 bushels, and amount charged, £6,766,587 19s. 7¼d. The quantity of barley imported into the United Kingdom in 1880 amounted to 11,705,290 cwt., equivalent to 3,277,481 qrs.

AT a recent meeting of the Paris Academy of Sciences a paper was read, "On the Velocity of Propagation of Explosive Phenomena in Gases," by M. Berthelot. The experiments were with mixtures of hydrogen and oxygen and of carbonic oxide and oxygen—2 vols. to 1. These were placed in a long iron tube—open or close, fixed in various positions, &c.—and were inflamed with an electric spark; the passage of the wave was measured by an electric method. The velocity was in general about 2500 m. per second. Explosive phenomena are more complex than a simple motion of translation or even the propagation of a sound wave.

THE Census in British Burmah gives the following returns:—In Arakan—males, 384,045; females, 257,965; total, 562,000, as against 484,363 in 1872, showing an increase of 16 per cent. Pegu—males, 1,249,346; females, 1,081,061; total, 2,330,407, against 1,662,658 in 1872, or an increase of 40·2 per cent. Tenasserim—males, 431,270; females, 380,548; total, 811,818, as against 600,727 in 1872, or an increase of 211,091, or 34 per cent. The totals for the entire province are—males, 1,984,661; females, 1,719,572; total, 3,704,253, as against 2,747,148 in 1872, showing an increase of 947,085, or 34·8 per cent. Rangoon in 1872 contains a population of 98,745; it now contains 132,004, showing an increase of 33,259, or 36·6 per cent. In 1872 the population of Moulmein was returned at 46,472; it is now, according to the *Bombay Gazette*, returned at 53,080, or an increase of 14 per cent.

WATER glass was discovered in 1640 by Von Helmont, who found that when in the preparation of glass from sand and alkali an excess of alkali was used, the glass dissolved in boiling water; but it was not until 1828 that water glass as now known was prepared and practically utilised by Von Fuchs, in stereochromy or solid colour painting, in mural and monumental decoration, and for the preparation of various cements and artificial stones. Water glass, soluble glass, or silicate of soda, as it is variously called, possesses, when properly prepared, many unique and valuable properties. In cold water is is nearly insoluble, or dissolves very slowly. In boiling water it dissolves with facility and remains in solution when the latter has cooled. Water containing 30 per cent. of the glass in solution is of a syrupy consistence, and may be used as a transparent varnish on many substances; on drying it forms a glassy coating that resists moisture and change of temperature very well. The *Scientific American* says it has been used extensively as a vehicle for certain pigments to form paints known as silica paints; but in the paints known by that name and largely used in this country, oil and the other common ingredients are used as the vehicle.

AS the result of an investigation of the statistics of the rate at which barometric changes traverse the British Isles, by Mr. G. M. Whipple, F.M.S., superintendent of the Kew Observatory, he concludes—(1) That the average rate of horizontal motion of barometric changes in their progress across the British Isles is about 53 miles per hour; (2) That the mean rate does not vary to any considerable extent from year to year; (3) That the maxima travel with somewhat greater velocity than the minima; (4) That the rate of horizontal motion is slightly diminished as the change passes northward. This is also proved by the fact that the mean velocity along the Valentia—Aberdeen, track, is slightly below that over the Falmouth—Leicester, track. By far the greater number of barometric changes traverse the country at rates between 30 and 60 miles per hour, but transits at the higher velocities are somewhat infrequent. The mean SW-NE velocity of 53 miles per hour, if resolved into N and S and E and W velocities by the ordinary method of the parellelogram of velocities, gives a resulting movement of 38 miles per hour in a West-East direction, which, he says, may be safely taken as the normal rate at which barometric changes traverse the British Isles.

THE periodicity of rainfall formed the subject of an enquiry by Mr. G. M. Whipple, superintendent of the Kew Observatory, and by him a paper was communicated on the subject to the Royal Society early this year. From all the available statistics extending back with more or less completeness for many years, he finally deduced a table which shows that in no one case is there any indication of a period of any integral number of years from five to thirteen inclusive running through them. Hence, whatever period of variation in rainfall there may be, coincident with fluctuations in the spotted surface of the sun, either of ten, eleven, or twelve years, this method of treatment shows it to be completely masked—in a long series of observation—by other variations. The discrepancies exhibited in the first tables obtained made it very desirable to extend the field of inquiry, by including as many observations in the discussion as possible. Eventually he was able to collect ten series, which increased the total number of years of observations used in the discussion to 978. The result of the extended investigation in no way affected the conclusion pointed out by the observations previously treated—viz., that taking the series of annual totals directly as they stand, there is no marked indication of the presence of a short cycle to be found. There are a few exceptions, in all of which cases the coincidences but slightly preponderate over the non-coincidences. Again, the curves of variation differ widely for the same epoch in localities comparatively close together.

MISCELLANEA.

THE export of coal from Newcastle, New South Wales, averages 26,000 tons per week.

MESSRS. JOSEPH KAYE AND CO., of Bank Works, Kirkstall, Leeds, have opened a store at 248, High-holborn, W.C.

THE new North Docks, Liverpool, will be opened by the Prince of Wales on the 6th September. The Princess will also visit Liverpool.

ON Tuesday the new Leith Docks, constructed from the designs of Mr. A. M. Rendel, M.I.C.E., was opened by the Duke of Edinburgh.

MR. GEORGE BENNIE has retired from the firm of George Bennie and Company, Glasgow, the business remaining in the hands of Mr. Bennie's partner, Mr. E. Rushton Coulborn.

THE main shaft, 235 yards deep, at the Oakwell Colliery, Ilkeston, was on Saturday blocked by an accident to a cage, and the 300 men and boys working below were imprisoned five hours.

A FINE promenade pier is being constructed at Nice with unusually extensive concert, bath and other accommodation at the outer end. It is illustrated in *L'avenir des Alpes Maritimes* of the 14th inst.

THE Sanitary Authority of Wallingford have been fined the mitigated penalty of £10, together with a further fine of 10s. a day so long as they shall allow the sewage of that town to pollute the Thames.

A NEW steel and iron foundry for the manufacture of small and large castings by the crucible and Siemens methods is being erected by Messrs. Wm. Wylie and Co., in Polmadie-road, Glasgow.

THE third annual national exhibition and market of machinery and utensils used in the brewing and mineral and aërated water trades will be held at the Agricultural Hall, London, from October 17th to October 22nd inclusive.

THE Barrow Shipbuilding Company has received an order from a French Company to build a steamer of large dimensions. She is to be 460ft. long, 50ft. wide, and 37ft. depth of hold, with engines similar to those of the City of Rome.

A LARGE mill—the Oak Mount mill, Burnley—which has been stopped for about two years, has just recommenced running. It contains 63,500 spindles and 560 looms, and employs over 500 hands. There has been considerable difficulty in getting workpeople.

SEVERE complaints have been made of the insufficiency of the water supply in Paddington and Marylebone, supplied by the Grand Junction Waterworks Company. As the source of supply is not likely to fail, it may be expected that a sufficient supply will soon be given.

MR. JOHN WATSON, the proprietor of Earnock Colliery, has had the workings fitted with Swan's electric light, and it is expected that the system will be in full operation in the course of a few days. A special engine of 12-horse power was erected to drive the dynamo machine.

A NEW catalogue of mining machinery manufactured at the Broad Oaks Ironworks, Chesterfield, has been published by Messrs. Oliver and Co. A considerable variety of mining and quarrying machinery is illustrated and described in it, and to those interested in machinery of this class it is useful. Several of the machines illustrated are the invention of Mr. R. Schram, who is the London agent for the above firm.

A SIMPLE form of pneumatic excavator on the principle of that of Mr. Reeves, as used at the Tay Bridge, is now being brought before the American public. The air pumps are dispensed with, and instead steam is passed into the vacuum chamber to expel the air. Then a jet of water is forced upon a perforated disc in the chamber, the steam is condensed, a vacuum is formed, into which rushes the gravel, stone, or whatever may be at the bottom of the pipe.

THE Wirral and Birkenhead Agricultural Society has just issued the prospectus, with rules and regulations, of the thirty-ninth annual show, which will be held at Birkenhead on Thursday, Friday, and Saturday, the 8th, 9th, and 10th of September next. Upwards of £1200 will be offered for competition, including a gold and several silver medals and money prizes for implements and machinery. All necessary information may be obtained from the secretary, Mr. J. Slater Lewis, 28, Hamilton-street, Birkenhead.

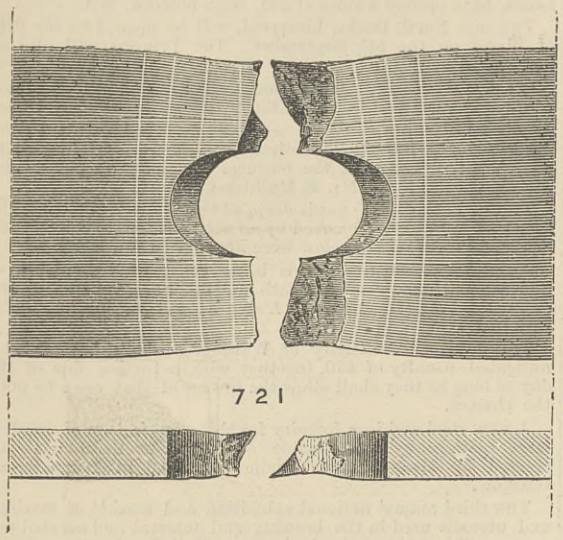
IT will be in the recollection of our readers that during the Russo-Turkish War the most important, or at any rate the most successful torpedo attack was the blowing up of the Turkish ironclad Lutfi-Djelil on the Danube. This was performed from a small spar torpedo boat built by Messrs. Yarrow and Co. for the Roumanian Government, and it may be of interest to know that it is still satisfactorily at work. One peculiarity of this little vessel was the mode adopted for condensing the steam so as to avoid the noise of the blast. This was effected by the exhaust being brought in direct contact with the skin of the boat below the water line, and was found thoroughly efficient where condensation without a vacuum was required.

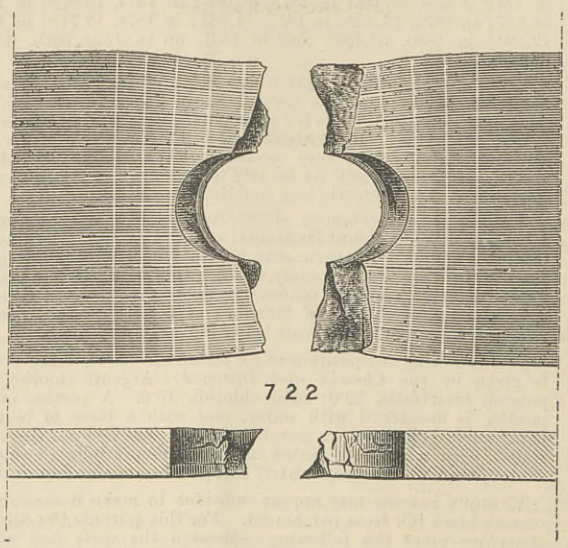
WE regret to learn, says the *Times*, that Sir George Airy is about to relinquish the office of Astronomer Royal, which he has filled since 1835 with so much honour to himself and advantage to the science of astronomy. Lord Northbrook, the First Lord of the Admiralty, and Sir Cooper Key, the Senior Naval Lord, paid an official visit of inspection on Tuesday to the Royal Observatory, over which they were conducted by Sir George Airy for the last time. The Astronomer Royal having been for so many years connected with the Scientific Department of the Admiralty, we earnestly hope that he will long enjoy the retirement which he has so well earned by the energy and devotion with which he has throughout his long career discharged the duties of his responsible office, and the many improvements which his great scientific attainments have enabled him to effect at the Royal Observatory.

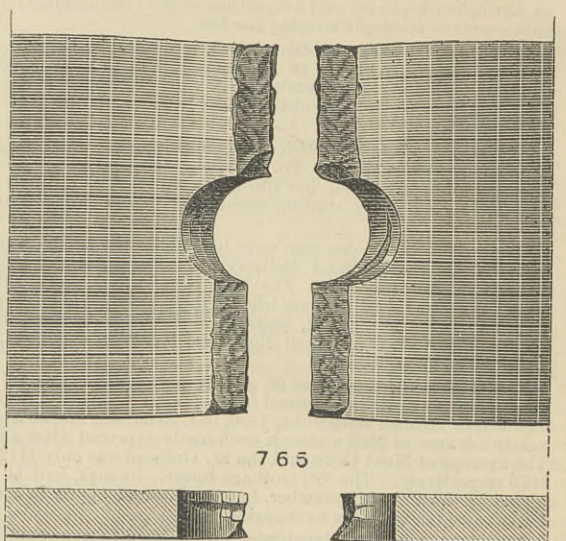
A NEW screw steamer—Chateau Lafitte—366ft., 25 × 41·1 × 30·0, of 3462 tons gross, and 450-horse power, with cylinders 45in. and 82in. by 50in. stroke, built by Messrs. Oswald, Mordaunt, and Co., shipbuilders and engineers, Southampton, for the Compagnie Bordelaise De Navigation à Vapeur, Bordeaux, went on her official trial of six hours' run round the Isle of Wight on the 14th inst., when, with a displacement of 4400 tons, she averaged a mean speed of 12¼ knots, with a strong tide against her for the greater part of the way. On the 21st inst. she went her second trial for speed on the measured mile with 1600 tons on board, when she averaged a speed of 13·6975 knots, one run being 14·062, and the other 13·333 Her engines indicated 2687-horse power, everything working cool and satisfactorily. She is the pioneer of the new company's fleet which is intended for service between Bordeaux and New York.

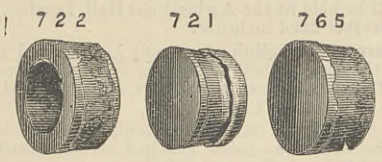
M. DE LESSEPS, according to the *Débats*, when tranquillity is restored in Tunis and Algeria, will complete and terminate "in Algeria and Tunis the task commenced by politics and the army." M. de Lesseps has come to the conclusion that the scheme of Commandant Roudaire to create an inland sea to the south of Tunis and Algeria is quite practicable. The Paris correspondent of the *Standard*, however, remarks that the news from Algeria and Tunis leads to the conclusion that the gigantic scheme of creating an inland sea between the sea and the Saharan plateau, even if it be practicable, is likely to be interfered with by the Arabs. It may also be asked by what process the European labourers engaged in digging this inland sea are to be protected, when the Spaniards employed on the works in the province of Oran can be massacred and led into captivity with impunity in proximity to French garrisons. The scheme which the *Débats* so warmly advocates would require at least fifty thousand workmen, and one hundred thousand soldiers to protect them.

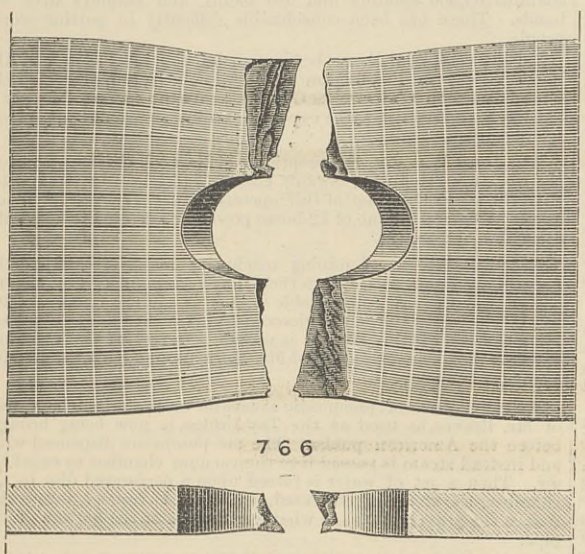
FRACTURED STEEL BARS.

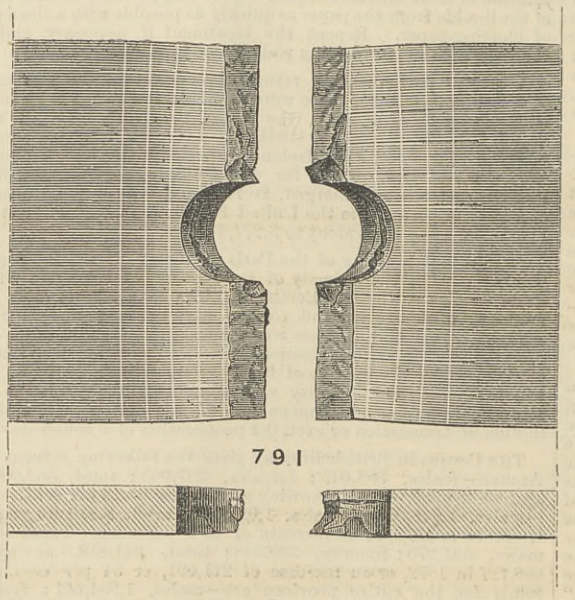


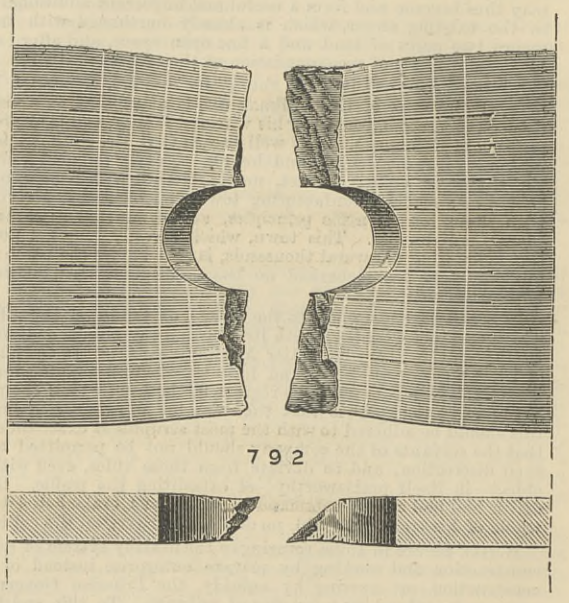


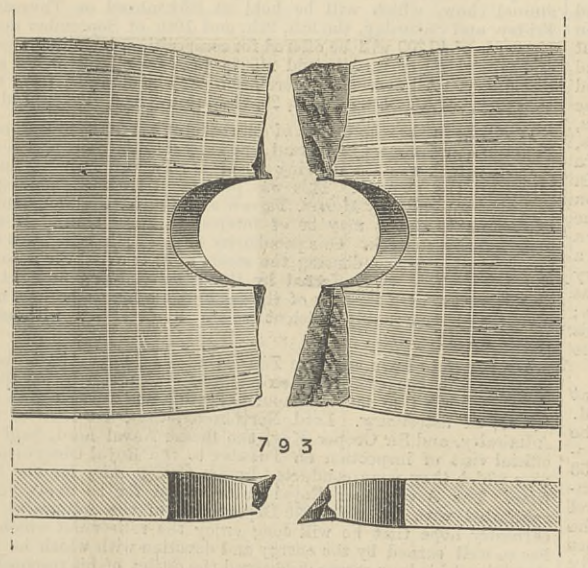


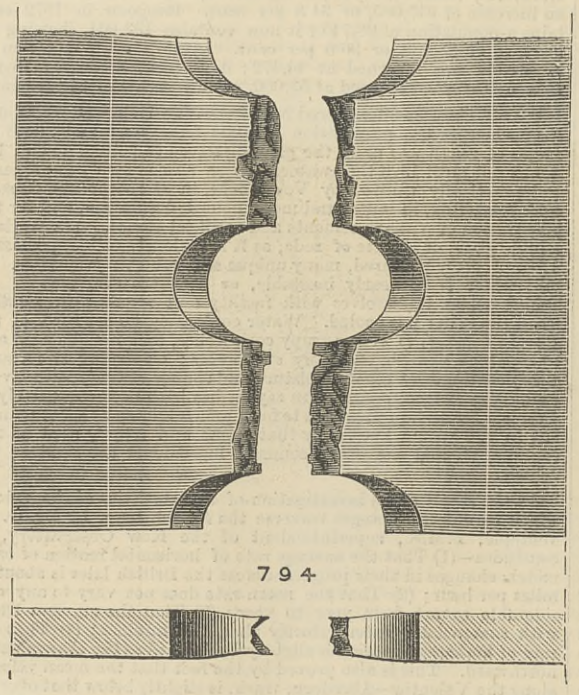


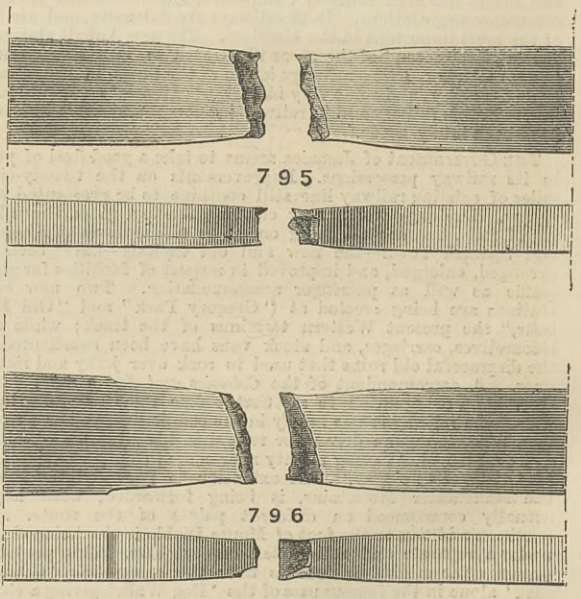












THE INFLUENCE OF SURFACE CONDITION ON THE STRENGTH OF STEEL.

Those who are best informed concerning what has been done during the last few years in the way of experimenting with steel, can hardly have failed to perceive that much of the work of investigation is being and has been done over and over again. It is difficult to imagine how much more can be deduced from the pulling of bars asunder in the testing machine. Many thousands of specimens have been thus broken. These specimens have been various in form, in length, and thickness; but it has been impossible to obtain from the manner of fracture of the specimens broken any solution of the problems which vex the hearts of steel makers and steel users alike. It has long appeared to us that a new departure was needed, and that experiments with steel should go over ground now untravelled. It is, we think, necessary before further progress can be made that a given phenomenon in the behaviour of steel should be selected, and that experiments should be conducted to ascertain the cause of the phenomenon; or if a theory be put forward to explain it, then this theory should be tested. To carry out this work fully and properly involves of necessity a considerable expenditure of time and money; but it is possible for many individuals to spend both, and so by degrees sound information may be acquired which will ultimately prove useful.

Acting on this conviction we have carried out the inquiry, particulars of which we now place before our readers. We have to thank Professor Kennedy, of University College, for making these tests, and Messrs. Richard Garrett and Sons, of Leiston, for the specimens tested.

Dr. Siemens has put forward as an explanation of the ease with which steel with ragged edges breaks, the case of a strip of india-rubber. This will bear a severe strain with ease until a very small nick is made in its surface, when it will gradually tear through. Something of the same kind is seen when a draper nicks with his scissors the edge of the calico or linen he wishes to tear across. Steel is supposed to give way thus because it is homogeneous. Iron will not so fail because it is made up of a number of layers of fibres, each of which may to a certain extent be regarded as homogeneous. If a dozen pieces of calico were pasted on top of each other, then the nicking with a scissors of one of the thicknesses would not ensure the tearing across of the whole for obvious reasons. Now a good deal of evidence of a positive character is available to prove that Dr. Siemens is right; but what may be called negative evidence is lacking. If ragged edges promote the breaking of specimens of steel, then it seems possible that the smoother the edge can be made the less likely will the steel be to break, and to test this point has been our object.

As a preliminary inquiry an experiment was made to test the relative influence on the strength of a plate of first punching a hole and then rimering it out, and next drilling a hole and then punching it out to full size.

The result is set forth in Table I. The bars were not annealed, but were heated that they might be levelled. All the specimens used throughout the investigation were cut from the same plate of Landore S S steel. The figures on the drawings are those stamped by Professor Kennedy on the specimens. 722 shows the piece punched out of specimen 722, which broke as shown in the engraving. A hole half-an-inch in diameter was first drilled in the plate, and then a $\frac{7}{8}$in. hole was punched. The punch was sharp and filled the boss well. 721 shows the punching from specimen 721. The cupping of the punching is very well marked. It will be seen that punching and rimering gave a better result than drilling and punching.

The next experiment was intended to show the influence of smooth surface on the strength of the specimen. In this case one hole was punched and the other drilled. The punching is shown in 765, and the nature of the fracture in the engraving of the broken bar, also number 765. Both these bars were annealed after the holes were made by heating them to a dull red in a coke oven; they were then withdrawn and allowed to cool slowly. The hole in No. 766 was subsequently very carefully burnished, and the extreme edges were removed. It will be seen that No. 765 gave a bad result. The steel is nominally 30-ton fire-box steel, but the specimen gave way at little over 24 tons. The specimen, No. 766, on the contrary, stood, it will be seen, 31·85 tons, and the extension was very good. The results are set forth in detail in Table II.

The third series of experiments was intended to carry

BREECH-LOADING AND ARMSTRONG RIBAND GUNS.

(*For description see page 73.*)

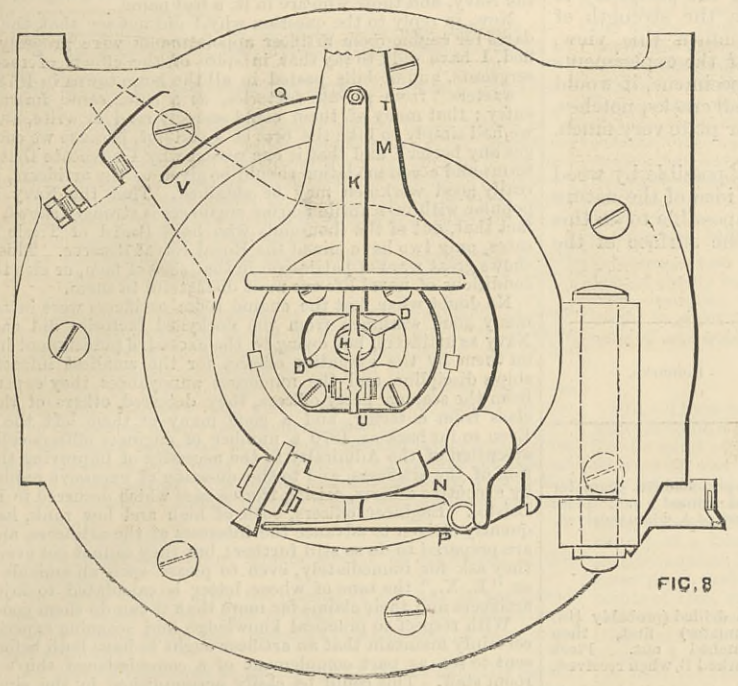


FIG. 8

MECHANICAL FIRING GEAR
SCALE 1/10

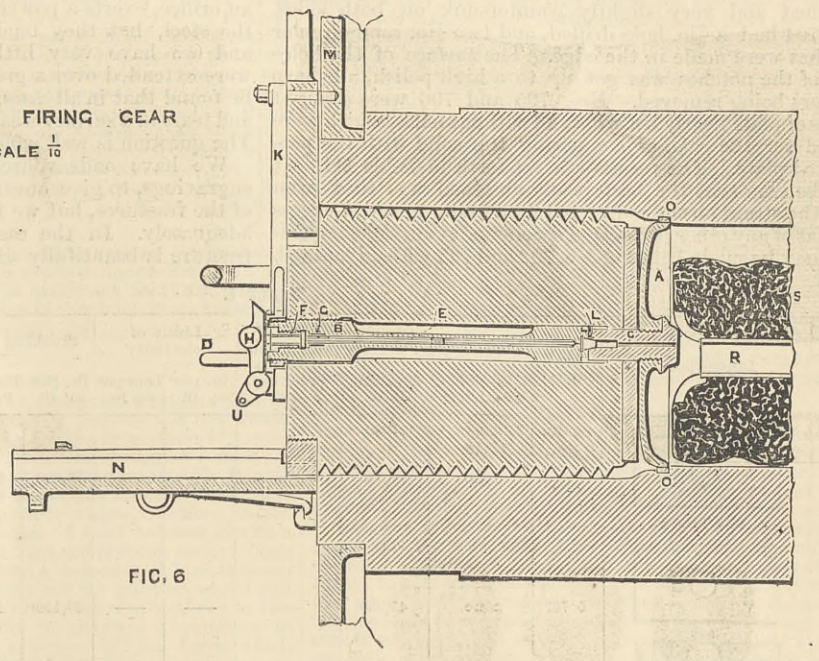


FIG. 6

FIG. 9

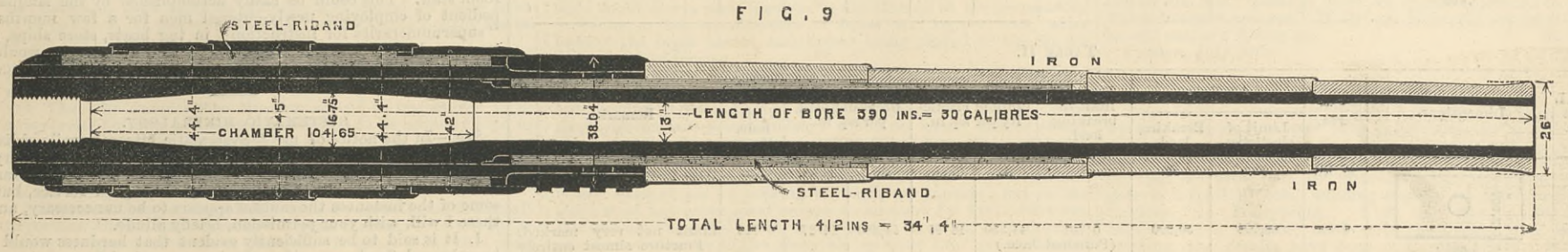
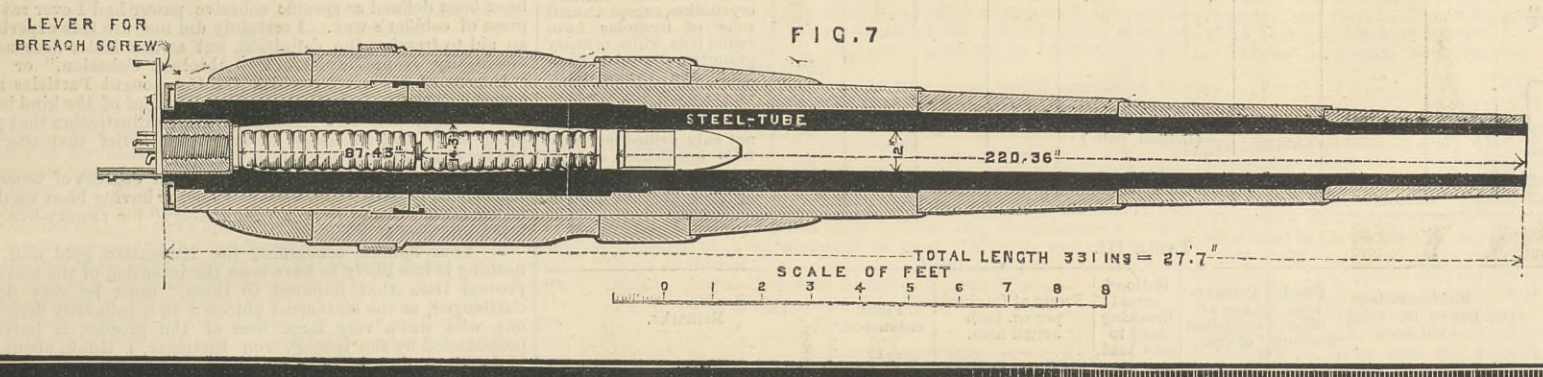
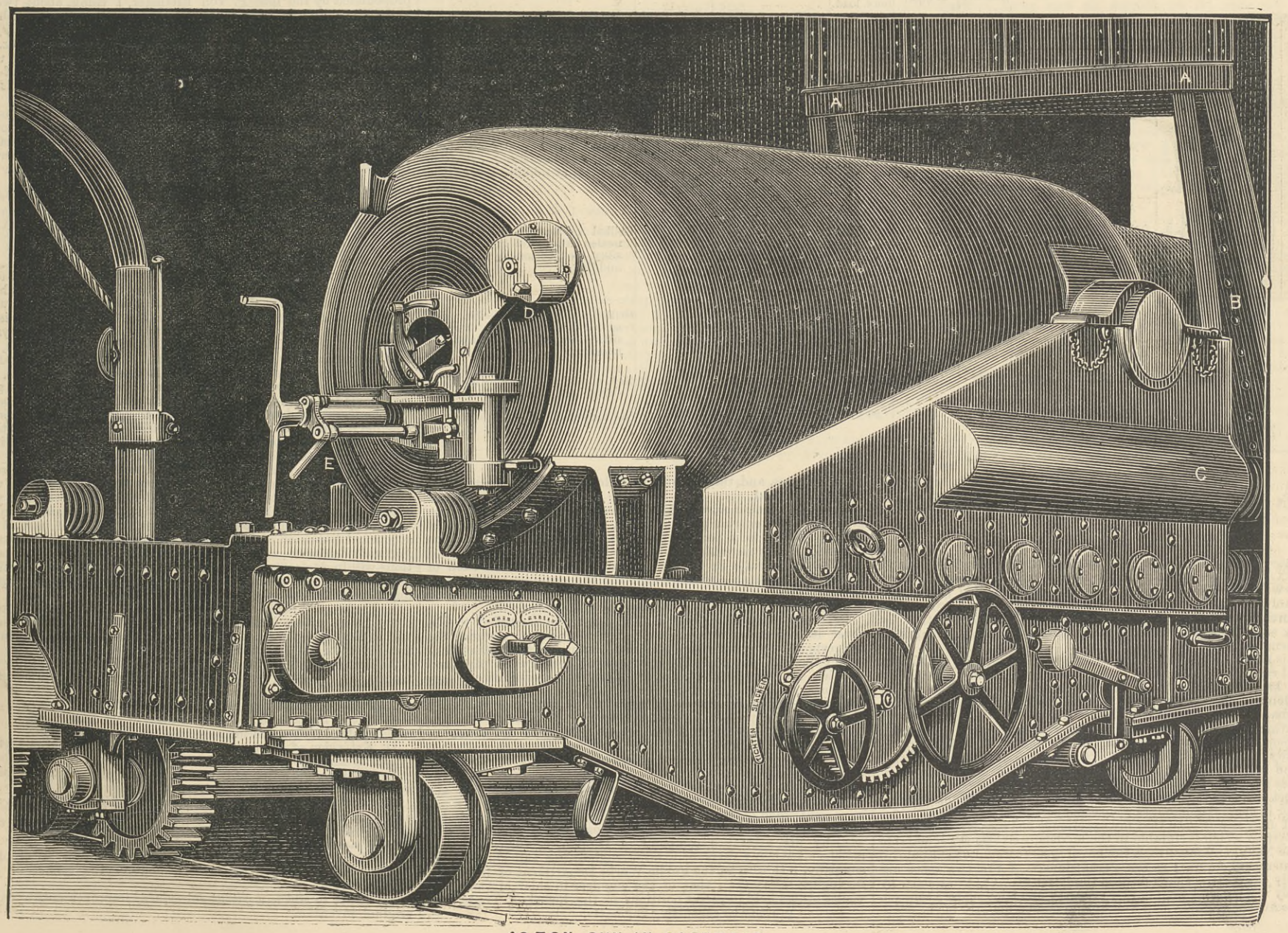


FIG. 7





43-TON GUN IN CASEMATE.

the inquiry a step further, wider plates being used, and of the strongest form, as shown by No. 794. The first bar, No. 791, had a hole punched with a ⅞in. punch. Bar No. 792 was drilled with a ⅞in. drill. The hole was carefully polished and very slightly countersunk on both sides. No. 794 had a ⅞in. hole drilled, and two ⅞in. semi-circular notches were made in the edge. The surface of the holes and of the notches was got up to a high polish, all sharp corners being removed. Nos. 795 and 796 were straight strips of plate nearly 1 in. wide and without holes, which were tested for the sake of comparing the solid with the perforated plate. The results are set forth in Table III. It will be seen that the best result obtained was that from 794, the strain on the contracted area being much in excess of that of any other perforated specimen. A special comparison may be made between No. 792 and 793 with advantage.

The experiments do not go far enough to permit them to be regarded as proving the proposition that the character of the surface of a steel plate, whether that surface be on the sides, or the edges, or constituting the periphery of an orifice, exerts a powerful influence on the strength of the steel, but they tend strongly to confirm this view, and we have very little doubt that if the experiments were extended over a greater range of specimens, it would be found that in all cases, excessively small cracks, notches, and tears in a surface weaken a steel bar or plate very much. The question is well worth pursuing.

We have endeavoured, as far as is possible by wood engravings, to give our readers a good idea of the nature of the fractures, but we feel that it is impossible to do this adequately. In the case of No. 794 the surface of the fracture is beautifully silky.

Table I.

U.C.L Test No.	Dimensions.	Nett area.	Absolute: Limit of elasticity.	Absolute: Breaking load.	Ratio of limit of elasticity to breaking load	Limit of elasticity: lb. per sq. in.	Limit of elasticity: Tons per sq. in.	Breaking load: lb. per sq. in.	Breaking load: Tons per sq. in.	Extension of holes.	Remarks.
		sq. in.		lbs.						in.	
721	2.516, .879 DIA., × .429 THICK	0·702	none	50,050	—	—	—	71,300	31·83	0·37	Hole punched ⅞in. diameter and rimed out, piece marked A, when received.
722	2.515, .878, .855, .900, .431	0·707	none	45,350	—	—	—	64,150	28·64	0·29	Hole drilled (probably ½in. diameter) first, then punched out. Piece marked B, when received.

Table II.

U.C.L Test No.	Dimensions.	Nett area.	Absolute: Limit of elasticity.	Absolute: Breaking load.	Ratio of limit to breaking load.	Limit of elasticity per sq. in.: lb.	Limit of elasticity per sq. in.: Tons.	Breaking load per sq. in.: lb.	Breaking load per sq. in.: Tons.	Extension of rivet hole. Mean.	Remarks.
		sq. in.	lb.	lb.		lb.	Tons.	lb.	Tons.	In.	Both pieces planed at edges
765	3.007, .855, .923, .442	0·936	38,700	50,890	0·761 (Punched hole.)	41,350	18·46	54,380	24·27	0·116	Limit not very marked. Fracture almost entirely crystalline, except a small zone of irregular form round hole, which is finely granular. Granular structure also shows itself round edges of piece.
766	3.002, .881, .440	0·933	35,700	66,570	0·536 (Drilled hole.)	38,250	17·08	71,360	31·85	0·432	The hole in this plate was not only drilled but carefully burnished, and all corners taken off. Fracture silky granular throughout.

Table III.

U.C.L Test No.	Dimensions.	Area.	Maximum load per sq. in. original area: lb.	Maximum load per sq. in. original area: Tons.	Final area after fracture	Percentage of reduction of area.	Ratio of actual breaking load to max. load.	Stress at fracture per sq. inch actual area: lb.	Stress at fracture per sq. inch actual area: Tons.	Final extension.	Remarks.
		sq. in.	lb.	Tons.	sq. in.	Per cent.		lb.	Tons.		
791	3.016, .782, .181, .423	0·937	63,200	28·21	0·854	8·9	1 : 1	69,340	30·96	Hole stretched 10·3 %	Punched hole. Annealed after punching, fracture crystalline, with exception of a dull grey irregular zone round margin of hole.
792	3.015, .435	0·928	72,940	32·56	0·712	23·3	1 : 1	95,080	42·44	Do. 41·9 %	Drilled hole. Annealed after drilling, fracture silky, extension greatest at middle.
793	3.004, .437	0·931	72,400	32·31	0·654	29·8	1 : 1	103,100	46·01	Do. 48·9 %	Drilled and burnished holes. Annealed after drilling, fracture silky, extension greatest at middle.
794	4.010, 3.265, .437	1·018	77,800	34·73	0·670	34·2	1 : 1	118,200	52·76	Do. 37·1 %	Drilled and burnished holes. Annealed after drilling, fracture silky, extension greatest at middle.
795	0·935 × 0·429	0·401	67,940	30·32	0·192	52·1	87 : 1	124,000	55·3	17·6 % in 10″ 39·0 % in 2″ at fracture.	Not annealed. Fracture silky, slight lamination visible.
796	0·938 × 0·435	0·408	66,940	29·89	0·212	48·0	89 : 1	114,100	50·96	16·5 % in 10″ 31·5 % in 2″ at fracture.	Not annealed. Fracture silky.

LETTERS TO THE EDITOR.

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

ENGINE ROOM ARTIFICERS, R.N.

Sir,—On reading the letters of your correspondents "C. C." and "E. X.," I could not help asking myself with what object they were written. On reperusing them I am still unable to imagine any solution to this question, and I should pass them by as quite unworthy of notice, as they certainly are, if it were not that by doing so I might be supposed to countenance something contained n them.

It is not my intention to enter into any discussion as to what a naval engineer should be—I stated this in my former letter—but as I had a considerable experience of engineering factories in London and the country, and some little experience also of the merchant service, before entering the Royal Navy, I think I know something of what mechanics are, and what may be fairly expected of them. And, since I have been in the Navy, I have had opportunities of learning a good deal of the method of engineering some of the largest English and foreign mail steam ship companies' vessels; therefore I do not plead ignorance of any part of the subject on which I write, nor do I rely on what other people tell me, or in general opinion, as your other correspondents say they do; and I may say at once that my experienee has convinced me that the system which is suitable to the merchant service is not suitable to the Navy, any more than the naval system would be suitable to the merchant service; as the circumstances of the two cases are totally different. I may dismiss the letter of "C. C." at once by simply stating that the plan he proposes was tried many years ago on board the training ship Sulphur, and subsequently in the dockyard factories, and that it utterly failed in every way, as other plans have failed.

The plan which is now being tried cannot, however, fail to be a great improvement on previous ones, although some years must elapse before it is in perfect operation. This plan is based upon that which has existed for many years in the navy of the United States, and consists in the very sensible and natural division of having two separate classes of men for the engine-room duties—namely, highly-educated scientific engineers to direct, and good skilled labourers to perform, the manual duties required.

Referring to the letter of "E. X." I am much puzzled to discover its object, as it is evidently not intended to advance the interests of the engine-room artificers. In my letter of the 8th of July I thought I advocated increased pay, a decent mess plan, and washing accommodation, increase of rank, increase of ordinary pensions, and the granting of special pensions to engine-room artificers; and on referring to it again, I find that it is really so. Yet "E. X." appears so blinded by rage that he has lost all sight of this; and shows still further his complete ignorance of things which have transpired in the Navy by asking absurd questions, and by making assertions which have not the slightest foundation in fact.

I will not stop to notice "E. X." further than to say that the engineer officers who resigned some twelve or thirteen years ago were gentlemen of my acquaintance—engineers truly—not simply skilled labourers. One of these gentlemen is now the actuary of a wealthy life assurance company in London, another has been manager for many years of a large engineering and shipbuilding company, a third is in the Public Works Department of India at a far higher salary than that of the engineer-in-chief of the navy, whilst others hold lucrative positions in the Board of Trade, and two are in practice as consulting engineers.

No doubt there have been many "dismissals" for drunkenness—not "resignations"—the men so dismissed being of the class of th e so-called "practical mechanic" or skilled labourer, who try "to drag out a miserable existence from shop to shop" and who give the Navy, and those who are in it, a bad name.

Now, in reply to the question why I did not see that the candidates for engine-room artificer appointments were properly qualified, I have only to say that in spite of the efforts of recruiting sergeants, and of bills posted in all the large towns in 1878, only "wasters" from private factories, as a rule, came forward for entry; that many of them could scarcely read or write, and that we had simply to take the best of a bad lot, because we could not get any better; and that is one reason why I advocate that better terms and accommodation should be given to the artificers, so that really good workmen may be obtained. That the Navy is not popular with mercantile marine engineers is strongly shown by the fact that, out of the thousands who hold Board of Trade certificates, only two have joined the Royal Naval Reserve. This either shows great want of patriotism in that class of men, or else that the conditions of naval life are most distasteful to them.

No doubt when first the engine room artificers were introduced many good workmen from the dockyard factories did enter the Navy as artificers, but owing to the excessive punishment inflicted on them by the executive officers for the smallest infraction of ship's discipline, and the numerous annoyances they experienced from the seamen petty officers, they deterred others of the same class from entering, and a good many of them left the Navy. Even so far back as 1870 a number of engineer officers called the attention of the Admiralty to the necessity of improving the position of the artificers, and to the question of excessive punishment by executive officers, arising from a case which occurred in H.M.S. Bristol. Engineer officers, both of high and low rank, have frequently striven to advance the interests of the artificers, and they are prepared to do so still further; but they cannot get everything they ask for immediately, even to please such an amiable person as "E. X.," the tone of whose letter is calculated to injure the artificers and their claims far more than it can do them good.

With respect to practical knowledge and seagoing experience, I certainly maintain that an artificer ought to have both before he is sent to sea as part complement of a commissioned ship's engine room staff. This could be easily accomplished by the simple expedient of employing newly-entered men for a few months as "supernumeraries for instruction" in tug boats, store ships, and troopers, by which means the artificers and the service would be much benefited.

Experience.

27th July.

SYSTEMATIC MINERALOGY.

Sir,—In the notice of my "Systematic Mineralogy," published in your impression of the 8th inst., you have found it necessary to "put the student on his guard" against sundry errors there enumerated. In this you have undoubtedly done good service, but in some of the instances the caution appears to be unnecessary, and to these I will, with your permission, briefly allude.

1. It is said to be sufficiently evident that hardness would not have been defined as specific cohesive power had I ever sat upon a piece of cobbler's wax. I certainly did not use this experiment as an aid to framing the definition, but as the latter does not differ essentially from Naumann's "Absolute Cohesion," or Millar's "Degree of Force with which the Component Particles are held together," the omission of experimental proof of the kind indicated does not appear to be a serious fault. The illustration that you rely upon in refutation seems to indicate a belief that slag lead is harder than copper, which is not correct.

2. The novelty as to the qualification of degrees of tenacity can scarcely be regarded as a very new one, it having been used almost in the same form in Dana's "Mineralogy" for twenty-five years at least, and probably longer.

3. Your opinion concerning the Hungarian gold mill, "that nothing is less likely to have been the intention of the users of this process than that imputed to them," must be very decidedly challenged, as the statement objected to is primarily derived from one who was a very large user of the process, it having been propounded by the late P. von Rittinger, I think, about twenty years since, and is to be found in that author's "Lehrbuch der Aufbereitungskunde," where it is also stated that the solubility of native gold—600 to 850 fine—is but small, being from 15 to 30 oz. per ton of mercury, or thereabouts. My own observations upon hydraulic gold workings in America have convinced me of the substantial accuracy of von Rittinger's theory. Solubility is one factor in the action, but the least important one.

4. The isomorphism of orthoclase and albite, which you consider erroneous, is, of course, to be understood in the sense previously defined in the text, where it is said that the morphological relation subsisting between these minerals is qualified as isomorphism by Raumelstey, and as Polysymmetry by Scachi. The latter has always appeared to me to be a somewhat superfluous term.

5. A table of specific gravities, taken from the Annuaire of the Bureau de Longitude, is said to occur at page 213. This is a mistake; there is no such table in the book.

H. Bauerman.

21st July.

PATENT LAW.

Sir,—In a leader in your issue of 1st July on "Patent-office Fees," you say you have the best interests of the inventor at heart and will be glad to see discussed in your correspondence columns the question raised by a letter from Mr. Hoyle in your same issue. Much that he says is well founded on fact. But when he says, as he plainly does, "I simply propose one law for the rich and another for the poor," I totally dissent. To begin with, you cannot possibly draw the line. In the next place, even if you could, it is not logical to tax inventions, for the more we get of really good inventions the more will the country benefit. Besides, your correspondent's proposal would fail to meet the objection you seem to imagine is inseparable from cheap protection, viz., that hosts of men would fly to take out patents, and neglect their own business in the attempt to make a fortune thereby.

Now after a careful perusal of your remarks on this subject—some of which not only I, but also many others have read with feelings of disappointment and regret—I feel convinced that your objections would be met were the patent law amended on the basis of the resolutions proposed by me on the 2nd inst. at the adjourned discussion of Mr. Lloyd Wise's recent paper, read to the Foremen Engineers, on Mr. Anderson's Patent Bill. These resolutions will in due course be considered by the above-named society, and I shall be glad to know the opinions of your readers respecting them. They are, in substance, as follows:—

1. That regard being had to the exigences of trade and foreign competition, such reform of the patent laws is urgently needed as will to the utmost encourage the introduction and development of new inventions and improvements.

2. That the Patents for Inventions Bill, 1881, brought in by Mr. Anderson and others, and lately read a second time, is satisfactory in principle, because it aims at providing:

A. Paid Commissioners of Patents.

B. Better management of the business of the Patent-office.

C. Better indexes and improved library accommodation.

D. Extension of the term of letters patent to twenty-one years (which is only one year more than in Belgium and Spain).

E. The same duration of patent in respect of foreign inventions notwithstanding any prior foreign patent.

F. Reduction of fees on future and on existing patents; also extension of term as applied to exisitng patents.

G. Grace (subject to fines) for payment of stamp duties.

H. Extension of the term of provisional protection.

I. Efficient protection from the date of application—by stopping "racing" for the seal, to the detriment of the earlier of two applicants.

K. Power to add to a patent subsequent improvements upon the original invention.

L. Compensation for use by the Crown of patented inventions.

M. Authority for public servants—not employed in the Patent-office—to become patentees.

3. That although the objects of the Bill, as briefly set forth in the foregoing resolutions, are satisfactory, it is capable of considerable improvement in detail.

4. That modifications of the following nature are desirable :—

a. The qualifications of the proposed Commissioners should be indicated.

b. The salaries proposed should be larger, to secure a better class of officers.

c. The duties of the Commissioners should be so defined as to preclude the possibility of undue interference with inventors, patentees, or others, and particularly so as to guard against arbitrary refusal of patents for alleged want of novelty or otherwise.

d. The Commissioners should draw the attention of every applicant for a patent, so far as practicable, to any analogous inventions already on record in the Patent-office.

e. The stamp duties payable after filing the specification should be payable by yearly instalments of £5 each, instead of as proposed in the Bill.

f. To discourage carelessness, the fine for non-payment of duty within the prescribed time should be £50, with power to the Lord Chancellor, however, to reduce the fine in any case where, in his opinion, the circumstances would justify that course.

g. Addition of improvements to an existing patent should be made at the patentee's risk, and should not be subject to the decision or opinion of any Government officer.

5. That regard being had to the great loss and injury inflicted on unwary inventors by grossly incompetent and fraudulent persons acting as patent agents, it is highly desirable that any Patent Bill that may become law should provide proper restrictions as respects patent agents.

6. That to this end :

h. All the present patent agents should be registered in the Patent-office.

i. No person should, after the passing of the Act, be permitted to act as a patent agent until he shall have served articles to a registered patent agent and passed an examination by some competent authority.

j. All persons registered as patent agents should annually obtain certificates of their right to practice, and should be made liable to be punished for misconduct by the Lord Chancellor or the Master of the Rolls.

7. That the use of the word "patent" in connection with any article or process that has not been patented in the United Kingdom should be punishable.

8. That the Patent-office Museum should be transferred to an appropriate building in a central position, and be properly kept up out of funds derived by the granting of patents, so as to form a reliable and well-arranged historical record of the progress of arts and manufactures, in connection with which technical lectures should be regularly delivered.

I trust now that you have freely opened your columns to this all-important subject many persons will avail themselves of the opportunity to express their views thereon. It seems to me that much of the seeming difference of opinion is due to misapprehension and the absence of a common ground of argument.

Oakley Works, Chelsea, S.W., July 11th. SAMUEL WORSSAM. Assoc. M. Inst. C.E.

OLD IRELAND IMPROVED AND MADE NEW IRELAND.

SIR,—I have just seen in THE ENGINEER of the 20th of May the review of my book with the above title, and as there are many erroneous statements contained in it, I hope you will kindly give me space, and permit me to correct them.

After carefully reading the review referred to, I have come to the conclusion that you have not read the work, and have criticised my book without reading it over; for were it otherwise, the conclusions which you have drawn from it, and the statements made respecting it by you, in reference to the works proposed by me for developing the resources of the country and improving the condition of the Irish people, would be very different to those set forth. You first refer to my estimate of 160 millions for the required public works in Ireland, to be got from the Government on loan at interest—and as you say spent in ten years—as only a "dream," but you are kind enough to say that you agree with me by expressing the following opinion, viz.: "We have not the slightest doubt that the expenditure of 16 millions annually in Ireland for ten years would do the island, in one sense, a great deal of good; but when we have conceded this, we have granted all that we are disposed to admit." In this last paragraph you have turned what you call my "dream" into a nightmare by proposing to spend 16 millions a year; such a proposal being utterly absurd, and was never made or thought of by me.

It would be impossible to spend 16 millions annually upon public works of any kind, which were properly carried out, and having reference to their after usefulness, in Ireland, for the best of all reasons, as the labourers, mechanics, engineers, and other establishments, together with the materials of bricks, mortar, stones, and ironwork required, could not be procured and collected together for the work in anything like the numbers or quantities necessary for such an outlay, in such a short space of time as one year. Of the 160 millions given in my estimate of works, 111⅓ millions are swallowed up on two works only, the artificial drainage of twelve million acres, and the tile or underground drainage of eight million acres; so that for all the other works proposed by me 48⅔ million remains, which is small, and not so very startling and "dreamy" as you would lead us to suppose, especially when we consider that only 30 millions have been spent by the Government on all the works carried out by them in the country during the last hundred years. These two works are of paramount importance to the country, hence their great cost and relative importance in any scheme of work for bettering the condition of the people.

It is acknowledged by men of all shades of opinion that there can be no prosperity in Ireland until the land is relieved from the devastating effects of river floods, by straightening and deepening the rivers, removing shoals, rocks, eel-weirs, and other obstructions out of their beds; and the fields made productive by tile drainage, thereby freeing them from excessive moisture, thus enabling the land to produce double the quantity of corn, potatoes, &c., that it does now for the same amount of labour and manure expended upon it.

The Government are now doling out small sums of money every year for these works of drainage, practically doing little or no good, owing to the smallness of the amounts expended, keeping the country unproductive, and the people poor, miserable, and discontented. At the rate of progress now made from year to year—and they have been at it in this way for forty years—it will be a thousand years before the work of drainage is completed. My proposals are—see pages 87 and 90 of my book—that the work of arterial drainage should be carried out and completed in thirty-three years at an expenditure of two millions a year, and the field drainage in twenty-two years at the same annual cost, all of which could easily be done, unskilled labour being that principally required for the work.

You are evidently a broad-gauge man, and consequently my proposals for constructing narrow-gauge railways for developing the resources of Ireland have had a seriously disturbing effect upon you. You say, "If I had kept my eyes open, that I would have known the narrow-gauge railway system of India was a complete failure, and that they will all have to be taken up and replaced by broad-gauge lines." I seldom keep my eyes closed, except when I am asleep, and my friends tell me I don't take as much of that as many others that they know, but it certainly is news to me that the narrow-gauge railways in India have failed. I was in India sixteen months ago, and I heard nothing of it then; on the contrary, the Government were at that time constructing narrow-gauge railways as hard as they could, which showed clearly that they did not think them a failure. I think your information is not quite correct on this point; but be that as it may, I can only tell you that they don't think them a failure in Ireland at all events, for what with those constructed and the lines sanctioned, the total length of narrow-gauge railways amounts to 150 miles.

I had a lot to say about other points raised and referred to in the review, such as the failure of the broad-gauge railways to command the traffic in Ireland, why they pay so little on the cost of their construction, &c., but I am at the end of my paper and must stop. I had also a great deal to say about my plans for the drainage and reclamation of the bogs and waste lands of Ireland, and the remarks made in disparagement of them by you. I think you are more hazy and uncertain on bog drainage than any other subject you have touched upon. In fact, you have "bogged" yourself in it, and there, I am sorry to say, I must leave you sprawling away, as I have no space left on which to pull you out on to dry land. J. P. DOYLE, C.E.

Croydon, July 10th.

[Comment on Mr. Doyle's letter would be useless. We publish it lest he should say that "justice has not been done to Ireland." We may, however, venture, perhaps, to point out that 100 millions might be spent to as much advantage in England as in Ireland in arterial and other drainage works.—ED. E.]

NAVAL BRASS.

SIR,—I have read Mr. Barry's letter, and noted what he evidently believes to be a failure in his attempt to produce this new metal. To the mind of a practical brassfounder the proportions of copper 62, zinc 37, and tin 1 part, would immediately suggest a metal of very considerable strength and tenacity. Since reading Mr. Barry's letter I have made an ingot of this metal, and found it to be something like what I would have expected—a close, fine fibre, indeed almost of a homogeneous appearance. I tried to break it with a sledge hammer, but failed. I next tried compression under a large screw press, and after having obtained a deflection of 1¼in. between points of 13in. suspension, it yielded; but the exact pressure I had no means of ascertaining. Judging from the results of one or two trials which I have made, in order to ascertain its qualities in forging, I am not encouraged to anything like the degree which you have set forth in your article of the 24th ult. This, however, is no doubt due in some measure to the absence of the preparatory processes in the manufacture of brass and copper rods, after leaving the ingot mould, and before being placed in the fire for the purpose of forging.

How Mr. Barry could arrive at such extraordinary results, provided he had the assistance of a brassfounder of even a very ordinary intelligence, I am at a loss to understand. But if he has employed an iron-brassfounder, I could no longer wonder at any result at which he might arrive—unless it had been the correct one. Of course, I do not wish to infer that this is the cause of Mr. Barry's failure, inasmuch that I have not the least authority which would warrant me in making any such assumption; but in the absence of any other good reason to account for his misfortune, this one has suggested itself to my mind, knowing, as I do, how prone most men are to the idea that to know the "proportions of the compounds" of any alloy is all that is required, the actual bringing together and the retention of the several metals being of no importance whatever, and may therefore be entrusted to any person who can melt them.

However, should Mr. Barry wish to see a small sample of the trial I have made, I will forward it to him on receipt of an intimation to that effect. FOUNDRYMAN.

22nd July.

SIR,—Referring to the correspondence in your last issue respecting "The Admiralty and New Alloys," I am desired to inform you that Mr. Muntz is at present absent from home, but that on his return he will reply fully to Mr. Farquharson's letter, and explain that the standard of good "Muntz's metal" is over 30 tons instead of 22. ROBT. THOMSON, Secretary.

Muntz's Metal Company, Limited, French Walls, near Birmingham, July 26th.

BRONZE CASTINGS.

SIR,—Replying to your correspondent of last week, "T. T.," I produce many tons of heavy castings of bronze, and considering how much cleaner, sounder, and in every way better I can get my metal from crucibles, I invariably, for all weights not exceeding 30 cwt. use crucibles—Morgan's make of 500 lb. capacity each. In cases of necessity the air furnace simply makes up the deficiency of my pot furnaces. The metal is conveyed in a channel to a "sow," with damper or shutter as near the mould as convenient; I run from 12 cwt. to a ton into the "sow" before raising the damper. I regulate flow of metal to mould by capacity of stream from crucibles and furnace. Cast quickly. Wash channel and sow with plumbago, drying before the metal is ready. S. R.

26th July.

PROPOSED BRIDGE OVER THE DOURO.

SIR,—I am sorry Mr. Reilly did not adopt the suggestion in my last letter, viz., to make a model of the bridge, as I think it would have shown who had made a muddle of the strains, and would have saved any further correspondence on the subject. Seeing, however, he has not done so, I trust that among such a large number as your readers comprise there will be found one with sufficient mechanical ability and regard for the correct solution of "a comparatively simple problem in structural mechanics" to be at the trouble of constructing a model and sending the results to THE ENGINEER. It is satisfactory to know that the discussion has been interesting and profitable to at least one of your readers; at the same time I am sorry your correspondent, Mr. Cutler, has not thrown more light on the subject, as I think the gist of his observations are contained in my letter published July 8th. I apologise for occupying so much of your valuable space.

A COMMON FIVE-EIGHT.

LOW TENDERS.

SIR,—If I should not be infringing on too much space of your very valuable paper, would you allow me space to comment in a few words on the lamentable death of the fireman who was killed between Clayton and Horton, on the Thornton branch of the Great Northern Railway on the 19th inst. Possibly many of your readers might not have seen the account. The accident happened thus—While the 8.5 a.m. train from the Exchange station—Bradford—was proceeding between the two named stations, it appears the fireman had occasion to go up on top of the tender to ascertain the quantity of water; whilst doing so his head came in contact with a stone bridge which knocked him off and killed him on the spot.

And now, Mr. Editor, the remark which I wish to make : Had the tender been fitted with one of Sharp's, of Sheffield, patent water receiving holes and tool-box combined as fitted in the new engines supplied by Beyer, Peacock, and Co. for the Lancashire and Yorkshire Company, it would have been an impossibility for such a sad accident to have occurred as the above patent is so convenient to the men on the foot-plate, and as it is a duty which very often is done or has to be done to ascertain the quantity of water in the tank, and such conveniences for the men would I am sure be much appreciated by them. A DRIVER.

Stockport, July 25th.

THE DUFFIELD BANK RAILWAY.

SIR,—Engaged as I am and have been for some years past in the construction and working of a considerable mileage of railways of this character, and flexible wheel base rolling stock, it will be readily understood that I take something more than a passing interest in the results given by them. The attempt of Mr. Haywood to arrive at conclusions of practical value is commendable in the extreme, as much by reason of its aims as by the earnestness of his efforts to attain them, his deductions, however, are unfortunately not of that worth they deserve to be. I am unable at this moment, owing to excessive pressure of work, to give an analysis of Mr. Haywood's views, but, with your permission, I will return to the subject again later on; in the meantime it is only just to say that whilst his example of my flexible wheel base is exceedingly creditable to him, it lacks the impress of large practical experience and the latest development of the mechanical principles involved. JAS. CLEMINSON.

7, Westminster-chambers, Victoria-street, S.W., July 21st.

WROUGHT IRON GALLERY—READING TOWN HALL.

SIR,—It appears to me that in designing the wrought iron gallery in the Reading Town Hall, Mr. Max am Ende has made much ado about nothing.

Practically the conditions were these—given a gallery to be supported on three sides; wanted, support for the fourth side. If this fourth side had been a straight girder, there would have been no difficulty about the matter, for it would have been easy to make it quite deep enough to carry the load to be put on it; but the fourth girder is not straight, but curved, and in this lies the only difficulty presented by the problem. There is more than one simple solution of the problem. It will suffice if I state one. By the introduction of a simple branch-and-root girder at each corner, cantilevers might have been entirely dispensed with, and the whole construction much simplified.

The conditions were, however, just those which would prove most tempting to the non-English minds as an occasion for a display of recondite mathematical reasoning, and I do not for a moment dispute that Mr. am Ende has provided a very neat and elegant solution of a neat problem. When he reasons with Mr. Parsey, however, against cantilevers, he rather breaks down. "After the Lord Mayor's coach comes the donkey cart." With cantilevers the work might have been done perfectly well; but Mr. am Ende's solution of the problem is the more pleasing of the two. I may, to help to elucidate matters a little, point out that there was no difficulty in making the whole gallery a rigid structure, which should be carried on the three walls, without any cantilever action whatever, and without root-and-branch girders. Mr. Max am Ende is too competent a mathematician perhaps to have overlooked this fact; possibly there are radical objections to this plan which I cannot now see. If Mr. am Ende will say what they are he will confer a favour on M. I. S. I.

London, July 26th.

SILKSWORTH COLLIERY.

SIR,—In the concluding paragraph of your article on the Silksworth Colliery, you state your belief that the engines at that colliery are the only winding engines in England the cut-off of which is controlled automatically by the governor. Permit us to say that we fitted our Mr. Stevens' patent automatic expansion gear to a pair of 40in. winding engines at the Great Western Colliery, at Pontypridd. This has been in regular work nearly twelve months, and notwithstanding the low boiler pressure, the results have been most satisfactory. We enclose diagram, and shall be glad to furnish further particulars should you think them of sufficient interest. THE USKSIDE COMPANY.

Uskside Ironworks, Newport, Mon., July 12th.

SAFETY VALVES.

SIR,—Referring to the discussion going on in your paper in June last, having no time to reply when in Liverpool, I beg to send you a report as I find the spring safety valves on board the steamship St. Columbia, made by Pattison and Hewitt, of Liverpool. The valves are 4⅞in. diameter, loaded to 90 lb. on the square inch. They blow off exactly at 90 lb., and come back sharp at 88 lb. on starboard boiler and 88½ lb. on port boiler, when they shut down quite tight, make no noise on closing, and blow steadily when blowing. The bracket that carries the easing shaft is cast on the spring case, and we get at the springs at once without any trouble. The adjusting rings are so arranged that the valves can be set when steam is up. Altogether the valves have given me the greatest satisfaction, being now six months on the ship and given no trouble. W. C. MARTYN, Chief Engineer.

S.S. St. Columbia, Baltimore, U.S., July 16th.

SAW GUARDS.

SIR,—I notice in your valuable paper of the 22nd, p. 56, an account of exhibits at the Derby Show, that Mr. Tayler, of Bury St. Edmunds, showed a new saw guard, which is no doubt effectual, but it cannot deal with flying splinters, which often cause bad accidents. Will you kindly allow me to state that my patent prize medal safety guard prevents these splinters being driven off; a model of it can be seen at the address below, and I shall be pleased to show a machine with recent improvements at work by appointment. E. R. DALE.

147, Queen Victoria-street.

NEW DOCKS IN BROOKLYN.—Perhaps nothing will be more gratifying to the shipbuilding interests all over the world than the positive assurance that ere another winter arrives they will have adequate facilities for docking and repairing steam and other vessels of the largest class at this port. Complaints having been made that there were no dry docks for the immense new European steamships which have lately been built, a company was formed to provide for this want, and it was decided to build docks large enough for vessels 600ft. long and drawing 24ft. of water. This will be large enough for any vessel afloat except the Great Eastern, including the new leviathan, the City of Rome. The company recently purchased 28 acres at the Erie Basin, South Brooklyn, the property having on it two dry docks, which were built some years ago, but which have not been in use for some time past. The property embraces a street frontage of 745ft., and a water front on the pier line of 1000ft., and extending from the street into the Erie Basin, a distance of over 1100ft., making a total length of bulkhead and pier accommodations for vessels of over half a mile. The entire property has been placed in the hands of well-known contractors, to enlarge and improve the two dry docks and appurtenances, and to extend and remodel the piers, bulkheads, &c., and make them suitable to the present wants of New York. The two dry docks will be put in thorough order and condition, and the larger of the two will be increased in length 600ft. The docks will be of wood, and the following will be the dimensions of them when completed :—

	Dock No. 1. feet.	Dock No. 2. feet.
Length on coping	500	600
Width on coping	124	120
Width at entrance	85	85
Draught of water	20	25

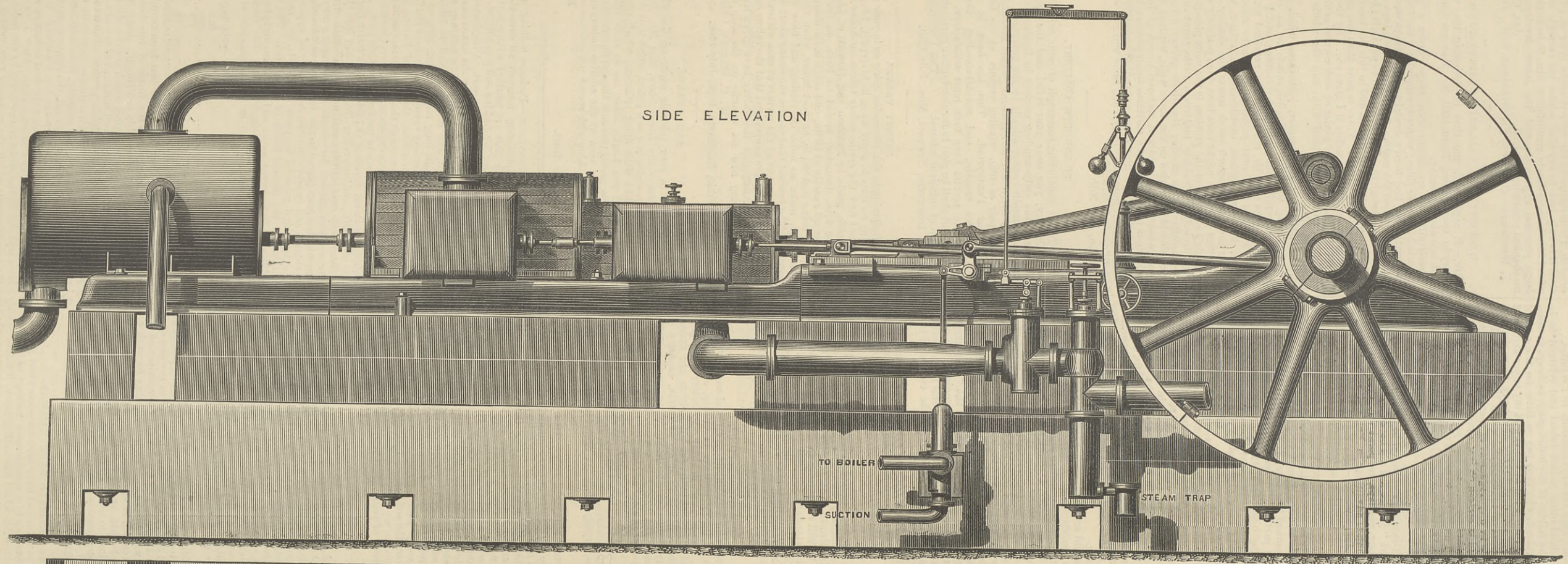
The coffer dam of dock No. 1 has just been completed, and the workmen are now engaged on the inside of the dock, preparing it for new timbers and thoroughly refitting it. Dock No. 2 is almost ready for the solid stone capping which is to be placed around the entire dock. The dry docks and sufficient of the adjoining property have been leased to Philadelphia parties. The lease is for fifteen years. The four solid brick warehouses now built upon the property, and which are of great capacity, have been leased for a term of fifteen years, together with all the property north-west of the dry docks, to the Centaur Steamship Company, the old Inman steamer City of Limerick being the first to occupy a berth at this property under the new management. Over 1,900,000 dols. had been laid out on the docks and property by the former owners, and the improvements which the company now owning them have on hand will cost from 800,000 dols. to 1,000,000 dols. more.—*The U.S. Nautical Gazette.*

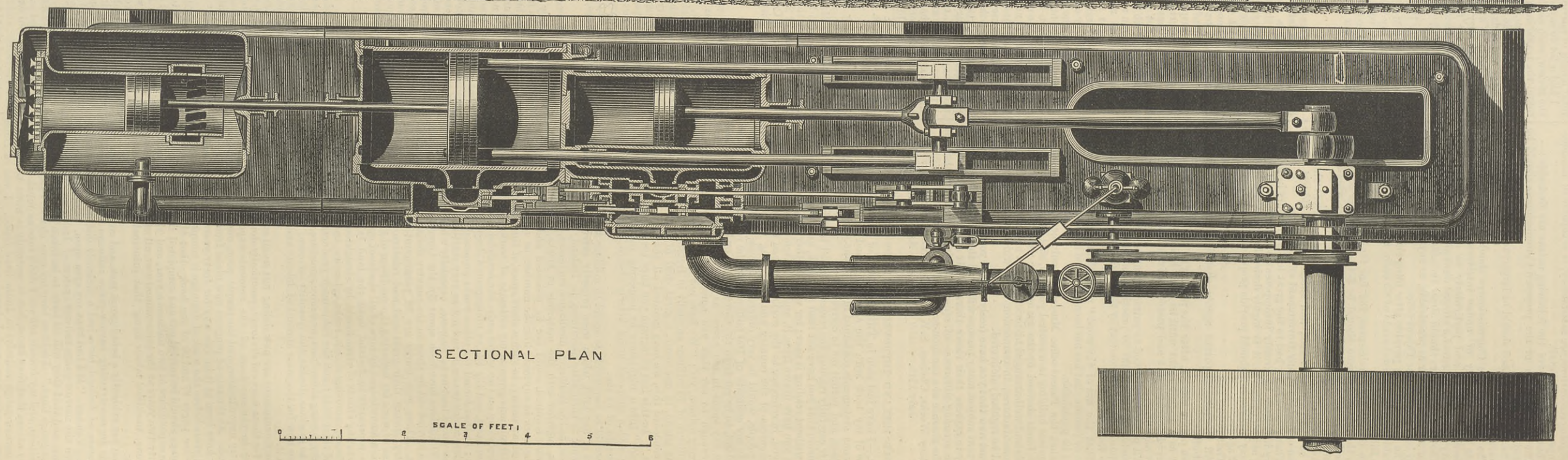
COMPOUND MILL ENGINE FOR MESSRS. ROUSE AND CO., BRADFORD.

MESSRS. TIMOTHY BATES AND CO., SOWERBY BRIDGE, ENGINEERS.

(*For description see page* 84.)

SIDE ELEVATION





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*** *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* 2*d. 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.*

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*** *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.*

W. T. R.—*We have already answered your question in the negative.*

W. F. M.—*The appeal has not yet been heard. It is impossible to say when it will be heard.*

D. B. B.—*We are unable to supply any information in addition to that which has appeared in* THE ENGINEER.

AMEDABAD.—*An illustration of the engine which exploded at Rainton appeared in* THE ENGINEER *for June* 3*rd.*

R. G. W.—*An American patent can be granted only to the inventor, who can apply for one through an American agent.*

E. B. (Rothenfelde).—*Messrs. Elliott, mathematical instrument makers, West Strand, London, supply a continuous indicator.*

M. D.—*There is no book on the Cornish engine published at the price you name. It is possible, however, that you could get a copy of Pole's treatise second-hand from T. B. Batsford, High Holborn. A complete set of papers on the Cornish engine, illustrated by working drawings, has been published in* THE ENGINEER. *The first of these papers appeared on Jan.* 7*th,* 1870.

W. R.—*Screw propeller shafts are usually broken by the irregular wear of the bearings, by which the shaft gets out of line, settling down in some places. The effect of causing a sagged shaft to revolve is exactly the same as if it was bent through a distance equal to the versed sine of the curve which it makes, twice every revolution. This continual bending finally destroys the texture of the shaft, which breaks just as a piece of wire bent backwards and forwards in the fingers breaks.*

J. W.—*Peroxide of hydrogen is known in the arts as hydroxyl. It was discovered in* 1818 *by Thénard. Its formula is* H_2O_2. *It differs from water in having another atom of oxygen united with each two atoms of hydrogen. It is an unstable compound, and a most powerful bleaching agent. It is prepared with extreme difficulty by passing a current of carbonic anhydride* CO_2 *through water in which baric peroxide is suspended. It is a colourless, syrupy liquid of astringent taste, liable to explode at* 212 *deg. If it could be prepared at a moderate price it would be of great value as a bleaching agent.*

CORRECTION.—*We are requested by Messrs. Hayward Tyler and Co. to state that they did not exhibit a Linford engine at Derby, though one was entered by them.*

LIMEKILNS.

(To the Editor of The Engineer.)

SIR,—Would some of your readers kindly tell me which are the most suitable lines, with regard to economy of fuel, for a vertical limekiln from which 16 to 20 tons of lime are drawn daily? CALCIUM.

July 27th.

THE COST OF CHIMNEYS.

(To the Editor of The Engineer)

SIR,—I shall feel greatly obliged to any of your readers who will kindly give me information as to about the cost of constructing a chimney of the following dimensions:—Total height above ground, 100ft. The first 25ft. to be 10ft. square of stone, the remaining 75ft. octagonal in form and of the usual proportions; the bore of the shaft, 2ft. 6in., and parallel. and about the difference of the expense in constructing the 75ft. octagonal part, in stone or brick. O V.

Bradford-on-Avon, July 21st.

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

THE ENGINEER.

JULY 29, 1881.

LOCOMOTIVE IMPROVEMENT.

ALL recent improvements in the construction of locomotive engines have had for their object the diminution of wear and tear, rather than a reduction in the consumption of fuel per train mile. It admits of being proved that the more durable an engine is, the less coal will it consume; and so, of course, the better a locomotive engine is in material, workmanship, and design, the less fuel will it use; but this kind of economy is obtained incidentally, not purposely. It is clear that a reduction in coal bills can only be obtained by generating steam economically and using it to advantage. It is many years, however, since in this country anything has been heard about special cut-off gear; and the changes which have been made in the proportions of locomotive boilers are very few. Tubes $1\frac{3}{4}$in. in diameter are the smallest, and 2in. in diameter are the largest used. The widest spacing is 1in.; the closest $\frac{5}{8}$in.; but both dimensions are abnormal, the one being a little less and the other a little greater than those usually adopted. In like manner the length of the tubes almost always lies between 10ft. and 11ft., and the heating surface is almost invariably arranged in the proportion of 60 of heating surface to 1 of grate surface, or thereabouts. It would appear that no better results than those now obtained can be had, no matter what changes are made in proportion; nor does it, indeed, seem to be possible to effect any improvement either in the use of steam or in its production. There is good reason to believe that the consumption of fuel in locomotives does not exceed 3 lb. per horse-power per hour, and in many instances where engines make long runs with loads which just suit them, the consumption of fuel is no doubt much less than this. Indeed, Mr. Stirling states that he has got down to a little over 2 lb. per horse per hour with some of his engines. The only attempts which are made to get away from existing rules of locomotive design take the direction of increasing the size of the cylinders to permit more expansive working. But these attempts have for the most part been failures; 1100 square feet for 17in. cylinders, 24in. stroke, give admirable results independently of the diameter of the driving wheels, a result which is due most likely to the circumstance that the average number of revolutions made in one minute by a goods engine will be not far short of those made by a passenger engine, if we exclude the highest speed at which passenger trains are run. Mr. Stirling, who attempted to depart from this rule, and used 18in. by 28in. cylinders with 8ft. wheels, and a heating surface of 1165 square feet, with 11ft. 8in. tubes $1\frac{9}{16}$in. diameter and 217 in number, has had to enlarge his boilers by augmenting the size of his fire-boxes—the only place where augmentation was possible—and with most satisfactory results. There is then, it would seem, reason to think that finality in the matter of relative proportions has been reached in this country, and that nothing can be saved by modifying them. The more carefully this truth is examined the more startling will it appear. The conditions of speed and load under which locomotives work vary very considerably, and a wide diversity exists between the qualities of the various coals used. Thus on the southern lines Welsh coal is burned, and in the north North-country coal. It might be thought that the boiler and furnace which would suit one would not suit another; but this is not the case, and whether dry Welsh coal or bituminous northern coal is employed, the result is much the same.

Under such conditions the word improvement can only have one meaning when applied to locomotive engineering. Changes in design and proportions can only do good in the sense of keeping the locomotive out of the repair shop. There is room for improvement in this respect. It is well known that an enormous mileage can be got out of individual engines. Thus, over 100,000 miles have been made with the most insignificant repairs; but the average for all the engines on a line may not be more than one-fifth of this. If the average performance of all locomotives could be raised to 50,000 miles per annum, without any repairs of importance, it would be a great thing for the railway companies. More than one locomotive superintendent has recently expressed his determination to get 100,000 miles out of each of his engines before it need visit the repair shops. Whether this result can or cannot be attained is an open question; but it is, at all events, well worth while to try to attain it. It can only be reached by paying the most scrupulous attention to a great number of details. For nothing, however, has an engine to be laid by so often as because of trouble with axle-boxes. When we consider how small is the bearing surface, and how heavy the loads, the wonder is that axle-brasses last as long as they do. An effective area of 40 square inches, or less, has to carry as much as seven or eight tons, representing a load of 450 lb. per square inch; and this is not only endured, but carried, without heating or cutting, day after day, for months together. But the very verge of endurance is no doubt reached; and it is well understood that an augmentation in the size of crank-shaft bearings, at all events, is highly desirable. This can only be got, properly, by increasing the length of the journals; and this, with inside cylinder engines and the ordinary type of valve gear, cannot be done. In the attempt to do it, outside crank cheeks have been made as thin as possible—thinner than, perhaps, it has been quite prudent to make them. Inside and outside bearings have been employed for the same purpose; but there is still room for change in this direction. Joy's valve gear, adopted by Mr. Webb, of Crewe, seems to have solved the problem. Last year the members of the Institution of Mechanical Engineers inspected at Barrow a goods engine fitted with this gear. The results of the work which has been done in the twelve months by this engine are, we understand, eminently satisfactory. With Joy's gear the valve chests are placed on top of the cylinders, and yet are driven direct without a rocking shaft. The cylinders can be got quite close together, and inside bearings alone of any required length can of course be employed. In this way the difficulty hitherto encountered in dealing with what are perhaps the most troublesome bearings in a locomotive are all got over, and it may be added that it also becomes possible to augment the lengths of the crank pins—an advantage worth having.

The method most in favour just now of keeping locomotives out of the repair shops consists in increasing their weight. Everything is heavier than it used to be. Engines of a given cylinder capacity weigh 10, 15, and even 20 per cent. more than their predecessors of the same cylinder capacity and heating surface did. It is not easy to see where progress in this direction—if it be progress—will stop. The rapidly extending use of the four-wheeled bogie has a good deal to do with the increase in the weight of locomotives. The modern English bogie is a tremendously heavy affair, and the extension of the engine frames in front over it, represents in itself a good deal of weight. It is to be hoped that the result obtained is worth the money. On this point there is, however, a great difference of opinion. Some English engineers like the bogie; others do not. One reason for its adoption is, however, that it saves the wear and tear of leading wheel tires, and an engine fitted with a bogie can keep at work, other things being equal, for this reason, longer than a six-wheeled engine. We have heard this disputed, and it has been argued that the small leading wheel of a bogie must wear out faster, as far as flanges are concerned, than the flanges of a 4ft. leading wheel. The balance of argument is, we think, in favour of the bogie. Another point in its favour is that it really seems to do what American engineers claim for it—settle down the road in advance of the heavily-loaded drivers. Although weight is objectionable, in the sense that its adoption to make parts of a machine strong seems to be a crude and even rude expedient, yet it may perhaps be shown that the modern locomotive does not weigh an ounce more than it ought. It is not contended by anyone that locomotives gain anything save durability from weight, and it is not too much to say that no one can say what the effect on repairs will be of an extra ton or two of metal in a locomotive. It is, however, quite certain that there is no uniformity of opinion among locomotive superintendents on the subject, many men of much skill and experience denouncing weight and keeping their engines as light as possible. It is to be regretted that it seems to be out of the question to get any figures which will show which policy is right.

COMPOUND PORTABLE ENGINES.

A GREATER number and variety of compound engines were exhibited this year at Derby than ever before appeared at an agricultural show. In describing these engines we intimated that they, no doubt, owed their existence in a large degree to the circumstance that compound engines are just at present in fashion. In other words, purchasers of portable and traction engines prefer to buy such engines; and their desires are met by the makers. So far as can be gathered, purchasers do not know for a fact whether compound portable or traction engines are better than any other engines. They believe, we suppose, that they are more economical, and therefore they buy them, but they would probably buy any other type of engine made by firms on whose reputation they can rely, if it were equally put forward as the best. It is not difficult to write the history of the compound portable engine. In the year 1863, Messrs. Robey exhibited at Islington, at one of the Smithfield Club Shows, a compound portable engine, invented by Mr. Edward Allen. The year before—that is to say, in 1862—Mr. Wenham, showed at Islington, a 10-h.p. compound portable engine, with cylinders 5in. and $8\frac{8}{4}$in. diameter, and 12in. stroke. The steam was superheated between the two cylinders. The boiler had 83ft. of surface, and the superheater on the smoke-box 25 square feet. Both engines were said to be very economical, but the system did not find favour in the eyes of users of portable engines, and both quickly died a natural death. The Cardiff competition for the prizes of the Royal Agricultural Society, held in 1872, showed that such admirable results could be obtained with the single cylinder, that—substantiating, as it did, the results of the Oxford trials of 1870—it gave the *coup de grace* for the time being to the compound system, concerning which nothing more was heard until Messrs. John Fowler, of Leeds, exhibited their "Yorkshire" engine at Kilburn. This engine, we need hardly tell our readers, closely resembles the mining engine made by Messrs. Robey; the principal difference being that it has one large and one small cylinder working compound, instead of two simple engines. According to the statements made by the makers, this engine was, at the date of its exhibition at Kilburn, the most economical non-condensing engine ever made. When describing it at the time, we stated as much. The example set by Messrs. Fowler was not repeated; but last year Messrs. Richard Garrett and Sons produced a compound portable, the performance of which was better by a small amount, as we personally ascertained, than the stated performance of Messrs. Fowler's "Yorkshire" engine. About the same period Messrs. Marshall and Sons, of Gainsborough, produced a portable compound engine, of much the same type as the Leiston engine. Concerning the performance of this engine we possess no information of any kind. The results obtained by Messrs. Fowler and Garrett showed that a compound engine is more economical than any ordinary simple portable engine. But while one section of the agricultural engineers was engaged in developing the compound system, Messrs. Davey Paxman and Co., of Colchester, were improving the performance of the simple engine. In the Diamond Fields, at the Cape, economical steam engines are a necessity, not so much because fuel is dear, as because at times it cannot be procured at any price. We have been credibly informed that as much as £30 has been paid for a single ton of coal, while £40 per day has been paid for the hire of a portable engine. If two men succeed each in obtaining ten tons of coal, the man who has an economical engine may be able to keep on working steadily until a fresh supply reaches him, while his neighbour, with a less economical engine, has to cease operations. It will be seen that such conditions afford an enormous stimulus to exertion. The engine must, however, be light as well as economical. Mr. Paxman, instead of compounding, made his boiler economical by adopting the best proportions, and he carried 120 lb. steam, and cut this off by a special form of valve gear. The result is that he has obtained a run of 5 hours 35 minutes on the brake with 14 lb. of coal per horse per hour. This is equivalent to 2·5 lb. of coal per dynamome-

trical horse-power per hour. The best result yet obtained with a compound portable or semi-portable engine was got by Messrs. Fowler with a 16-horse power engine, driving two 4ft. stones. The consumption of fuel—Welsh coal—is given by Mr. Redshaw as 2·125 lb. per indicated horse-power; but this engine is fitted with a condenser. If we add 10 per cent. as the excess of indicated over dynamometrical horse-power, the consumption of Mr. Paxman's non-condensing engine will be 2·25 lb., as compared with 2·125 lb. for the condensing engine. From this it would appear that it is possible to build a single cylinder portable engine which will be as economical as any compound yet constructed. As bearing on the same point we may state that Mr. P. Stirling, of the Great Northern Railway, has informed us that as the result of a most careful series of experiments, he has found that some of his locomotive engines develope one horse-power for every 2·06 lb. of coal burned.

We cite these facts for the double purpose of showing the precise position of the compound *versus* simple portable engine question, and to prove that there is nothing about the compound engine which renders it of necessity more economical than the simple engine. But if this point be once conceded, we have nothing to urge against the use of compound portable and traction engines. Whether, indeed, the compound or the simple system be adopted is merely a question of expediency, and in this light, and in this light alone, should it be studied by the purchaser. Now in favour of the compound traction engine, at all events, a great deal may be said. The pressure carried in such engines has been gradually creeping upwards, and 140 lb. is not seldom met with. If steam of this pressure is to be used economically, it must be employed with a large measure of expansion; but to do this properly there must be a large cylinder. But if a large cylinder and a high pressure be put into the hands of the ordinary traction engine driver, the result will be disastrous. The tendency with all users of traction engines is to overload them. The large cylinder and high pressure will be utilised to the full, the boiler will be forced to do more than it ought, and will be burned out, or failing this it will not keep up the full pressure; the engine will be kept in full gear instead of being notched up, and the result will be disappointment all round. To put on a special cut-off gear is out of the question with a traction engine, although it does very well with a portable engine always running one way. If now the engine be compounded, it becomes impossible for the steam to be used without being expanded. If two traction engines, the one compound, the other simple but fitted with an extra large cylinder, were both put into the hands of highly competent men, it is possible that one would burn as little coal as the other. Put into the hands of the ordinary driver, the compound engine ought to burn about 25 or 30 per cent. less fuel. In other words, compounding compensates for want of skill and honesty of purpose on the part of the driver and owner of the engine. It is quite possible that the people who buy traction engines have realised this truth, but we much doubt it; and for the moment, at least, the demand for compound traction engines—if there be a demand—is simply the result of a desire on the part of the purchaser to have something new and presumably better than anyone else in his district has.

It is, we think, a remarkable fact that the builders of traction and portable engines have taken so long a time to find out the peculiar virtues of the compound system. As we have explained it, it is nearly twenty years since such machines were first brought under their notice. No one can accuse them of want of energy, shrewdness, or intellectual ability. They rank among the most competent mechanical engineers in the world. Is it not fair to argue that if the compound system held out any startling promise of advantage to be derived from its adoption it would have been adopted long since? The truth is that, as we have said, the compound portable engine has advantages which have nothing to do with the theory of its action, and depend for their realisation on the want of skill of those who have charge of it. It is only now that this aspect of the question begins to be understood. The putting forward of a compound engine as eminently economical touched no one's heart, but the assertion that it will compensate for the deficiencies of a driver goes home at once to the intelligence of purchasers. But it is by no means to be assumed that such a reason for its adoption is to be continued or neglected as insignificant. Any improvement which will make the steam engine give a better duty than it would give without it under the conditions of working should be valuable—only let the truth be stated; let the saddle be put on the right horse.

What we have said of traction engines applies largely to portable engines. The conditions under which the highest economical results can be got from this type of engine are not always present. Special cut-off gear must be used if the simple engine be retained; and it becomes an open question whether under the conditions it is not better to substitute a second cylinder for the special valve gear. Much may be said for both; but it is indisputable that in many cases the balance of advantage will be altogether in favour of compounding. More regular turning will be got with two cylinders than with one. The weight of the fly-wheel may be kept down, and strong mechanism not likely to get out of order will take the place of the more or less delicate arrangements inseparable from the use of special cut-off gear. The same arguments will to a large extent apply in this case as in that of the marine engine. So long as special appliances were required for compounding the marine engine, so long did its merits remain unappreciated. As soon, however, as it came to be understood that the only constructive difference between the compound and the simple screw engine was that, whereas the latter had two cylinders of identical dimensions, the other had one cylinder bigger than the other, the compound system was adopted. There must in any case be two cylinders, and compounding them is a better and a simpler job than fitting two single cylinders with more or less complex cut-off gear. In just the same way it has been pointed out by Mr. Lavington Fletcher that there are now in his district a great many simple engines which are most wasteful of fuel, and that by compounding these engines—McNaughting them—a great saving of fuel might be effected. He adds that as good results might be obtained by putting down new simple engines, but no comparison can be drawn between the cost of the two operations. It is fair to Mr. Fletcher to make this statement, as we have assumed from certain passages in his last report that he favours the compound system simply because it is economical. We have received a communication from him on the subject in which he says:—"The compound system is the only practical means we have, in many cases at all events, of availing ourselves of the advantages of high pressure. It is not very difficult to renew a range of boilers. They can be pulled out one at a time without stopping the mill. But to pull down an old beam engine and put a horizontal one in its place is a very serious question; whereas an engine can be McNaughted with very slight interference with the regular working. I think it will at once be seen that in dealing with old engines and existing arrangements it is far easier to 'McNaught' an engine, or to put on what they term a 'pusher,' than to root out the whole thing and go in for single-cylinder engines *de novo*. I think this has been a little lost sight of. It is explained in the report that the results are derived from the indication of the engines under the Manchester Steam Users' Association only, and in a prior report it was distinctly stated that 'though Tables 1 and 2 are in favour of the compound system, it must not be concluded therefrom that the compound engine is necessarily more economical than the single-cylinder engine. The table deals simply with those engines under the inspection of the association.'"

For ourselves our contention is, and always has been, that no special economy is to be derived from compounding, *per se*, but that circumstances arise under which compounding is essential to economy, because of the circumstances. It may, however, yet be found that the compound engine will secure economy *per se*, for a reason about which little or nothing has been heard. We allude to the compression of steam between the two cylinders, and the consequent re-evaporation of the water condensed in the high-pressure cylinder. An apparent instance of this is found in the case of Messrs. Garrett's compound portable engine, in which the high-pressure cylinder gives out much less power than the low-pressure. The point requires, however, further investigation before it becomes possible to speak decidedly upon it.

THE BRITISH WORKMAN.

"Put not thy faith in princes," is a biblical caution with which we are familiar from infancy. We are taught by ever recurring experiences that the warning is equally applicable to the other end of the social scale. A year and a-half since the Cleveland blast furnacemen, acting under the advice of their chosen leaders, and after repeated conferences, adopted conjointly with their employers a sliding scale whereby their wages were to be regulated for two years certain. The sliding scale was based on the actual price of pig iron, ascertained quarterly from the books of the masters by an independent public accountant. In consideration of the advantage of such a guarantee against the risk of strikes, the masters agreed to a somewhat higher basis level of wages than the price of pig iron would then justify or than had previously been paid. In other words, they conceded to the men for the whole period an extra payment which was deemed to be the equivalent for the greater security against strikes. Since the adoption of the scale certain advances of wages have been made in accordance with the accountant's report; and these upward movements have of course been made without demur from either side. Now the tables have turned. The accountant recently issued his report for the second quarter of the present year, showing that a reduction of 2½ per cent. must take place for the third quarter. This reduction has been made, and we regret to say that a portion of the men at once gave proof that to trust in their good faith was to rely on a broken reed. On Saturday, the 16th, the mine fillers at Messrs. Downey and Co.'s Lackenby and Coatham Works came out on strike without a minute's notice, and their example was immediately followed at Messrs. Bolckow, Vaughan and Co.'s Works, at Eston and South Bank. Remonstrance was quite useless. A union official who feebly protested was hooted; other men who would have taken the place of the malcontents were intimidated, and twenty-four furnaces were left to their fate. Until the Tuesday afternoon following the position remained the same, the strikers meanwhile having unsuccessfully visited other works in the district, endeavouring to make the strike general. Then on the urgent remonstrance of the president and secretary of their own union, to whom be all honour for the tact and honesty they displayed, the men returned to their posts, and the furnaces were again put into blast. But unfortunately untold damage had probably already been done. The loss to employers and to employed will run into thousands of pounds. The injury to the furnaces themselves will certainly be found to be very great; and probably some of them will never be in good working order again until they are emptied of their contents and relined from top to bottom. But the loss and annoyance which have occurred are nothing to what would have been the case had the strike become general. Truly our great iron and coal industries can only be carried on in fear and trembling. It is in the power of a few excitable, irresponsible, reckless workmen if they happen to take action when circumstances favour, to infect an indefinite number of their comrades and bring calamity, if not ruin, on numbers of innocent people. The present difficulty is over and only the bill has to be paid. No doubt the aggrieved firms will consider it as one of those contingencies which are inseparable from the carrying on of their trades. A feeling of thankfulness that it was no worse may possibly pervade their minds rather than of annoyance at the injustice they have suffered. But we conceive it to be our duty in the public interest to paint things in their true colours. We like to call a spade a spade, when we fully recognise it to be one. And we deem it to be of the utmost importance for our great national industries, that the sacredness of contracts should be upheld, whether between buyer and seller or between workmen and employer. He who knowingly and wilfully breaks a contract he has voluntarily and deliberately entered into is doing as much to make law and order impossible, and to reduce society to anarchy and barbarism, as is the brigand or the pirate. All honour be to the men who refused to join in this industrial insurrection. But in our opinion those who commenced and carried it on for three days and then only succumbed because they could not succeed in making it general, deserve very much stronger censure than we fear has yet been, or is likely to be, dealt out to them.

GUY FAWKES WANTED.

Sir W. Harcourt's startling information to the House on Monday night has interested us all. The discovery of ten infernal machines at Liverpool speaks at once to the unscrupulous wickedness of the Fenian conspirators in America, while we have for the pleasant side of the question the fact of our police having effected a capture. We believe that it is even hinted that the intended destination of such machines was beneath the floor of the House of Commons, so that we find ourselves in the presence of a modern edition of the gunpowder plot, just at that stage when Monteagle has received Tresham's letter and action has been taken on it. We are, however, brought up suddenly by the reflection that the central figure of the whole is missing, we have no Guy Fawkes! What a tame matter our 5th of November would be had he been lacking in James's reign. Perhaps, however, it may appear that we are treating a most serious matter in a frivolous way. We will, therefore, shortly trace out a few facts bearing on the question. It appears that six of the machines were found in one case and four in another. Each machine consisted of a metal box divided into two compartments, the upper one containing a six hours clock movement for firing a detonator, and the lower one a charge of obout 2 lb. of a compound termed nitro-lignite, nearly resembling dynamite, but not so strong—probably made by the action of nitric acid on sawdust. The detonators necessary to fire the charges were absent. It is impossible to divine what was the precise object sought to be attained by this consignment, but we can fix certain limits to it. First then it is clear that the vessels carrying them were not intended to be injured by them, for, in such a case, detonators would have been inserted. Further, there would not be found six cases, each with a separate clock movement, for the first one that acted would blow up all the others. Then the comparatively small size of the charges prevents us from drawing a comparison with the horrible engine which exploded while it was being sent on board the Mosel at Bremerhaven by P. Thomas. The charges recently found at Liverpool would by no means have blown up or sunk a vessel. It is probable that the damage effected by a single machine containing only 2 lb. would be very limited in most instances. As each machine, however, had its own clockwork, it was surely intended to act by itself; yet in what way serious damage was to be effected by 2 lb. of nitro-lignite it is hard to say. The *Standard* throws out the hint that the police may have seized the charges too quickly to enable the consignee to present himself. We know of no ground for saying so. On the contrary, from what we can learn, we believe that very ample information was furnished and wisely acted on, and that it was pretty clear that no consignee was likely to come forward. Then arise other doubts, was there ever a consignee? or was the whole matter concocted to advertise the Fenians, and while it tended to create a panic in the hearts of Saxons, to draw out further subscriptions from the friends and admirers of the brotherhood? Lastly was it the plan of an enterprising individual to make a private haul for himself? We believe that the information was very definite in terms. The machines were pretty sure to be seized, while an imaginary name would prevent the necessity for the existence of a consignee. We do not know what reward is given in such cases, but we should feel an inclination to stipulate that it should not exceed the value of the goods taken, unless some guilty person was found—in fact, Guy Fawkes. The possibility of anyone collecting money either for himself or for the Fenian brotherhood by manufacturing conspiracies and reporting them himself is disheartening, no doubt, although a happier supposition than that of a recklessly wicked plot. The police should have their eyes open, whatever may be thought, only we suggest that their eyes be open to both alternatives, not one only.

THE JUBILEE OF MIDDLESBROUGH.

A little late in the day the iron-made town of Middlesbrough is preparing to celebrate its jubilee. It is now over fifty-one years since the commencement of what an inscription on the front of the first house described as "the new town of Middlesbrough-on-Tees," but owing to uncontrollable circumstances, the celebration of that jubilee has been deferred, until the period for the unveiling of the statue of Mr. Henry Bolckow, who may be described not only as the founder of the great iron and steel making company that bears his name, but also as one of the pioneers of Middlesbrough. In addition, portraits of the founder of the town and of one of its oldest citizens are to be presented; and the date for the occurrence of these events has been chosen as that for the celebration of the jubilee—two months hence. It is too late now to question the utility of celebrations such as this, but it may be questioned whether a more fitting method of that celebration could not have been devised—something that would have been of practical benefit for all time to the town—than that of statue erection, portrait presentation, and feasting and fireworks. But the decision has been come to, and it may be that in the method that has been chosen the present generation will have fixed upon its memory as fully as in any other way the marvellous growth of the town since the days when it was a small coal shipping port. In the three periods into which the life of the town may be divided, there is something like an epitome of northern history—that of the small coal trade; then that of the iron, and now that of steel, still in its youth. The periods of transition from one of these to the other have given the checks that the town has experienced. Its trade is now being slowly placed on a sounder foundation, and it may be believed that there is in the future a further growth. Already it possesses within its bounds the largest number of blast furnaces in any one district, and there is close to it—within the bounds of the port of Middlesbrough—probably the most noted and the largest of the steel-works in the world. In the course of a very short time another extensive works will be begun, and there are indications that as a producer of Bessemer steel, and of steel produced by the dephosphorisation process, there may be as large a production in Middlesbrough, relatively, as there is now of crude iron. It is well, therefore, that at the present time the capital of North Yorkshire should demonstrate to the world that it has outgrown the check which the decay of the iron rail trade gave to it, and that it is preparing for another advance. The jubilee compares the town of the present with that of the past, and though it must be acknowledged that its life has been chequered, yet it is certain that it has been one of marvellous progress.

THE AWARDS AT THE MELBOURNE EXHIBITION.

Things do not seem to have gone very comfortably with the members of the jury section No. 26 of the Melbourne Exhibition. Twelve of them send a communication to the *Melbourne Argus*, from which it would appear that their awards have been in many instances overruled by a machinery committee, which they say consisted largely of exhibitors and their agents. They say:—"Among other objects we had to adjudicate upon a port-

able steam engine, the general design and workmanship of which did not appear to us to be above mediocrity, while the slide valve, a most vital part, was of a form for which, after diligent search in the works of the highest authorities, no precedent or justification could be found, and to which all those members of the jury who had made steam machinery their special study raised most serious objections. The award was given and appealed against. Experts were called in, and by their written report confirmed our award, and here we supposed the matter would end, the regulations distinctly implying that an award so confirmed is absolute and final. To our great surprise, however, the Machinery Committee, of which the Melbourne representative of the makers of the engine is a member, raised the award to first order of merit. We at once protested, and a conference was arranged on the subject of disputed awards. At this so-called conference we were denied a hearing, the objectionable award was maintained, a pledge distinctly given by the committee was violated, and a resolution passed reflecting most seriously upon our reputations." In concluding their communication they summarise their grievances, and among the items it is alleged "that their awards have been submitted for revision to a body, members of which are immediately interested in the exhibits of which the awards are in dispute." If awards to new arrangements of valve gear or anything else are to depend upon "precedent or justification" in "the works of the highest authorities," it is, perhaps, not to be wondered at that those who make the awards get into hot water.

UNIVERSITY COLLEGE, BRISTOL.

WE have on one or two occasions referred to this college, and to the arrangements in the department of civil and mechanical engineering and surveying, for the practical instruction of students during the six summer months, and theoretical instruction during the winter months. This is perhaps the best arrangement that could be made for ensuring an intelligent acquirement of practical and theoretical knowledge, especially if the students make the best of their advantages, and note fully during the one six months the points upon which they find they particularly need to bestow most attention during the other. Careful students will do this, and no arrangement can be made which will cause a careless one to learn his profession thoroughly. The engineering classes are under Professor J. F. Main, Mr. A. Marshall, M.A., being president, and the civil and mechanical engineers, under whom, or in whose office, or in and on whose manufactories or works, the summer six months may be spent, are fifteen in number. We have received an intimation that the coming college session commences on the 10th October, but we are not informed as to the success of the scheme which has now been under trial several years.

THE EXPLOSIVE POWERS OF DUST.

A REPORT has been presented on the results of experiments made with samples of dust collected at Seaham Colliery, in compliance with the request of the Home Secretary, by Mr. F. A. Abel, C.B., F.R.S., President of the Institute of Chemistry, and Chemist to the War Department:—"The results of the experiments with Seaham and other dusts appear (says Mr. Abel) to have demonstrated—(*a*) That coal-dust in mines not only much promotes and extends explosions in mines, by reason of the rapid inflammability of the finely-divided combustible, and of the readiness with which it becomes and remains suspended in air-currents, but (*b*) that it may also be itself readily brought into operation as a fiercely burning agent which will carry flame rapidly as far as its mixture with air extends, and will operate even as an exploding agent, through the medium of a proportion of fire-damp in the air of the mine, the existence of which, in the absence of the dust, would not be attended by any danger. (*c*) That dust in coal-mines, quite apart from any inflammability which it may possess, can operate in a distinct manner, as a finely-divided solid, in determining the ignition of mixtures of only small proportions of fire-damp and air, and consequently in developing explosive effects. (*d*) That a particular dust in a mine may, therefore, be a source of danger, even though it contains only a small proportion of coal or combustible matter. Although the explosion which may occur through the agency even of a non-combustible powder, in the manner described, may be of very mild or feeble character in the first instance, it may be almost at once increased in magnitude and violence by coal-dust which the first ignition will raise and bring into action. The proportion of fire-damp required to bring dust in a mine into operation as a rapidly burning or an exploding agent, even upon a small scale, and with the application of a small source of heat or flame, is below the smallest amount which can be detected in the air of a mine, even by the most experienced observer, with the means at present in use, as has been already demonstrated by the experiments of Mr. Galloway. Indeed, with dusts of highly sensitive or dangerous character, under those conditions, and very possibly with dusts not more so than the least sensitive of the Seaham samples, in the presence of a source of considerable heat and flame, such as a blown-out shot or an overcharged hole would constitute, a small proportion of fire-damp, the possible existence of which in the mine might not be in the least suspected, may serve as the inciting cause to the development of an explosion of coal-dust. In the complete absence of fire-damp, coal-dust exhibits some tendency to become inflamed when passing a very large lamp flame at a high velocity; if exposed to the action of a large volume of flame, such as produced by the explosion of freely exposed gunpowder or gun-cotton, it exhibits, in addition, a decided tendency to carry or propagate flame. But, so far as can be determined by experiments on a moderate scale, this tendency is of limited nature, and very different indeed from the property of carrying or propagating flame, which even comparatively non-sensitive dusts possess in the presence of a very small quantity of fire-damp. In conclusion it may be admitted as possible that, with the large volume of flame and the great disturbing effect of a blown out shot as the initiatory cause of the ignition of dust, and its suspension in the surrounding air, such inflammation may, in the complete absence of fire-damp, be propagated to a greater distances than the results of small experiments would warrant one in assuming. But it can scarcely be maintained that the air of a mine in which the coal gives off gas at all can be at any time free from fire-damp; and as the existence of very small and unsuspected quantities of that gas in the air of a mine may suffice to bring about the ready propagation of flame by coal dust, and thus to develope violent explosive effects, it would appear needless to assume that coal dust may, in the entire absence of fire-damp, give rise to explosions, even of only limited character in coal-mines, in order to account for casualties which cannot be ascribed to the existence of accumulations or sudden outbursts of fire-damp."

EVEN the water supply of Paris could not remain unaffected by the hot weather of last week; the supply was regulated or restricted, so as to make the inhabitants feel the necessity for economy, which is not fully appreciated when a circular is distributed asking that no waste shall take place.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending July 23rd, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m to 10 p.m., Museum, 8566; mercantile marine, building materials, and other collections, 3833. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 2214; mercantile marine, building materials, and other collections, 456. Total, 15,119. Average of corresponding week in former years, 17,877. Total from the opening of the Museum, 20,159,800.

VERTICAL PLATE BENDING MACHINE.

AMONG the most recent improvements adopted for avoiding leakage from the seams in the bottom of boilers is to make the boiler plates sufficiently long to enable a complete boiler ring to be formed of one or two plates, and so avoid a rivet joint in the bottom part of boiler. By the use of the ordinary horizontal plate bending machine the work of bending these extra long plates into proper "set" is found to be an operation of very great difficulty, and entailing the expenditure of a large amount of additional time and labour, and great risk to the workmen. To meet this difficulty Messrs. Scriven and Co., of Leeds Old Foundry, Leeds, have designed and introduced a vertical plate bending machine to bend the longest plate to a complete circle or any radius.

It easily bends wrought iron plates 1¼in. thick, and steel plates 1in. thick cold and 7ft. wide, and the front roller is adjustable and arranged to lift out, so that a plate can be bent to a complete circle or tube. This machine bends plates faster than horizontal rolls and with considerably less number of men, and with no risk to workmen. The plates also come out perfectly circular without the double curvature at the end, which is unavoidable when using horizontal rolls, and what is of equally valuable importance, the required "set" of the plate is obtained to a nicety and with perfect ease. These new bending rolls are of exceedingly simple arrangement and are very successful, for by their use there is a saving of fully 50 per cent. of the labour and time consumed in the ordinary course of plate bending. The gearing and driving pulleys are under the floor line, thus giving a clear course all round the machine, and the driving pulleys can be carried to any convenient distance from the machine to be suitable for driving; or the machine can be driven with a 10in. diameter cylinder steam engine with reversing link motion for reversing the rolls.

These vertical plate bending machines are working at Palmer's Shipbuilding and Iron Company, Limited, Jarrow-on-Tyne; Barrow Shipbuilding Company, Limited, Barrow-in-Furness; Earle's Shipbuilding and Engineering Company, Limited, Hull; and Messrs. Thos. Richardson and Sons, Hartlepool.

ROLFE'S SEWER VALVE.

WHEN valves are used to trap the ends of drains they are usually constructed as in Fig. 1. The dotted portion shows the free space left for the entrance of sewer gas when the outflow is small. Mr. Spencer Rolfe, of Westminster-chambers, has devised

FIG. 1

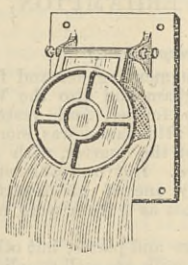
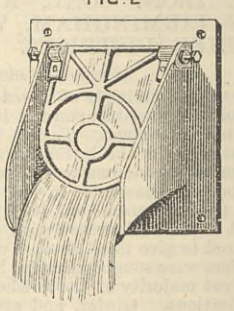


FIG. 2



the arrangement shown in Fig. 2, by which the entrance of sewer gas is prevented. The engravings explain themselves. The traps are made in all sizes by Messrs. Blakeborough and Son, Brighouse, Yorkshire.

INSTITUTION OF MECHANICAL ENGINEERS.

THE following programme has been issued of the Newcastle meeting, 1881, held at Newcastle-on-Tyne, and commencing Tuesday, 2nd August. The following papers have been offered for reading and discussion: "On the Tyne, as connected with the History of Engineering," by Mr. I. Lowthian Bell, F.R.S., of Port Clarence; "On the Progress and Development of the Marine Engine," by Mr. F. C. Marshall, of Newcastle; "On Iron and Steel as Constructive Materials for Ships," by Mr. John Price, of Jarrow; "On Printing Machinery," by Mr. John Jameson, of Newcastle; "On some recent Improvements in Lead Processes," by Mr. Norman C. Cookson, of Newcastle; "On Bessemer Steel Plant, with special reference to the Erimus Works," by Mr. C. J. Copeland, of Barrow-in-Furness; "On a Feed-water Heater for Stationary and Locomotive Engines," by Mr. George S. Strong, of Philadelphia, U.S.; "On Slipways," by Mr. William Boyd, of Wallsend; "On Compressed Air upon Tramways," by Mr. W. D. Scott-Moncrieff, of London. On Monday, the 1st August, the secretaries' office will be open from 2 to 7 p.m., at the Wood Memorial Hall—adjoining the meeting room—for the registration of addresses, issue of detailed programmes, members' cards, visitors' cards, &c. The office will also be opened on Tuesday, Wednesday, Thursday, and Friday, at 9 a.m., for the same purpose. Members' letters may be addressed to the Institution of Mechanical Engineers, Wood Memorial Hall, Newcastle-on-Tyne. On Tuesday, 2nd August: 10.0 a.m., reception in the lecture room of the Literary and Philosophical Society, by the Mayor of Newcastle, Mr. Jonathan Angus; 10.30 a.m., address of the president, Mr. Edward A. Cowper, the reading and discussion of papers will follow; 1.0 p.m., luncheon at the assembly rooms, by invitation of the general committee; 2.15 p.m., special train from the central station to visit the works of Sir W. G. Armstrong and Co., Elswick, by invitation of the firm; 3.30 p.m., special train from Elswick to Newburn, for members wishing to visit the Newburn Steelworks, by invitation of Messrs. John Spencer and Sons; leaving Newburn on return to Newcastle at 5.10; 4.15 p.m., return by special steamer from Elswick to the Swing Bridge, Newcastle, for members who have not gone on the excursion to Newburn; 4.30 p.m., inspection of Swing Bridge; at 7.0 p.m. the members are invited by Sir W. G. Armstrong, C.B., F.R.S., past president, to dine with him at the Banqueting Hall, Jesmond Dene—evening dress. On Wednesday, 3rd August: 10.0 a.m., meeting in the lecture room for reading and discussion of papers; 1.30 p.m., special train from central station to Jarrow; 2.0 p.m., luncheon at Jarrow, by invitation of Palmer's Shipbuilding Company; 3.0 p.m., inspection of Palmer's Shipbuilding and Engineering Works, Ironworks, &c.; 5.0 p.m., special train from Jarrow to Newcastle. The annual summer dinner of the Institution will be held at the assembly rooms, at 7.30 p.m. Thursday, 4th August: 10.0 a.m., meeting in the lecture room, for reading and discussion of papers; 1.0 p.m., luncheon at the assembly rooms, by invitation of the general committee; 2.15 p.m., special steamer from the quay; 2.45 p.m., arrive at the works of the Wallsend Slipway and Engineering Company; 3.30 p.m., departure from ditto; 3.40 p.m., arrive at the Lead Works of Messrs. Cookson and Co.; 4.40 p.m., departure from ditto; 5.0 p.m., arrive at the Coble Dene Dock; 6.0 p.m., departure from ditto; 6.20 p.m., land on the North Pier at Tynemouth; 6.40 p.m., return from Tynemouth by special train; 8.30 p.m., conversazione in the rooms of the Literary and Philosophical Society, by invitation of the society and of the general committee. The lecture room and Wood Memorial Hall will be lighted by Swan's electric lamps. The museum of the Natural History Society will be open, and an exhibition of microscopes will be on view. Models illustrative of the Stephenson Centenary, &c., will also be on view. Friday, 5th August: 9.55 a.m., special train from central station to Sunderland; 10.30 a.m., arrive at Sunderland. The party will drive to Monkwearmouth Colliery (574 yards deep), and thence by the left bank of the Wear to visit the Southwick Engine Works of Messrs. George Clarke and Co., marine engineers, and the Pallion Iron Shipbuilding Yard and Engine Works of Messrs. William Doxford and Sons. 12 noon, the party will go on board a steamer, by invitation of the River Wear Commissioners, and will be taken down the Wear (passing the Coal Staiths, Railway Bridge, Wearmouth Bridge, &c.), to the new docks, where submarine rock-boring and blasting, with the diamond drill apparatus, will be seen in operation; 1.0 p.m., the party will land to visit the Chain Cable and Anchor Testing Works of the River Wear Commissioners, which will be seen in operation; 1.30 p.m., the party will be received by the commissioners and their chief officials, and will be conducted by them over the docks, witnessing the coal shipping arrangements, working of vessels through the new Sea Lock, &c.; 2.30 p.m., dinner at Queen's Hotel, by invitation of the engineers and shipbuilders of Sunderland; return to Newcastle by ordinary trains. 9.30 a.m., special train from central station to Haydon Bridge; 10.20 a.m., arrival at Haydon Bridge. Conveyances to Langley Barony Mines (two miles) will be provided by the general committee. The party will proceed first to the Honeycrook Works (hoisting, crushing, and cleansing machinery), where those members who wish can enter the mine by the adit to see the process of extracting the ore. Thence the party will proceed to the Leadbitter Shaft and Joicey Shaft (pumping and winding engines, crushing and dressing machinery), and will then drive back to Haydon Bridge. 1.45 p.m., luncheon at Haydon Bridge, by invitation of Bewick and Partners, Limited; 3.0 p.m., special train from Haydon Bridge to Newcastle; 3.50 p.m., arrival at Newcastle.

THE REGISTRATION OF PLUMBERS.

A BILL for the registration of plumbers and the supervision of all plumbing work by the Health Departments of New York and Brooklyn, has been passed by the Legislature at Albany and approved by the Governor. The law with regard to registration will go into effect next March; the more important provisions take effect immediately.

The following rules, drawn up by the New York Board of Health, after consultation with intelligent plumbers and sanitary engineers, will probably be substantially adopted under the new law:—

"When the (plumbing) work is completed and before it is covered from view the Board of Health is to be notified, that it may send inspectors, upon whose report the board will act upon its final approval.

"All materials to be of good quality and free from defects; the work to be executed in a thorough and proper manner.

"All the plumbing in the house so placed as to be readily inspected.

"Every soil pipe and waste pipe of iron, and extending through and at least 2ft. above the roof, of undiminished size.

"No traps on vertical soil pipes or vertical waste pipes.

"The house drain of iron, with a fall of at least ½in. to the foot, and provided with a proper trap near the street, and with an inlet for fresh air just inside the trap. It should run along the cellar wall, and never be hidden under ground.

"These iron pipes to be sound, free from holes, and of a uniform thickness of not less than ⅛in. for a diameter of 2in., 3in., or 4in., or five thirty-seconds of an inch for a diameter of 5in. or 6in. Before they are connected they should be thoroughly coated inside and outside with coal-tar pitch, applied hot, or with some other equivalent substance.

"All joints in the soil-pipes and waste-pipes so calked with lead, or with cement made of iron filings and sal ammoniac, as to make them impermeable to gases.

"When lead pipe or trap is connected with an iron pipe, the joint should be made through a metallic sleeve or ferule, and calked with lead.

"Every sink, every basin, every water-closet, and every tub or set of tubs separately and properly trapped.

"All traps ventilated by a special pipe extending above the roof.

"Every 'safe' under a basin, refrigerator, or other fixture, drained by a special pipe not directly connected with any waste-pipe, drain, or sewer.

"Every water-closet supplied with water from a special cistern, and not by direct connection with the Croton supply.

"No overflow pipe from a cistern to be directly connected with any soil-pipe, waste-pipe, or drain.

"When the pressure of the Croton is not sufficient to supply the cistern a pump should be provided.

"No cistern for drinking water to be lined with lead."

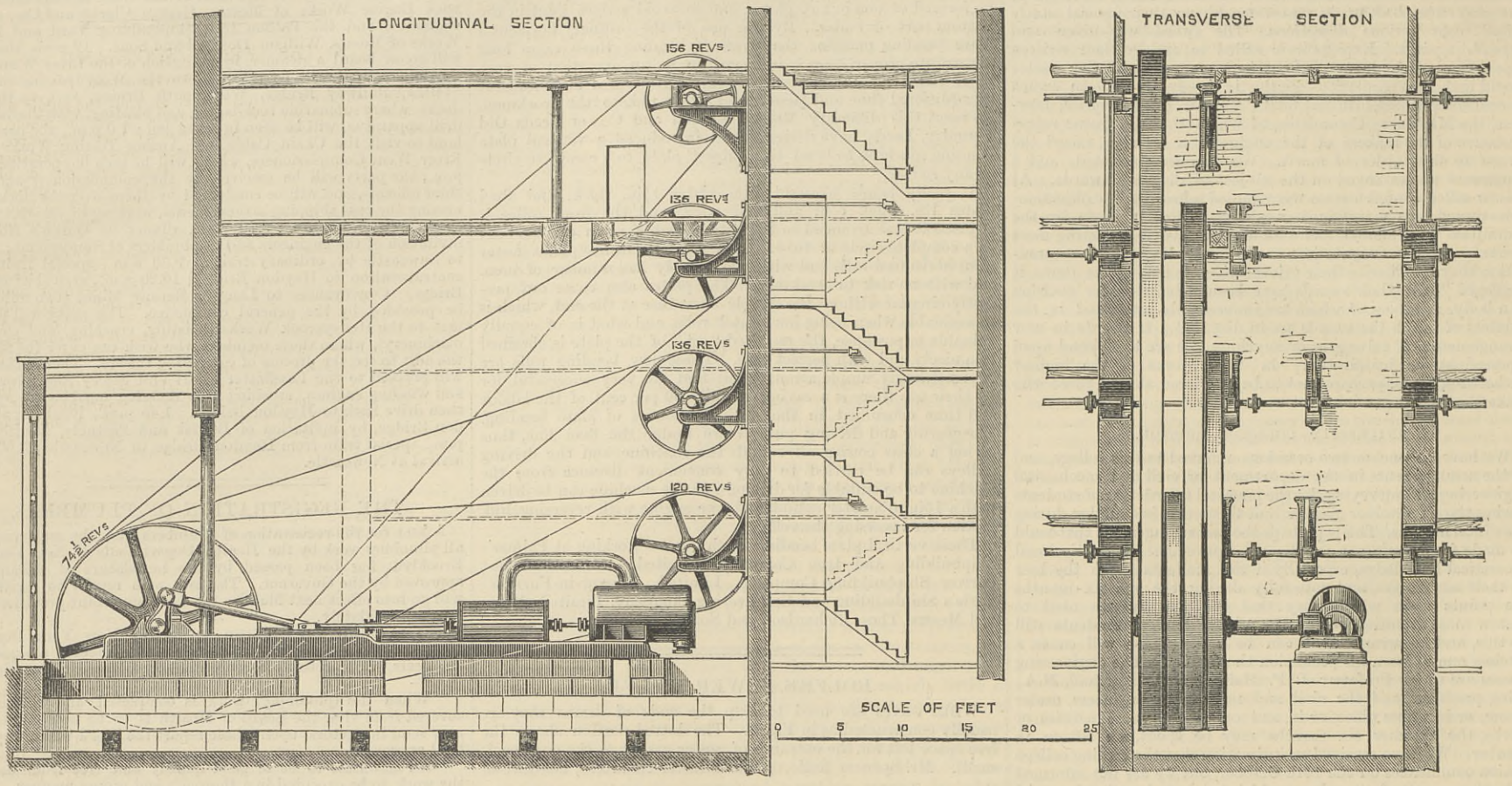
THE IRON AND STEEL INSTITUTE.—The autumn meeting of the Iron and Steel Institute will be held in London on the 11th and three following days of October next.

FLETCHER'S SOLID FLAME COOKING APPARATUS.—Some time since Mr. Fletcher, of Warrington, whose name is so well-known in connection with the application of gas in furnaces of various kinds for laboratory and metallurgical purposes, turned his attention to the construction of gas cooking apparatus, and amongst other things he has made some very excellent solid flame boiling furnaces, in which the mixture of the gas and air is very perfectly effected by their introduction tangentially into a small circular basin-like cavity, which is covered with a stout perforated sheet metal cap, and thus forms a large burner giving a solid flame of great heat, and with combustion so perfect that there is no lighting back and slight explosion when the gas is turned off. The gas may be turned very low, and still a good atmospheric flame is given. The burners are simple in design and made in a variety of forms suitable for either ordinary kitchen use, or as there is no smell given off, or very little, the small form may be used on the breakfast table.

OPENING OF THE CLACTON-ON-SEA WATERWORKS.—On Tuesday last the directors of the Clacton-on-Sea Gas and Water Company formally opened their waterworks at Clacton. The ceremony of starting the engines and pumps, and turning on the water to the town mains, was performed by Mr. S. Chaplin, Mayor of Colchester, in the presence of a large and fashionable assembly. The engineer, Mr. Jabez Church, M. Inst. C.E., F.G.S., who designed and carried out the works, explained the operation of the machinery, and conducted the party over the works, which were tastefully decorated with flags and flowers. The mayor, in an appropriate speech, declared the works to be opened. The party then walked through the company's gasworks, which adjoin the waterworks, where the process of gas manufacture was explained, and afterwards dined at the Royal Hotel by the invitation of the directors of the company. These waterworks were commenced in May, 1880, trial borings having previously been made by the sinking of an artesian well to the depth of 120ft. from the surface, with a boring continued to a depth of 405ft. into the chalk. The water, which is of a remarkably good quality, is pumped into the tower by a 15-horse power engine, and bucket and ram pumps in duplicate. The tower itself is built of red brick with Bath stone dressings, is 101ft. high, and contains a wrought iron circular tank holding over 30,000 gallons, which is carried on wrought iron girders. The service of water will be constant, and the pressure of water sufficient to throw a powerful jet over the highest house in Clacton. The contractor for the well and main laying was Mr. T. Tilley, of Walbrook; for the engine, boiler, pumps, and tower-tank, Messrs. H. Young and Co., of Pimlico; Messrs. Saunders and Son, of Dedham, Essex, were the builders, and Mr. H. Caldecott was clerk of works.

COMPOUND MILL ENGINE FOR MESSRS. ROUSE AND CO., BRADFORD.

MESSRS. TIMOTHY BATES, AND CO., SOWERBY BRIDGE, ENGINEERS.



The engine which we illustrate above is an admirable example of the modern type of spinning mill machinery. Our drawings practically explain themselves; that given above showing the way in which the power is taken off the engine, by a separate belt for every floor.

The engine is at present driving 32,000 worsted spinning and twisting spindles with all the necessary preparing machinery. The engine is indicating 600-horse power, but when fully loaded it will indicate 900-horse power at 74½ revolutions per minute. The friction diagrams for engine and mill show 140 indicated horse-power, including all shafting and straps, which is very moderate. Steam is supplied at 60 lb. pressure by ordinary Lancashire boilers.

The air pump is constructed on a special system which does away with one-half the valves, and has given great satisfaction. The engine, as a whole, reflects much credit on its makers, Messrs. Timothy Bates and Co.—Pollitt and Wigzell.

NOVEL OIL SEPARATOR.

We give an engraving of a machine for separating oil from metal chips, such as turnings, drillings, chips from bolt and screw machines, and from small articles such as screws, bolts, and nuts, which in their manufacture are necessarily coated with oil, much of which is commonly lost. By the use of this machine the oil carried by the chips, screws, &c., is very quickly separated from the metal by centrifugal action, leaving only a slight film, which is beneficial rather than otherwise.

FIG. 1.

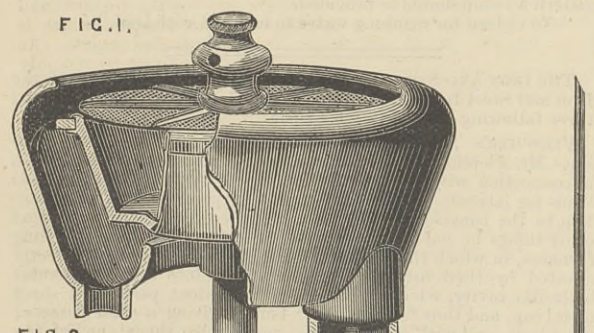
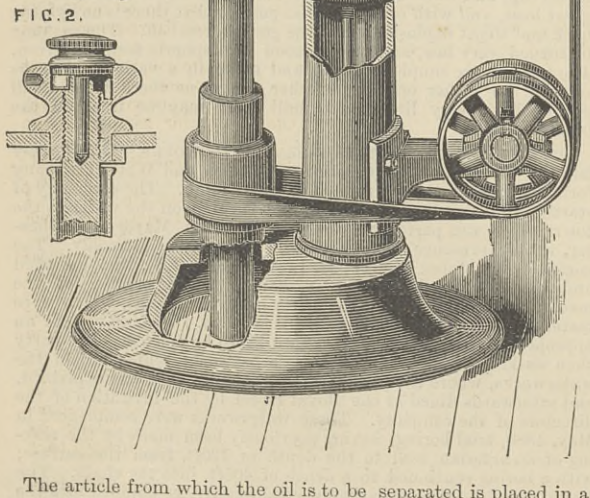


FIG. 2.



The article from which the oil is to be separated is placed in a removable conical pan in the revolving drum, and confined by a metal cover fastened securely over the top of the drum by the lock nut shown in Fig. 2. The machine shown in the illustration is about 30in. high, and requires a floor space about 20in. square. It revolves at a speed of 2000 revolutions a minute, and is noiseless and free from jar. The *Scientific American*, from which we quote, says the machine is well made, carefully finished, and is accompanied by a shaft and hangers. Further information may be obtained of Mr. C. F. Roper, P.O. Box 1211, Boston, Mass.

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

(From our own Correspondent.)

Indications multiply of a steadily augmenting demand for raw and rolled iron alike upon the Birmingham and also the Wolverhampton exchanges. To-day in the former, and yesterday—Wednesday—in the latter town, the attendance was more than customarily numerous at this period of the quarter, with greater readiness by consumers to buy forward. But no ironmaster who has a month's orders on hand in any one of his departments, would book at other than such advances as b.yers were no more prepared to give this than last week.

Orders were sought after for best bars and plates, but otherwise the great majority of the finished iron mills are well supplied with specifications. Girder, and angle, and T-iron is selling a little better in most of the sections; yet boiler plates are in quieter demand than three months ago for all but inferior qualities. High-class bars are in slightly improved request. The makers maintain the positions which, in the matter of prices, they have relatively taken up—two firms demanding £7 10s., and the rest £7, with a further 12s. 6d. for Earl Dudley's iron. But as one of the two firms who require the higher range of prices is engaged mostly upon a class of bars which, being for a special use, secure £9 per ton, the influence of the minority is not considerable upon the market.

Colonial and Government and home orders are increasing for rivet iron of the best brands, and chain iron is in improving request, both for light and for heavy goods. There is likewise a little more doing in exceptional instances in anvil iron, but as a rule the anvil makers still hold heavy stocks.

Medium bars are selling to the local engineers and the merchants, and are going to India, and the Antipodes, and the Cape. Prices range from £6 up to £6 10s. Common bars are in more active request this week, and the consumers have to pay more by from 2s. 6d. to 5s. than they bought at in their contracts of two and three months ago. Makers who then accepted £5 15s. are now requiring £5 17s. 6d. and £6, and they are better able to get these higher prices now than the lower at the earlier date. The same prices, or a little over, have to be given for nail rods, in which, though the current demand is weak, there will soon be a better trade doing, for the obstinate strike of the operative hand nailers looks likely soon to cease in the concession by the employers of the operatives' demands. Shoeing iron was procurable to-day at from £6 down to as low as £5 17s. 6d.

Strip iron keeps in demand and prices remain strong for the time of the year, at for medium qualities of gas strip £6 to £6 2s. 6d. At those quotations consumers are holding off. Hoops are no cheaper on the week. They were quoted yesterday at £6 7s. 6d. to £6 10s., usual qualities, but for the brands of some high-class houses £8 was demanded.

The sheet trade held its own. Every maker is well sold forward, and buyers press rather than withhold specifications. A common quality of working up sheets was to be had to-day at £7, and occasionally a little less. For Russian roofing sheets, on the other hand, there were makers who were asking up to £10, though merchants, who were the chief buyers, declined to give the price. There was less eagerness both yesterday and to-day to buy shown by the galvanisers. A few of them asserted that they were now "out of the market," inasmuch as they "had bought up to Christmas." Makers did not heed this bearing. They still quoted £10 for latens, £8 10s. for doubles, and £7 15s. for singles, intending, perhaps, to give way a trifle in latens, and perhaps a shade in singles, but to require the full figure for doubles.

Galvanised sheets were a shade less strong, the wired advices from Australia having shown a drop of some 10s. per ton on the previously quoted maximum rates. A few firms asked £12 per ton for corrugated 24 w.g. delivered in Liverpool. Excellent shipments are going forward to Australia, to South America, and the Cape. At the same time the home business is stronger, a better demand than last year being expressed by the agriculturists for this commodity both as to rick roofs and as shedding.

Pig makers were firmer in their prices than a month ago, a few makers of good and also medium all-mine hot blast sorts requiring from 1s. 3d. to 2s. 6d. rise for lots needed by new customers. Consequently only old customers were able to-day to buy high-class Staffordshire at £3 5s., and Shropshire at £3 was not pressed. Inferior sorts were checked in their upward tendency by the failure of the attempt to bring about concerted action between the makers in Cleveland and Glasgow for reducing the make in both those centres. Derbyshire, Northampton, and Lincolnshire iron was hard to sell at anything above £2 2s. 6d. Yet £2 5s. and occasionally £2 7s. 6d. was asked. Part-mine iron was quoted £2 5s. to £2 10s.; and cinder pigs, £2 to £2 2s. 6d. In no case, however, did we learn that these prices had been obtained. For Barrow grey forge hematite 65s. was asked, and for foundry qualities, 67s. 6d. to 72s. 6d. per ton.

Machinery is in good demand for export, pumps and pumping engines being in leading request. Rather more has been doing with Russia lately in hydraulic machinery, lifting jacks, differential pulley blocks, &c., and the Government requirements in this line are fairly good. Cartridge machinery for the east of Europe has been in special request of late.

Messrs. Cochrane, Grove, and Co., of Dudley, have just received part of an order for twenty-seven miles of iron mains, which the Liverpool Corporation have divided between this local firm and a Glasgow house, and which will be used on part of the new Liverpool water supply route from Wales.

In the manufacture of the large water pipes for use in Southern Africa, the order for which I have previously recorded, Messrs. Piggot and Co., of the Hooper-street Works, Birmingham, are resorting to gas heat in the welding process. The gas does not pass through a regenerator, but is supplied by a Strong's patent gas furnace.

Amongst the gas engineering work upon which the hands at the same establishment are now engaged is a gasometer 90ft. deep and 190ft. in diameter, and a three-lift holder.

Bridge and girder work, railway roofing and piers are being turned out in large quantities from the heavy ironfoundry yards, and wrought iron tubes are in improving demand for Canada, South Africa, and Australia.

Concurrently with an improved demand for English sporting guns complete, it is satisfactory to know that gun barrels are now being made in Birmingham which, on the score of price, are largely putting a stop to the business which the Belgians were doing in barrels in this country. The large demand on American account for cheap guns is causing a great number of arms to be turned out which will reflect no credit on our English factories, for they are in many instances inferior imitations of standard patterns.

The operative nut and bolt makers of Darlaston have officially withdrawn the notice they had served on their employers to terminate the list of prices and sizes upon which they are being paid. The hands had intended seeking higher wages, but they are content to continue at work and receive wages based on the 1877 list.

At the half-yearly meeting of the Railway Rolling Stock Company, held in Wolverhampton on Tuesday, a profit of £3249 was declared, which is £561 less than last half-year. A dividend at the rate of 3 per cent. per annum was declared.

A dividend for the past half-year at the rate of 7½ per cent. per annum, out of profits, will be recommended at the coming annual meeting of the Sandwell Park Colliery Company.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—Somewhat of a lull has come over the iron trade of this district during the last few days, and the weekly market at Manchester on Tuesday was characterised by a quiet tone, so far as business was concerned. Sellers, however, continue very firm in holding for the slight advance which has recently been made in prices, and even at present rates it is difficult to book orders for extended deliveries. Enquiries are being made in the market for forward contracts, and in a few cases sales of outside brands, with deliveries extending into next year, are reported; very few makers, however, will go further than the end of the year, and in many cases they decline to book further than the next three months.

In Lancashire pig iron a few sales have been made at prices equal to about 44s. for No. 4 forge, and 45s. for No. 3 foundry delivered into the Manchester district, and these prices are now the minimum prices quoted by local makers.

There is no material change to notice in outside brands of pig iron coming into this market. The business doing is still chiefly in Lincolnshire iron, which, delivered equal to Manchester, is quoted at 44s. up to 45s. 6d. per ton, less 2½. Sales of Derbyshire and Middlesbrough iron are extremely limited, and the prices asked for these are little more than nominal, so far as this market is concerned.

In finished iron a more decided improvement is apparent than has yet been established in the pig iron trade. Not only has a considerable business recently been done in bars, and also in hoops and sheets, but there is still a tolerably good inquiry in the market, and the new business has been done at better prices. The average price recently realised for local bars delivered into the Manchester district has been £5 17s. 6d., and makers who throughout Manchester, Bolton, Warrington, and Wigan are generally well supplied with orders, in some cases for the next three months, are now holding out for £6 per ton as the minimum price.

I continue to hear reports all round of increasing activity amongst locomotive builders and in the general engineering

branches of trade, most of which are now getting fairly well occupied, although, as I have previously pointed out, it is as a rule upon very low-priced work.

Inquiries I have made during the week amongst representatives of the men also furnish evidence of a better state of things so far as actual employment is concerned. For several months there has been a gradual decrease in the number of men out of work, and in the various Lancashire districts connected with the Amalgamated Society of Engineers there are at present fewer men reported on the books than has been the case for the last five years.

In the coal trade business continues extremely dull, and although there has been rather more of the common classes of round coal going into consumption for iron making and other manufacturing purposes, this has had no perceptible effect upon the large supplies coming into the market, which are still far in excess of requirements. The only class of fuel upon which there is any pressure for supplies is in the better qualities of slack, and for these sellers are firm, with this exception, prices all through are weak, and although any further permanent reduction of list rates is scarcely probable, stocks are forced upon the market by needy holders at extremely low figures. At the pit mouth the average prices are about as under :—Best coal, 8s. to 8s. 6d.; seconds, 6s. to 7s.; common, 4s. 6d. to 5s. 3d.; burgy, 4s. 3d. to 4s. 9d.; good slack, 3s. 9d. to 4s. 3d.; and common, 3s. to 3s. 6d. per ton.

The rapid development of tramway systems, not only throughout this immediate district, where scarcely a week passes without some new section being opened, but also throughout the country generally, is naturally causing considerable attention to be directed to the important question as to the possibility of employing mechanical means in the place of horse-power for working the traffic, and also to the best construction of carriage. At the large carriage works in this district all kinds of tram-cars are now being turned out, and the progress which has been made in this direction has gone so far that cars have even been constructed with separate inside compartments for the special accommodation of smokers. The great demand, however, is for cars of the lightest possible construction, even at the sacrifice of strength and durability, and the reduction of the weight is one of the main points to which makers have now to turn their attention. In this direction great improvements have been effected upon the cumbersome carriages which were first brought out, and now a large number of light one-horse cars is being produced.

In the direction of applying engine locomotive power to tramways numerous experiments are being made, and a brief reference to what is being done in this district will be of interest. Messrs. Ashbury and Co. and Messrs. Beyer and Peacock, of Manchester, have just completed for the North Staffordshire Tramways Company a combined tramcar and engine from the designs of Mr. Hy. Vignoles, the well-known railway engineer. The engine is of the ordinary locomotive type, the special feature being that all the gearing is carried out of sight, under the carriage platform, the boiler occupying one end of the car. Over this is built the carriage, having the appearance of an ordinary tram-car, divided into two sections, one containing the boiler and affording accommodation for the engine driver, and the other being set apart for the passengers. Seats are carried along the full length of the roof, and a zinc canopy protects the outside passengers from the smoke of the engine funnel, and also from the weather. The piston-rods, condensing pipes, and all working gear carried underneath the car are concealed from view by an apron covering the wheels. Access to the car is provided by a lobby at one end running along one side of the boiler room to the passenger compartment, and a staircase leading to the roof, and at the opposite end of the carriage by the ordinary footsteps and staircase. The car is constructed to carry about sixty passengers, but both its weight and dimensions would seem to stand in the way of the adoption of this description of tram carriage in its present form. The total weight of the carriage and engines is about 11 tons, and the length over the platform is 30ft. 9in., whilst the height from the rails to the top of the canopy is 13ft. 5in. Messrs. Ashbury and Co, are also constructing cars for the Dewsbury, Birstal, and Batley Company, which are to be drawn by a separate engine designed by Messrs. Kitson and Co., of Leeds, and which will be contained in an independent carriage so constructed that when working the engine and passenger carriage will have the appearance of two tram cars linked together.

Another description of engine designed for tramway purposes has just been completed by Messrs. Daniel Adamson and Co., of Hyde Junction, on Col. Beaumont's principle of the application of compressed air. Some time back I referred to the experimental trials which were made at Messrs. Adamson's works with the first engine constructed by Col. Beaumont upon this principle. The results then obtained were highly satisfactory, but the engine itself was too cumbersome for the special purpose with which it had been designed, and in the meantime Messrs. Adamson have devoted their attention to the simplification, as well as the reduction of the weight of the working parts, and the engine which has just been completed, although similar in principle, differs considerably from the one I briefly described a few months back. The new engine resembles in outside appearance an ordinary tramcar, minus the seats on the top, the whole being contained in a cab or house of neat design, having windows at the side and open at both ends for the convenience of the driver. Inside the cab are contained the reservoirs or receivers for storing the air at the pressure required, which is in this system used at an initial pressure of 1000 lb. per square inch. The method of filling the reservoir with air at this pressure has been reduced to a simple process. At the starting or filling station a stand-pipe is provided in a convenient position, and the driver has only to connect this pipe with a branch pipe provided for the purpose on the engine. The stationary engine then pumps in the air, and the time occupied is little more than that required to supply an ordinary locomotive with water. The reservoir being filled, the engine is ready for its journey, and can be worked down until the air is exhausted to a pressure of 200 lb. The great departure in this, from other high-pressure air systems, is that the pressure of 1000 lb. is used direct on the working piston, and a larger volume being used as the pressure in the reservoir reduces, no reducing valve is necessary. An arrangement is also provided to supply a sufficient amount of heat to permit expansion. In accordance with the requirements of the Board of Trade the engine is fitted with automatic brakes and stop valves for controlling the engine when exceeding a speed of eight miles per hour, whilst the engine is capable of being driven from either end so as to avoid the necessity of turntable or other means for the return journey.

Barrow.—The position of the hematite pig iron trade is undisturbed, but there is still a very active demand, and prices are fully maintained. An increased trade is being done with America, and the enquiry which has lately been experienced from this quarter has led to the acceptance of a large amount of business. The consequence of this is being shown in the activity which is observable at all the ports on the coast, and at Barrow in particular, where all the ocean berths are occupied by large steamers taking in cargoes for America, the Continent, and the colonies. It is noteworthy that stocks have within the past few weeks undergone considerable reduction, and at the present time, although large, there is every reason to believe they will be reduced to a much greater extent before October closes. If this proves to be the case the prospects of the winter will be rendered more cheerful, as with heavy stocks in hand at the close of the season it was to be expected that the production of metal, both iron and steel, would be reduced. Bessemer iron is quoted at 56s. per ton at makers' works, and No. 3 forge at 54s. per ton. Shipbuilders having booked one or two very large orders are more than ever busy, and engineers have also participated in the increase of business.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

ON the week there is an improvement in the iron trade, and this improvement is more noticeable in manufactured iron than in raw material. Still pig irons are selling fairly well, the extra demand being caused by the stoppage of certain Lancashire supplies through disputes with the workmen. Plates and sheets are the best going things, and on these the mills are very busy. After Messrs. John Brown and Co., Limited, started their Swinton rolling mill last week—it having been idle for a few years—notices were given in several of the boiler plate rolling mills here that full time would be allowed the men until further notice. This is encouraging, and ironmasters are anticipating a better autumn demand in all lines. The reason of this activity in the plate trade is not far to find. During the past three years casualties to shipping have been extraordinarily great owing to rough weather. Losses of vessels have been exceptionally large, and these losses, because of a slight revival in the shipping trade, are now sought to be replaced. The principal shipbuilders in the Scotch yards have orders for iron-built steamers, consequently both boiler and ship-plates are in great demand. It is well known that in marine engines high pressures are run on the boilers. None but best plates will stand these extreme pressures with safety. Orders, therefore, are being issued to the first-class houses who send out the highest qualities of material requisite in this line. "B. B." plates are asked for largely, and contracts at present in hand indicate a continuance of good trade in this line for some time to come.

Though there is no revival in the pig iron trade of South Yorkshire to an extent which would warrant the blowing in of many of the furnaces at present damped down if it is shown that the present revival is likely to continue we shall hear of some of the old firms again risking moneyi n the smelting trade. It was during this month of last year the prices in the iron trade took an upward leap, and the advance in rates continued until November. Between August and November large contracts were made for forward deliverics, and those deliveries have continued until well into the middle of this year. The company-suppliers who entered into them have done well, but customers badly, owing to the relapses in prices. Last year's experience of revival in the iron trade is therefore keeping buyers back for the present, and the improvement can therefore be only attributable to a sterling and genuine demand.

Passing to the Bessemer department, there also we find an improvement in business. The large contracts which have recently been secured by district houses for rails are relieving stocks, and holders of Bessemer billets decline to book orders under £6 15s. per ton, cash at works. Super billets are fetching £8, and special brands and upwards £9 per ton. The call for these billets is not pressing, but it is steady. The late depression has had one good effect. Converters of Bessemer material have had foreign irons offered to them at very low rates. They have purchased largely, converted the material and stocked, and the metal now being sent out is of much better quality than a year ago. Prices are at least 20s. per ton under the quotations of November last, and business is not so brisk as then; still, it is on a firmer basis, owing to the absence of speculation.

Those engaged in the best cast steel departments are doing well, but this branch of business is confined to the leading houses or old-established connections. Makers of common cast steels are suffering from the competition of agents for Bessemer, and up to the present have had the worst of the fight. The introduction of extra proportions of foreign irons into Bessemer billets, termed in the trade "super," has knocked converters of common cast steels out of the market. It is asserted, and not without truth, the best marked Bessemer, at £9 10s. per ton, is more to be relied on in tempering than cast steel at £12. The latter must necessarily vary in temper in a ton because of its process of unit manufacture, whilst one blowing of Bessemer, if good, is good, and can be depended upon throughout the 8 tons cast at one pouring.

Coalowners are finding trade on the decline, and already many of the collieries in the South Yorkshire district have received notices of reductions of wages. On the other hand, the amalgamation of the South and West Yorkshire Miners' Associations must be regarded as having an influence against further concessions being made on the part of the men. The new association is styled the "Yorkshire Miners' Association," and its council meeting was held yesterday at the Miners' Hall, Barnsley. An executive committee and trustees have been appointed, with Mr. Cowey, of Sharlstone, as president, and Mr. G. Cragg, of Dodworth—president of the late South Yorkshire Miners' Association—as vice-president. It was decided to try to induce the colliery owners in South Yorkshire to adopt a sliding scale, and to ask them to call a meeting at some future date to consider the matter.

In the cutlery trades there is very little fresh to note, excepting the Australian orders are again coming in, principally for goods intended for trans-shipment in the South Sea Island trade. Some good lines have also come in from the Spanish South American provinces, but these are principally placed through London and Birmingham agencies. The country trade in cutlery is dull, and American customers are again holding back their lines; still trade with the United States in better class goods is brisk as compared with twelve months ago.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

QUIETUDE and steadiness were the leading characteristics of the iron market held at Middlesbrough on Tuesday. Prices were not altered in any material degree. No further approach appears to have been made towards fulfilment of the project of blowing out a certain percentage of the blast furnaces of the district, and the idea that the Scotch ironmasters would join in anything of the kind seems now to be generally ridiculed. The partial strike of last week among the blast furnacemen against the award under the sliding scale has lessened the production of pig iron by some thousands of tons, and in so far the accumulation of stock for the month will be less than might otherwise have been reckoned on. Nevertheless, it is believed there will again be an increase when the monthly statistics are made known. The shipments, though they have increased during the last few days, will certainly amount to less than last month, and the local consumption has been affected by partial strikes at the ironworks and shipyards.

No. 3 g.m.b. may be had at 37s. f.o.b. for prompt, and 37s. 6d. for delivery over the remainder of the year. Warrants are offered at 38s., forge iron is 36s., and mottled and white at proportionately lower prices. Connal's stock of Cleveland iron is now 183,528 tons, being an increase of 1216 tons during the week. At Glasgow the total is 572,202 tons. With such stocks and with a production still in excess of consumption, it is not thought likely or probable that pig iron can rise for some time to come; and the probability is there may be a fall of value in the winter, when the shipping season is over, if not before.

Manufactured iron continues steady. Plates are from £6 for large and £6 2s. 6d. for small quantities, free on trucks Middlesbrough, less 2½ per cent. discount. Bars, angles, and iron rails are at £5 12s. 6d., same terms and conditions.

Most of the shipyards on the north-east coast are more or less impeded by partial strikes, the malcontents being at present the platers' helpers. It is thought probable that the disputes will soon be adjusted, but in the meantime they are a source of loss and annoyance, altogether out of proportion to their importance. They are indirectly affecting the manufactured iron trade also by interfering with the execution of contracts. Shearmen and their helpers are continuing to give great trouble at some of the plate mills. Performing as these men do the last operation in the process, they have the power of stopping all previous operations, and inflicting loss and injury on all others concerned in the manufacture; and they do not scruple to exercise their power without notice and on the slightest pretext. A large batch of them are summoned to appear before the Middlesbrough stipendiary on Monday week, to account for a recent act of this kind involving the stoppage of a plate mill for a whole week.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THE annual holidays being now at an end, the public works are again in full operation, and trade prospects, on the whole, appear encouraging. But the iron market has not been very active. Four blast furnaces which had been damped down at Gartsherrie for repairs about ten days previously were again put in blast on Monday, and three others were expected to be lighted up at Eglinton in the course of the week. There are at the time I write 116 in blast as compared with 117 at the same time last year, and of these five are working hematite.

Business was done in the warrant market on Friday at 47s. 4½d. On Monday forenoon transactions were effected at 47s. 5d. to 47s. 5½d. cash, and 47s. 6½d. one month, the afternoon quotations being 47s. 5d. to 47s. 3½d. cash, and 47s. 6d. to 47s. 5½d. one month. The market was flat on Tuesday at 47s. 4½d. to 47s. 2d. cash and 47s. 3½d. one month. On Wednesday the tone was again dull, with business down to 47s. To-day—Thursday—the market was flat, at 47s. to 47s. 1d. cash and 47s. 2d. one month.

The prices of makers' iron are a little easier, although there is not much actual change in the figures :—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1 is quoted at 55s.; No. 3, 49s.; Coltness, 57s. and 49s.; Langloan, 57s. and 49s.; Summerlee, 55s. and 47s.; Calder, 55s. and 48s. 6d.; Carnbroe, 51s. and 47s.; Clyde, 50s. and 46s.; Monkland, 48s. and 45s. 6d.; Quarter, 48s. and 45s. 6d.; Govan, at Broomielaw, 48s. and 45s. 6d.; Shotts, at Leith, 56s. and 49s. 6d.; 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, 48s. and 44s. 6d.; Dalmellington, 48s. and 45s.

The shipments of pig iron from Scottish ports for week ending Saturday last amounted to 12,705 tons, against 11,118 in the preceding week, and 11,062 in the corresponding week of last year. Italy, the United States, and Germany are at present our largest customers.

The malleable trade is generally active, some of the works being unusually busy. A number of fresh orders is reported. The reduction of wages in the North of England will, however, according to rule, affect those here, which will be reduced proportionately.

The coal trade exhibits a gratifying measure of activity. For consumption in the ironworks and factories at home there is a large steady demand, and the shipping trade keeps particularly good.

Efforts have lately been made to organise a miners' union in the West of Scotland. Meetings for this purpose have for the most part been held privately, but the success attending them has only been indifferent, probably because those at the head of the movement are not miners, but outsiders. Two public meetings have been held within the past three days in the neighbourhood of Glasgow, at which proposals were made for restricting the output, but no result of consequence is expected to follow in the meantime. The executive of the Fife and Clackmannan Miners' Association met at Dunfermline on Saturday, and received reports from the mining districts of the two counties, which went to show that the trade is at present in a flourishing condition.

A number of public works has been inaugurated this week in Scotland, besides the Edinburgh Dock at Leith, which was opened on Tuesday by the Duke of Edinburgh. Among these are the Annan Waterworks, which have been erected under the direction of Mr. W. Henderson, C.E., Dumfries, at a cost of £12,000. The reservoir, which is situated seven miles from the town, covers 16 acres, and will hold 27,000,000 gallons. The filter bed and tank, five miles nearer Annan, are at a height of 215ft. above sea level, and will pass about 150,000 gallons daily. Seven-inch pipes convey the water from the tank to the town. Works to supply water to the inhabitants of Corstorphine, near Edinburgh, have likewise been formally opened.

The North British Association of Gas Managers held their annual meetings in Glasgow at the close of last week, under the presidency of Mr. Gilchrist, of Dumbarton.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

STEADY improvement in coal is now the leading feature, and business continues to wear that brisk and hopeful aspect which is suggestive not only of permanence but of improved prices. At Swansea, where business in coal has flagged, I can now see not only a better demand but a stiffening of price, and should this condition last over the next week, and there is a good prospect, there will certainly be a lifting of price. Higher prices are sustained at Cardiff and Newport, and I see that 9s. f.o.b. is quoted for house qualities—Rhondda. Through and through is in demand at 8s. 6d., and even 7s. 6d. and 8s. are obtainable for the small or smiths' coal.

Prices are not lower than they have ruled of late, but there is a lessened demand. Men, too, are not working harmoniously, and there are widespread rumours of impending strikes. For ordinary coke 15s. to 15s. 6d. are asked f.o.b. Liverpool or London; charcoals remain at from 18s. to 19s.

A good show of implements is expected from the midland counties at the Glamorganshire Agricultural Show, to be opened at Merthyr next week. Sheffield, Leeds, Market Harborough, and other places will contribute.

At the close of this week the Art Exhibition will open at Cardiff. Arrangements are made for outdoor exhibition of machinery, and most if not all of the electric lights will be shown, so that there will be a capital opportunity for comparing the various patents.

The iron trade remains without any special feature of interest. Bars are quoted at £5 2s. 6d.; rails from £5 7s. 6d. to £5 10s., according to specifications; steel rails, £6 5s. to £6 10s., though I have known steel sold at £6. Heavy wrought scrap will fetch 70s.; old iron generally is rather low at from £2 to £2 2s. per ton.

I have still no movement to record from Cyfarthfa. Modifications and improvements are being carried out at various works at Swansea, Treforest, and Tredegar. A large business is being done in foreign ore. Newport alone has received in the half-year ending June no less than 1,325,000 tons. Many of the leading iron firms are now buying freely, prices being as low as can be reasonably expected, viz., 14s. per ton. For quantities sales can even be effected at 13s. per ton. This is a considerable reduction to the ruling figure last year. I know one firm who bought at 30s. something like 30,000 tons. The course now would be to finance by purchasing at 13s., and as prices improve—and it is expected they will—the ruinous loss may be modified considerably.

The South Wales and Bristol Wagon Works announce a dividend of 10 per cent., and a substantial balance carried forward.

LAW AND CLARK'S CIVIL ENGINEERING.—While admitting the propriety of closing the correspondence on this subject as we did in our last impression, Mr. Law wishes it to be pointed out with respect to the paragraph of the last letter published relating to sleepers, that "the original reading in Mr. Law's book was 'the form of sleeper most generally employed,' and in the new edition this reads 'the form of sleeper most universally employed.'"

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.

19th July, 1881.

3132. WINDING, &c., J. and J. Horrocks, Manchester.
3133. BEVERAGE, C. Kempster, jun., Nessciffe.
3134. MOULDING, &c., T. and J. Humphreys, Hulme.
3135. SCREW PROPELLERS, W. Morrison and C. Norfolk, Kingston-upon-Hull.
3136. BOTTLES, &c., T. P. Richardson, Wordsley.
3137. LACTIC ACID, H. J. Haddan.—(*C. E. Avery, U.S.*)
3138. SOAP LYES, F. Versmann, New Charlton.
3139. LAMPS, W. R. Lake.—(*E. B. Requa and F. F. Lambert, U.S.*
3140. TELEGRAPHS, E. G. Brewer.—(*T. A. Edison, U.S.*)
3141. TOOTH-BRUSHES, G. Gillies, London.
3142. PURIFYING LIQUORS, W. R. Lake.—(*Purifying and Maturing Process Company, Hartford, U.S.*)
3143. SMALL-ARMS, J. S. Edge, jun., Yardley, and J. Deeley, Birmingham.
3144. PICKERS, C. F. and E. Burslem, Chedale.
3145. HEATING GASES, H. Haug, Germany.
3146. BRAKES, G. K. Winter, Norwood.
3147. GERMINATING GRAIN, &c., A. J. and A. Q. Reynolds, Southampton-buildings, London.
3148. STEAM ENGINES, W. R. Lake.—(*D. Renshaw and H. T. Litchfield, Massachusetts, U.S.*)
3149. MALT EXTRACT, H. R. Randell, London.
3150. DRYING, &c., W. R. Lake.—(*C. G. Till, U.S.*)
3151. TEACHING CHILDREN the ALPHABET, W. C. Day, Bedford-square, London.

20th July, 1881.

3152. STORING, &c., HEAT, F. Webb, J. Reddrop, and M. Foye, Crewe.
3153. DISPATCH TUBES, &c., T. J. Mayall, Reading, U.S.
3154. MELTING, &c., POTS, J. Brown, Cradley.
3155. ALARM SIGNALS, A Kelday, London.
3156. FURNACES, &c., T. E. Parker, Fondon.
3157. HOSE COUPLING, W. E. Gedge.—(*D. Kendall, U.S.*)
3158. WEIGHING CRANES, L. A. Groth.—(*A. Verdiere, Paris.*)
3159. SAFETY SHAVING APPARATUS, L. A. Groth.—(*A. C. T. Adam, Germany.*)
3160. LOOMS, H. J. Haddan.—(*L. J. Knowles, U.S.*)
3161. LOOMS, H. J. Haddan.—(*L J. Knowles, Y.S.*)
3162. PAPER BAGS, J. H. Johnson.—(*W. C. Cross, U.S.*)
3163. EVAPORATING VACUUM APPARATUS, F. H. F. Engel.—(*Niederberger and Co., Hamburg.*)
3164. MACHINE GUNS, T. Nordenfelt, London.
3165. BORING BLOCKS, J. F. Wiles, Old Charlton.
3166. ELECTRIC LAMPS, W. Morgan-Brown.—(*G. P. Harding, Paris.*)
3167. PERFORATING CHEQUES, &c., R. Donkin, London.
3168. FIRE-ARMS, H. Simon.—(*F. Vetterli, France.*)
3169. DYNAMO, &c., MACHINES, A. M. Clark.—(*W. Laing, Paris.*)

21st July, 1881.

3170. COOLING, &c., AIR, R. R. Gibbs, Liverpool.
3171. GAS, W. P. Thompson.—(*H. T. Smith and H. U. Alcock, Australia.*)
3172. PRESSURE GAUGES, &c., T. Bassnett, Liverpool.
3173. RAISING LIQUIDS, P. J. Catterall and E. Birch, Manchester.
3174. FENCE WIRE, A. C. Henderson.—(*Messrs. Witte and Kamper, Osnabrück, Germany.*)
3175. STEERING, &c., VESSELS, A. Figge, G. A. Köttgen, and H. Wedekind, Broad-street, London.
3176. CARPETS, E. Crossley, G. Marchetti, R. Cochrane, and W. Mallinson, Halifax.
3177. CASES for WIRES, T. J. Mayall, London.
3178. FASTENING APPARATUS, T. Taylor, Derby.
3179. HEALING WOUNDS, G. Lowe, Barnet.
3180. TRICYCLES, J. G. Smith, Lancaster.
3181. BOILERS, F. C. Glaser, Berlin.—(*H. Heine, Berlin.*)
3182. BOILER FURNACES, P. F. Dundon, San Francisco.
3183. DECORATING PAPER HANGINGS, W. Cunningham and W. Cunningham, jun., Park-walk, Chelsea.
3184. TANNING, W. H. Cox, Russell-street, London.
3185. SOLITAIRES and STUDS, L. A. W. Lund, London.
3186. SPEED GOVERNORS, M. Havelock, Newcastle-upon-Tyne.
3187. ELECTRIC LAMPS, W. R. Lake.—(*J. Nichols, U.S.*)
3188. MALLEABLE BRONZE, H. Lake.—(*L. Létrange, Paris.*)
3189. ELECTRIC LAMPS, W. R. Lake.—(*H. Maxim, U.S.*)
3190. ELECTRIC LIGHTING, R. H. Hughes, London.

22nd July, 1881.

3191. METAL TYPE, G. K. Cooke, Fleet-street, London.
3192. ROLLING LEATHER, E. Wilson, Exeter.
3193. VALVE GEAR, G. L. Lambert, Nottingham.
3194. SCISSORS, &c., G. G. M. Hardingham, London.
3195. RAILWAY SLEEPERS, H. L. Bucknall, London.
3196. PIANOFORTE ACTIONS, J. Browne, London.
3197. GALLERY for GLOBES, &c., J. W. Cade and T. W. Duffy, Liverpool.
3198. FASTENING ROPES, J. W. Cade and T. W. Duffy, Liverpool.
3199. COMBINATION CARRIAGE, J. N. Rowe, Lancashire.
3200. TRICYCLES, A. Burdess, Coventry.
3201. PRINTING, W. P. Thompson.—(*A. H. Rogers, U.S.*)
3202. STANDARD WEIGHTS, W. Parnall, Bristol.
3203. SPRINGS, W. Buckley, Sheffield.
3204. LAWN TENNIS BATS, C. Simons, Gloucestershire.
3205. WRITING INSTRUMENTS, J. Kuttner, London.
3206. HARVESTING, H. H. Lake.—(*D. M. Osborne, U.S.*)
3207. ROUND WROUGHT CHENILLE, C. Gorecki, Paris.
3208. PREPARING COTTON, &c., J. Higgins and T. S. Whitworth, Salford.
3209. GAS, C. S. Ellery, Bath.
3210. LIGHTING LAMPS, W. H. Stokes, Birmingham.
3211. OBTAINING ZINC, H. Lake.—(*L. Létrange, Paris.*)
3212. VELOCIPEDES, G. Singer, Coventry.
3213. RIFLE, C. Garbe, Berlin.
3214. ELECTRIC LAMPS, A. M. Clark.—(*L. J. Bouteilloux and W. Laing, Paris.*)
3215. CENTRIFUGAL MACHINES, J. H. Johnson.—(*La Société dite Raffinierie de St. Ouen, Paris.*)

23rd July, 1881.

3216. SUGAR, W. E. Halse.—(*U. Esmarch and E. Passbury, St. Petersburgh.*)
3217. FASTENERS, E. P. Wells, Notting-hill, London.
3218. REGISTERING the TRAVEL of VEHICLES, R. H. Brandon.—(*L. Pouget, Montpellier.*)
3219. PULLEY BLOCK, R. Priest, Stafford.
3220. LOOMS, C. T. Bradbury & R. Harrison, Chester.
3221. SCOURING, &c., FABRICS, J. Warrall, Ordsall, Salford, and J. Kershaw, Wadsworth, Halifax.
3222. DRYING FABRICS, R. F. and W. H. Carey and W. Partington, Bulwell.
3223. CAMP, &c., FURNITURE, T. Barnby, Birmingham.
3224. GALVANIC BATTERIES, J. and A. J. Higgin, Manchester.
3225. SAWING MACHINES, T. Robinson.—(*W. Smyth, U.S.*)
3226. WEAVING, R. Ecroyd, Lomeshaye.
3227. CHANGEABLE LASTS, J. Fieldhouse, Keighley.
3228. CONTROLLING TELEPHONIC COMMUNICATIONS, J. Imray.—(*L. A. Brassear and O. Dajaer, Brussels.*)
3229. RAILWAY BRAKE, T. H. Ramsden, Snailesworth.
3230. PAPER BAGS, T. Coates, Carlisle.
3231. COMMUTATORS, E. G. Brewer.—(*T. Edison, U.S.*)
3232. CARBONISING, &c., SUBSTANCES, W. L. Wise.—(*Messrs. Pilon, Freres, et Cie., Paris.*)
3233. SPINNING, T. Coulthard, Preston.
3234. GAS, S. Pitt.—(*A. Berland, St. Petersburgh.*)
3235. DISPLAYING ADVERTISEMENTS, W. Dorset, London.

25th July, 1881.

3236. SHARPENING the TEETH of CARD-RIBBON, A. C. Henderson.—(*Messrs. A. Rousseau and Sons, France.*)
3237. TWIST LACE, &c., MACHINES, J. R. Hancock.
3238. ELECTRIC CONTACT, B. J. B. Mills.—(*G. Leclanché, Paris.*)
3239. FEED-WATER HEATERS, J. H. Johnson.—(*G. Strong, Philadelphia, U.S.*)
3240. ELECTRIC LIGHT, T. E. Gatehouse, Camberwell.
3241. ARMY TRENCHING TOOL, A. H. Storey, London.
3242. PRINTING PLACARDS, W. Brierley.—(*P. Dhonau, Dresden, Saxony.*)
3243. COMBING FIBRES, G. Little, Oldham.
3244. CORDS, &c., W. Dean and A. Orrah, York.
3245. VELOCIPEDE, T. Brown, Euston-road, London.
3246. PUMPS, H. J. Haddan.—(*L. Maneny, France.*)
3247. ELECTRIC CLOCKS, F. T. Reid, Exeter, and J. U. Valentine, Teignmouth.
3248. CAPS and HATS, S. K. Prager, London.
3249. BELLS and GONGS, R. C. Lindop, Liverpool.
3250. STEAM COOKING APPARATUS, D. Grove, Berlin.
3251. SUPPLYING WATER to ENGINES, D. Halpin, London.

Inventions Protected for Six Months on deposit of Complete Specifications.

3137. LACTIC ACID and LECTILES, H. J. Haddan, Kensington, London.—A communication from C. E. Avery, Boston, U.S.—*19th July*, 1881.
3141. PURIFYING ALCOHOLIC LIQUORS, W. R. Lake, Southampton-buildings, London.—A communication by the Purifying and Maturing Process Company, Hartford, Connecticut U.S.—*19th July*, 1881.
3157. HOSE COUPLING, W. E. Gedge, Wellington-street, London.—A communication from D. B. Kendall, Howland Flat, U.S.—*20th July*, 1881.
3160. LOOMS, H. J. Haddan, Strand, London.—A communication from L. J. Knowles, Massachusetts, U.S.—*20th July*, 1881.
3161. LOOMS, H. J. Haddan, Strand, London.—A communication from L. J. Knowles, Massachusetts, U.S.—*20th July*, 1881.
3182. BOILER FURNACES, P. F. Dundon, San Francisco, U.S.—*21st July*, 1881.

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

2901. ENGINES, R. Waller, Helbeck Moor Foundry, Leeds.—*20th July*, 1878.
2884. FILTER PRESSES, J. Bowing, Old Broad-street, London.—*19th July*, 1878.
2895. TRANSPARENT, &c., DEVICES, J. E. Jefferies, Yeo Bank, Congresbury.—*20th July*, 1878.
2904. PUNCHING JACQUARD CARDS, T. Nuttall, Ramsbottom.—*20th July*, 1878.
2905. BRASS SCREW NUTS, W. E. Everitt, Birmingham. *20th July*, 1878.
2939. TUBULAR, &c., FORMS of IRON and STEEL, J. G. Willans, Bayswater, London.—*24th July*, 1878.
3038. BELTS or BANDS, M. Gandy, Liverpool.—*31st July*, 1878.
3894. TRAMWAYS, W. Mackison, Dundee.—*20th July*, 1878.
3103. DISTRIBUTING, &c., TYPES, H. J. Haddan, Strand, London.—*6th August*, 1878.
2912. PRODUCING DESIGNS, W. B. Woodbury, Norwood. *22nd July*, 1878.
2913. KILNS, C. Amand, Boulevard de Strasburg, Paris.—*22nd July*, 1878.
2919. CUTTING HEDGES, A. Ridgway, Market-place, Macclesfield.—*22nd July*, 1878.
2923. STOP-TAP BOXES, C. T. Hill, Heywood.—*23rd July*, 1878.
3222. BORING, &c., R. H. Brandon, Southampton-buildings, London.—*15th August*, 1878.
3252. TREATING SACCHARINE, A. P. Price, Lincoln's-inn-fields, London.—*17th August*, 1878.
2945. OPERATING WINDOW BLINDS, N. Hunt, Ashley Down.—*24th July*, 1878.
2958. DRYING WHITE LEAD, J. C. Martin, Richmond.—*25th July*, 1878.
2968. CHAINS, R. Applegarth, Abchurch-lane, London. —*26th July*, 1878.

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

2537. PULVERISING SUBSTANCES, J. R. Alsing, Finsbury-square, London.—*20th July*, 1874.
2564. REAPING MACHINES, W. M. Cranston, Worship-street, London.—*22nd July*, 1874.
2696. DENTAL ENGINES, G. T. Bousfield, Sutton.—*4th August*, 1874.
2587. GAS, H. Aitkin, Falkirk.—*24th July*, 1874.
2606. REFINING LOAVES of SUGAR, F. Wirth, Frankfort-on-the-Maine, Germany.—*25th July*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 12th August, 1881.

919. CONVERTING RECIPROCATING MOTION into ROTARY MOTION, E. Edmonds, Fleet-street, London.—A communication from F. B. Nichols and C. Thomson, Halifax, Nova Scotia.—*3rd March*, 1881.
994. CONDENSING APPARATUS, J. Spence, Newcastle-on-Tyne.—A communication from J. C. Spence, Calcutta.—*8th March*, 1881.
1149. WATER PIPES, L. S. Powell, St. James-square, Notting-hill, and C. V. Boys, Wing Oakham.—*16th March*, 1881.
1168. INDICATING APPARATUS, W. R. Lake, Southampton-buildings, London.—Com. from P. J. Pointe and C. P. Porcher, Paris.—*17th March*, 1881.
1181. TAPS or COCKS, S. Hands and W. Weaver, Wolverhampton.—*18th March*, 1881.
1184. PIPE JOINTS, J. A. Berly, Relf-road, Peckhamrye, London.—A communication from L. Langlois, Rue Viérinkx, Louvain, Belgium.—*18th March*, 1881.
1185. MACHINE GUNS, F. Löbel, Brighton. —*18th March*, 1881.
1206. ELECTRICAL APPARATUS, R. R. Harper, Finsbury, London.—*19th March*, 1881.
1220. INGOTS, J. H. Johnson, Lincoln's-inn-fields, London.—A communication from E. Wheeler, Philadelphia, U.S.—*19th March*, 1881..
1238. TRAMWAYS, &c., H. P. Holt, Park-row, Leeds.—*21st March*, 1881.
1249. TAPS or COCKS, P. O'Connor, Wavertree.—*22nd March*, 1881.
1276. CUTTING PAPER, &c., J. H. Johnson, Lincoln's-inn-fields, London. — A communication from H. Schlatter, Reutlingen, Germany.—*23rd March*, 1881.
1359. SCREW PROPELLERS, N. D. Spartali, Liverpool.—*26th March*, 1881.
1457. VENTILATING APPARATUS, R. H. Reeves, Parkhurst.—*2nd April*, 1881.
1562. SOAP, H. H. Lake, Southampton-buildings, London.—Com. from B. Jaffé and Darmstaedter, Charlottenburg, Germany.—*9th April*, 1881.
1618. LATCHES and LOCKS, G. E. Wilson, Leeds.—*13th April*, 1881.
1739. STIFFENERS for CORSETS, &c., E. P. Alexander, Southampton-buildings, London.—Com. from L. C. Warner, New York, U.S.—*22nd April*, 1881.
2603. WASHING WOOL, &c., J. Clough, Grove Mills, near Keighley.—*15th June*, 1881.
2684. BREAKING STONES, &c., H. J. Ramu, Brussels.—*18th June*, 1881.
2744. METAL CANS, C. Laurent, St. Pancras, London, and H. W. Brand, Mayfair, London.—*23rd June*, 1881.
2816. TREATING SPENT LYES, G. Payne, Millwall, London.—*27th June*, 1881.
2857. PUMPS, &c., K. W. A. Leverkus, Manchester.—*30th June*, 1881.
2867. TELEPHONIC APPARATUS, W. E. Potter, Liverpool. —*1st July*, 1881.
2953. THERMOMETER, M. Immisch, Highgate-road, London.—*6th July*, 1881.
3137. LACTIC ACID, &c., H. J. Haddan, Kensington, London. —A communication from C. E. Avery, Boston, U.S.—*19th July*, 1881.

Last day for filing opposition, 17th August, 1881.

1075. CAPS, D. Butterfield, Keighley.—*12th March*, 1881.
1126. SHARPENING PENCILS, J. Darling, Glasgow.—*15th March*, 1881.
1227. CLEANING and SEPARATING WHEAT, &c., E. Davies, Liverpool.—*21st March*, 1881.
1235. ELECTRIC LIGHTING, G. A. Tabourin, Marseilles. —*21st March*, 1881.
1236. ELECTRIC LAMPS, &c., J. A. Berly, Relf-road, Peckham-rye, London.—*21st March*, 1881.
1244. COATING METAL PLATES, R. and J. Lewis, Llanelly.—*21st March*, 1881.
1245. AXLES, &c., W. M. Riddell, Finsbury-pavement, London.—*21st March*, 1881.
1250. SHOWSTANDS, L. A. Groth, Finsbury-pavement, London.—A communication from A. Dubois, Paris. —*22nd March*, 1881.
1252. RAISING, &c., WINDOW SASHES, J. W. Lewis, Halifax.—*22nd March*, 1881.
1265. UNCOUPLING, &c., APPARATUS, C. F. C. Morris and F. H. Bennett, Blackfriars-road, London.—*22nd March*, 1881.
1267. COMBINED COUCH and ARMCHAIR, F. W. Sinnock, Bristol, and G. R. Martin, Bath.—*22nd March*, 1881.
1269. NECKTIES, &c., S. W. Robinson, Nottingham.— *22nd March*, 1881.
1271. PICKLING, &c., IRON, D. and W. Rosser, Cilfrew Tin Plate Works, near Neath.—*22nd March*, 1881.
1277. FURNACES or STOVES, H. G. Grant, Bull's Head-chambers, Hopwood-avenue, Market-place, Manchester.—A communication from A. Prevot, Bergerac, France.—*23rd March*, 1881.
1298. FOLDING CRATES, &c., J. R. Kelsey, Strutton-ground, Westminster.—*23rd March*, 1881.
1303. WINDING-UP WATCHES, &c., H. H. Lake, Southampton-buildings, London.—A communication from K. Vogel, United States.—*23rd March*, 1881.
1308. SCREWS, S. Gibbs, Herne Bay.—*24th March*, 1881.
1319. SUSPENDING, &c., APPARATUS, G. Keey, Birmingham.—*24th March*, 1881.
1327. HEATING STOVE, T. Morgan, Cockspur-street, Westminster.—A communication from O. Elterich, Nurenberg, Bavaria.—*24th March*, 1881.
1354. CASTING METALS, J. C. Mewburn, Fleet-street, London.—A communication from J. Demogeot, Paris. —*26th March*, 1881.
1386. UTILISING LIQUID FUELS, H. N. Crellin, jun., Parkside, Kew-road, Richmond, and C. S. Rolfe, Westminster-chambers, Westminster.—*29th March*, 1881.
1394. SIGNALLING APPARATUS, J. C. Park and H. J. Pryce, Bow, London.—*29th March*, 1881.
1411. HYDRAULIC APPARATUS, E. de Pass, Fleet-street, London.—A communication from P. O. Oechelhäuser, Berlin, Germany.—*31st March*, 1881.
1445. HAIR FELT, J. Erskine, Greenock.—*1st April*, 1881.
1483. COCKS, &c., J. Ingleby, St. Peter's-square, Manchester.—A communication from R. Meyer, Breslau. —*5th April*, 1881.
1514. STEERING APPARATUS, F. W. Willcox, Sunderland.—*6th April*, 1881.
1654. MEASURING APPARATUS, A. M. Clark, Chancery-lane, London.—A communication from T. Sourbé, Bordeaux.—*14th April*, 1881.
1678. WOOLLEN FABRICS, J. H. Riley, Bury.—*16th April*, 1881.
1708. BOAT PLUG, A. M. Clark, Chancery-lane, London. —A communication from L. H. Rymond, New York, U.S. —*19th April*, 1881.
1787. DYNAMO-ELECTRIC MACHINES, A. M. Clark, Chancery-lane, London.—Com. from H. J. Müller and A. Levett, New York, U.S.—*25th April*, 1881.
1801. PREVENTING RADIATION OF HEAT, R. Stewart, Leadenhall-street, London.—*26th April*, 1881.
2093. CORN MILLS, A. E. F. Chattaway, Wixford.— *13th May*, 1881.
2311. PAPER-CUTTING MACHINES, J. Kenyon and W. Ainsworth, Blackburn.—*26th May*, 1881.
2378. FIRE-ARMS, W. Nokes, Chester-street, Aston.— *31st May*, 1881.
2442. TAPS, &c., J. L. Corbett and W. Lochhead, Glasgow.—*3rd June*, 1881.
2498. MOTOR ENGINES, W. R. Lake, Southampton-buildings, London.—Com. from M. Arzberger and A. Oblasser, Austria.—*8th June*, 1881.
2537. METALLIC ALLOYS, &c., G. A. Dick, Cannon-street, London.—*10th June*, 1881.
2747. PURIFYING WATER, G. Bischof, Hart-street, Bloomsbury, London.—*23rd June*, 1881.
2924. ENGINES, G. W. Robertson, Glasgow, and I. Beck, Sheffield.—*5th July*, 1881.
2942. WAGONS, F. F. Redfern, South-street, Finsbury, London.—A communication from M. V. Wormer, Darfton, U.S.—*5th July*, 1881.
2949. COTTON ROPES, H. Birkmyre, Port Glasgow.— *6th July*, 1881.
2962. RAILWAY VEHICLES, W. R. Lake, Southampton-buildings, London. — A communication from W. Robinson, Boston, U.S.—*6th July*, 1881.
2993. BREECH-LOADING SMALL-ARMS, S. B. Allport, Birmingham.—*7th July*, 1881.
3019. COMBING COTTON, W. R. Moss, Bolton.—*9th July*, 1881.
3058. JOURNAL BEARINGS, W. R. Lake, Southampton-buildings, London.—A communication from J. R. Baker, Jersey, U.S.—*12th July*, 1881.
3068. HAMMOCKS, A. M. Clark, Chancery-lane, London. —A communication from V. P. Travers, New York, U.S.—*14th July*, 1881.
3157. HOSE-COUPLING, W. E. Gedge, Wellington-street, Strand, London.—A communication from D. B. Kendall, Howland Flat, U.S.—*20th July*, 1881.
3160. LOOMS, H. J. Haddan, Kensington, London.—A communication from L. J. Knowles, Massachusetts, U.S.—*20th July*, 1881.
3161. LOOMS, H. J. Haddan, Kensington, London.—A communication from L. J. Knowles, Massachusetts, U.S.—*20th July*, 1881.
3182. BOILER FURNACES, P. F. Dundon, San Francisco, U.S.—*21st July*, 1881.

Patents Sealed.

List of Letters Patent which passed the Great Seal on the 22nd July, 1881.)

151. MICROSCOPES, F. H. Wenham, New Bond-street, London.—*12th January*, 1881.
307. PREVENTING WATER from FREEZING, J. Rule, Dublin.—*24th January*, 1881.
330. ROUGHING HORSESHOES, W. Bishop, Blenheim Cottages, Sebastopol-road, Lower Edmonton.—*25th January*, 1881.
334. WASHING and SEPARATING ORES, &c., D. Burns, Brookside, Haltwhistle.—*25th January*, 1881.
339. REAPING, &c., MACHINE, A. I. Boss, Bloomsbury, London.—*26th January*, 1881.
342. HANSOM CABS, W. Johnstone, Edinburgh.—*26th January*, 1881.
379. DISTRIBUTING APPARATUS, T. E. Golding, Conduit-street, Bond-street, London.—*28th January*, 1881.
382. BRAKES, J. Lansley, Basingstoke.—*28th January*, 1881.
401. FASTENINGS for BRACELETS, &c., E. Atkins, Birmingham.—*29th January*, 1881.
413. UNHAIRING, &c., HIDES and SKINS, E. G. Brewer, Chancery-lane, London.—*31st January*, 1881.
488. MOULD JOINTS, C. J. Allport, Queen Victoria-street, London.—*4th February*, 1881.
489. NAILING BARREL HOOPS, W. Morgan-Brown, Chancery-lane, London.—*5th February*, 1881.
500. SEWING, &c., MACHINES, W. E. Gedge, Wellington-street, Strand, London.—*5th February*, 1881.
508. SLABS, &c., of SUGAR, M. Bauer, Boulevard Magenta, Paris.—*7th February*, 1881.
609. SPRING BEDS, E. P. Alexander, Southampton-buildings, London.—*12th February*, 1881.
681. SOAP, W. R. Lake, Southampton-buildings, London.—*16th February*, 1881.
744. DOOR CHAINS, &c., H. Skerrett, Whitby-road, Sparkbrook.—*21st February*, 1881.
777. PRINTING PRESSES, A. M. Clark, Chancery-lane, London.—*23rd February*, 1881.
924. STRENGTHENING MASTS, &c., H. J. Harrison, Liverpool.—*4th March*, 1881.
1010. SPINNING HEMP, &c., J. Barbour, Belfast.—*9th March*, 1881.
1205. PRESERVING ORGANIC SUBSTANCES by GAS, C. F., A. W., and A. L. Lawton, New Rochester, U.S.— *23rd March*, 1881.
1643. STEELYARDS, O. Jones, Salford.—*14th April*, 1881.
1649. SIGNALS, A. J. Boult, High Holborn, London.— *14th April*, 1881.
1783. MEASURING ELECTRIC CURRENTS, E. G. Brewer, Chancery-lane, London.—*25th April*, 1881.
1802. ELECTRIC LIGHTS, &c., P. Jensen, Chancery-lane, London.—*26th April*, 1881.
1856. RAILWAYS, A. W. L. Reddie, Chancery-lane, London.—*29th April*, 1881.
1904. ORNAMENTING WOOD, &c., A. Martin, Store-street, Bedford-square, London.—*3rd May*, 1881.
1918. CARBON CONDUCTORS, E. G. Brewer, Chancery-lane, London.—*3rd May*, 1881.
1941. TIRE FASTENER, A. Longsdon, New Broad-street London.—*4th May*, 1881.
1943. ELECTRIC LIGHTING, E. G. Brewer, Chancery-lane, London.—*4th May*, 1881.
2277. SEWING BOOKS, &c., D. M'C. Smyth, Hartford, U.S.—*24th May*, 1881.
2295. TREATING REFUSE MATTER, A. Baron von Podewils, Munich, Bavaria.—*25th May*, 1881.
2384. OSCILLATING STEAM ENGINES, H. J. Haddan, Strand, Westminster.—*31st May*, 1881.

(*List of Letters Patent which passed the Great Seal on the 26th July*, 1881.)

4245. TREATING ORES, J. C. Stevenson and J. G. Tatters, Westoe.—*26th February*, 1881.
361. SADDLES, A. Scholefield, Halifax.—*27th January*, 1881.
365. ACID, W. J. Cooper, Westminster-chambers, Westminster.—*27th January*, 1881.
377. SAFETY VALVE and GAUGE, E. Field and P. M. Cotton, Chandos-chambers, Adelphi, Westminster.— *27th January*, 1881.
394. GAS BURNER REGULATORS, W. W. Wynne, Chancery-lane, London.—*28th January*, 1881.
398. SCALES, H. J. Haddan, Strand, Westminster.— *29th January*, 1881.
406. ICE, J. Hopkinson, Manchester.—*29th January*, 1881.
411. SPINNING APPARATUS, J. Hodgkinson, Bolton.— *31st January*, 1881.
418. STOPPERS for BOTTLES, B. Zibach, Whitechapel-road, London.—*31st January*, 1881.
421. MACHINE REST, &c., H. and W. Sutcliffe, Halifax. —*1st February*, 1881.
427. HORSESHOES, R. Ingram, Store-street, London.— *1st February*, 1881.
454. TAPS, &c., E. J. Collis, Stourbridge, and J. D. Ready, Wolverhampton.—*3rd February*, 1881.
456. COMBINED MUFF, BAG, &c., I. Pick, Queen Victoria-street, London.—*3rd February*, 1881.
477. FILTER, T. Dunlevie, Station-street, Burton-on-Trent.—*4th February*, 1881.
587. HYDRAULIC CRANES, F. W. Walker, Leeds.—*10th February*, 1881.
591. TABLE, W. R. Lake, Southampton-buildings, London.—*10th February*, 1881.
620. PACKING SUGAR, &c., A. Scots, jun., and J. D. Scott, Greenock.—*14th February*, 1881.
881. MOULDING APPARATUS, W. A. Ingalls, Providence, U.S.—*1st March*, 1881.
951. BRACELET, &c., FASTENINGS, J. M. Banks, Birmingham.—*5th March*, 1881.
959. KNITTED, &c., FABRICS, E. Whitehall, Nottingham.—*7th March*, 1881.
1584. TREATING ORES, &c., J. Hargreaves and T. Robinson, Widnes.—*7th March*, 1881.
2187. MARINE STEAM ENGINES, W. Allan, Sunderland.— *19th May*, 1881.
2227. GAS, F. W. Crossley, Great Marlborough-street, Manchester.—*21st May*, 1881.
2305. WEAVERS' HARNESS, W. R. Lake, Southampton-buildings, London.—*25th May*, 1881.
2329. FASTENINGS, T. Green, Northampton.—*27th May*, 1881.
2395. WHEELED VEHICLES, S. Pitt, Sutton.—*31st May*, 1881.

List of Specifications published during the week ending July 23rd, 1881.

4329, 6d.; 4696, 6d.; 4707, 6d.; 4847, 6d.; 4870, 2d.; 4967, 6d.; 5199, 8d.; 5203, 6d.; 5206, 8d.; 5229, 4d.; 5268, 6d.; 5272, 6d.; 5276, 4d.; 5281, 6d.; 5291, 4d.; 5293, 6d.; 5295, 6d.; 5296, 8d.; 5299, 6d.; 5302, 2s. 6d.; 5304, 6d.; 5306, 6d.; 5308, 6d.; 5315, 6d.; 5318, 6d.; 5330, 2d.; 5331, 2d.; 5333, 10d.; 5335, 2d.; 5341, 2d.; 5342, 2d.; 5343, 6d.; 5348, 4d.; 5353, 2d.; 5354, 2d.; 5356, 2d.; 5358, 2d.; 5359, 2d.; 5360, 4d.; 5362, 8d.; 5364, 2d.; 5365, 4d.; 5366, 6d.; 5367, 6d.; 5368, 2d.; 5370, 6d.; 5371, 6d.; 5373, 2d.; 5376, 6d.; 5377, 2d.; 5378, 2d.; 5379, 2d.; 5380, 4d.; 5381, 1s. 2d.; 5382, 6d.; 5283, 6d.; 5384, 8d.; 5385, 4d.; 5387, 6d.; 5389, 6d.; 5391, 2d.; 5322, 6d.; 5393, 6d.; 5395, 2d.; 5396, 8d.; 5398, 6d.; 5399, 4d.; 5400, 2d.; 5401, 2d.; 5402, 6d.; 5403, 6d.; 5405, 6d.; 5406, 8d.; 5407, 2d.; 5409, 2d.; 5410, 6d.; 5411, 2d.; 5413, 6d.; 5414, 2d.; 5417, 2d.; 5418, 4d.; 5419, 2d.; 5420, 2d.; 5421, 2d.; 5422, 4d.; 5423, 2d.; 5424, 6d.; 5425, 6d.; 5426, 2d.; 5428, 2d.; 5429, 2d.; 5430, 2d.; 5431, 4d.; 5433, 6d.; 5434, 6d.; 5438, 6d.; 5439, 6d.; 5440, 2d.; 5453, 6d.; 5463, 4d.; 5466, 6d.; 5489, 6d.; 5490. 4d.; 11, 4d.; 29, 6d.; 35, 6d.; 735, 6d.; 1315, 6d.; 1506, 6d.; 1655, 6d.; 1697, 6d.; 1701, 6d.; 1833, 2d.

*** 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.*

4329. SHARPENING SAWS, *S. Rolland.—23rd October*, 1880. 6*d.*

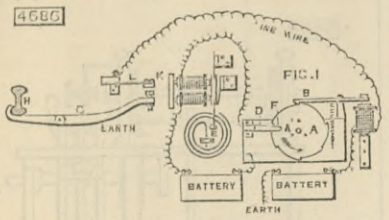
Suitable cutting, holding, and advancing mechanisms are mounted on a table having at one end brackets to carry a shaft which rotates and actuates the cutter and feed mechanism by bands. The cutting instruments, which may consist of emery wheels or steel cutters, are formed at their periphery to correspond to the form of the saw teeth. The cutter is mounted in a fork piece fitted to a rock lever, which is actuated by a disc cam, whereby it is raised from one tooth when it falls by its own weight into the next tooth of the saw, which has been moved forward.

4686. IMPROVEMENTS IN SIGNALLING ON RAILWAYS, AND MEANS OR APPARATUS THEREFOR, *W. W. Biddulph.—13th November*, 1880. 6*d.*

The object of this invention is to afford at each signal box on the line an approximate indication as to the position of any train travelling between such box and the next in either direction. For this purpose the inventor provides an indicator and means for driving and arresting or locking same, so that it may be released temporarily by the train closing or breaking an electric circuit as it passes predetermined points of the line, whereupon the indicator is caused to make a partial rotation, to show that the train has passed the respective part of the line. Supposing a train to have left one station, and be travelling towards A. On moving over the contact point at A, a current is passed through the electro-magnet in the signal boxes at the two stations, *i.e.*, that the train is

travelling from and that towards which it is going. Thus the armatures are momentarily raised, thereby allowing the discs to revolve till brought up by pawls. The depression of the rails caused by the passing of the train is utilised to operate a contact point by acting upon a lever which automatically returns and breaks the circuit after the train has passed. The drawing illustrates the apparatus. A is the disc, divided into segments, controlled by pawl B, and connected with an armature. D is a contact piece pressing against A, and which is in connection with one pole of

4686

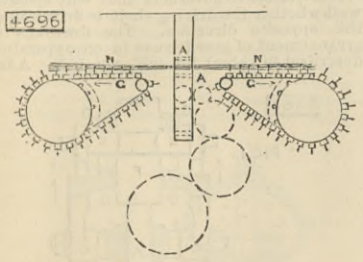


a local battery. This battery circuit includes a trembling bell. In the back of the disc is a stud F of ivory, which rests over and breaks the contact of the spring when the disc is at its starting point. G is the lever connected to earth with short arm in contact with the rail H, the other arm being provided with contact piece corresponding to contact piece K on spring L.

4696. PREPARING FIBROUS MATERIALS FOR SPINNING, *H. M. Girdwood.*—*15th November*, 1880. 6*d.*

This relates to the roughing process, and may also be adapted to the hackling process. A pair of endless

4696



travelling boards A receive between them the fibrous material N, the ends of which are carried over two flexible or articulated sheets of hackles G revolving at right angles to the boards A, one on each side.

4707. VELOCIPEDES, *E. Burstow.*—*16th November*, 1880. 6*d.*

The velocipede consists of one large central wheel and four smaller ones, the rider sitting over the former and working it by treadles. The small wheels are arranged in pairs so connected together that when the axle of one pair is moved that of the other pair moves in the opposite direction, so as to facilitate running in a curve.

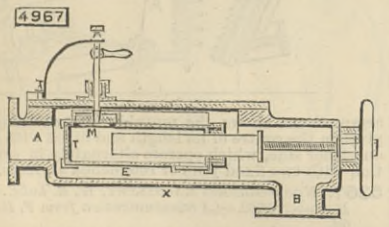
4870. STEAM ENGINES, *C. J. Galloway and J. H. Beckwith.*—*24th November*, 1880.—(*Void.*) 2*d.*

In order to prevent water being drawn from the condenser into the cylinder during the racing of the piston a vessel containing a float connected to a valve is arranged in the exhaust pipe. The weight of the float and valve is such that the latter remains closed when the former is not immersed, but when it is immersed the valve is raised and allows water to flow out or air to pass in.

4967. DETERMINING THE QUANTITY OF WATER CARRIED MECHANICALLY BY STEAM, *C. D. Abel.*—*29th November*, 1880.—(*A communication from F. A. Brocq.*) 6*d.*

This consists in taking a known volume of the mixture of steam and water, and increasing its volume with suitable speed until a decrease of pressure shows itself, whereupon by determining the proportion between the two volumes the proportion of water contained in the saturated steam will be ascertained. Steam enters chamber X at A and issues at B. On the upper side the chamber has a large rectangular opening closed by a plate. A second

4967

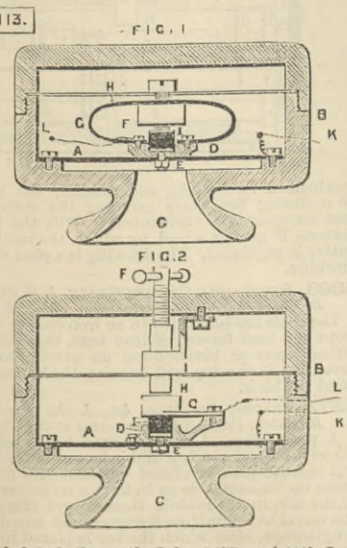


cylindrical vessel E is bolted inside chamber X, and is made of gun-metal, and serves to receive the known volume of steam and water. In it is an opening T equal in height to the diameter of A, and at the lower side is a similar aperture, both openings being fitted with slides. Chamber E contains a plunger, and at M is an opening covered by a corrugated disc of German silver, constituting the sensitive membrane of a pressure gauge.

5113. IMPROVEMENTS IN TELEPHONES, *J. B. Morgan.*—*8th December*, 1880.—(*A communication from T. A. Edison.*) 6*d.*

This invention relates to improvements on the carbon telephone described in patents Nos. 2909 and

5113.

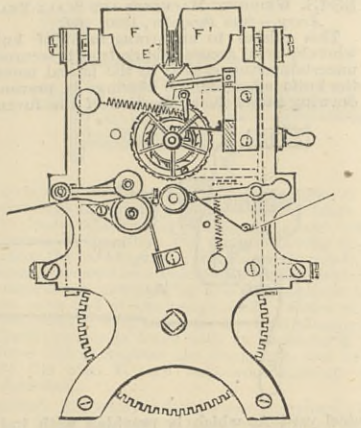


2396, and dated the 30th July, 1877, and 15th June, 1878, respectively. The object of the invention is to allow the diaphragm to respond to the atmospheric vibrations without being unduly checked, and at the same time to ensure the necessary pressure and extent of surface contact between the carbon and the electrodes to produce the corresponding electric undulations in the line. In the Figures, the diaphragm is represented at A with a case B and mouth-piece C, the diaphragm A resting on or being secured at its edges to B. The carbon is shown at I; D is a cup of insulating material holding I; E an electrode in the shape of a metal rivet holding D to the diaphragm, the other electrode being a platina disc at the end of screw F passing through spring G connected at its ends to cup D. H is a weight carried by the spring, and one wire K is connected to A, and the other wire L to spring G. The vibrations produced by speech, &c., act upon the atmosphere, and vary the electric condition of the circuit in consequence of H acting by its inertia to vary the pressure on the carbon. In Fig. 2, the screw F is made to act upon a magnet that varies the initial pressure upon the carbon by its proximity to the weight H, which is of iron.

5162. IMPROVEMENTS IN PRINTING TELEGRAPHS, *H. van Hoevenbergh.*—*10th December*, 1880. 1*s.* 2*d.*

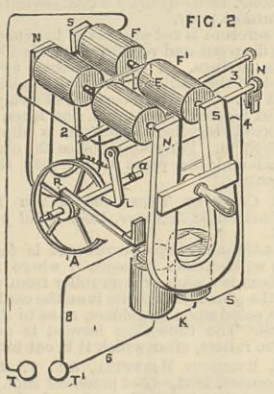
This invention relates to improvements in automatic printing telegraphs by means of which the rapidity and certainty of operation of the apparatus is improved, the synchronism between the transmitting cylinder and the type wheel of the receiver is improved by causing the same to be regulated automatically once during each revolution. Fig. 1 shows the receiving apparatus, which is of old construction and form, the improvement which forms the subject of the invention being in an arrangement for producing the vibration of the armature E, by which the step-by-step advance of the type wheel A is produced through the agency of an escapement. Two electro-magnets F and F1 are arranged with their poles facing towards each other upon opposite sides of E. The yoke of these electro-magnets consists of a permanent steel magnet of horse-shoe shape, into the opposite poles of which N and S (see Fig. 2) the respective cores of the electro-magnets

5162 FIG. 1



are secured. F and F1 are preferably arranged with their similar poles facing each other, so that the armature E is attracted indifferently by either pair of cores when no current is passing. The coils are so arranged that a positive current will generate an electro-magnetism which will reinforce and strengthen the normal magnetism of F, and neutralise that of F1; E therefore will be attracted by F, and not by F1. The contrary will occur if a negative current be sent. Thus by transmitting alternate currents, E may be made to vibrate very rapidly. The other improvements relate to the parts of the apparatus which produce the impression of the proper letter on the paper, and moves it forward as required, and the synchronism of the type wheel with the transmitting apparatus at the distant station. Fig. 2 shows the general arrange-

5162 FIG. 2

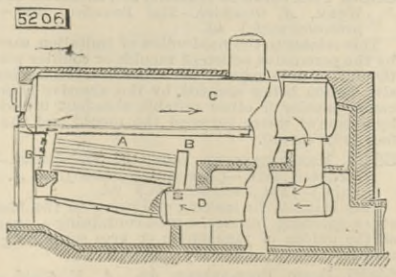


ment of the circuits and mechanism, T and T1 being the binding screws for the attachment of the line wires. The normal circuit through the instrument is from T by wire 1 to electro-magnet F; thence by wire 2 to F1; thence by wires 3, 4, and 5 to printing magnet K; thence by wire 6 to T1. The shunt circuit, which cuts out K, starts from the point 4 between the type wheel magnets F F1, and the printing magnet K, and goes through the frame of the instrument to the kerb of the type wheel A, and thence through contact point R, spring S (when the latter is in contact), and wire 8 to binding post T1, where it rejoins the main wire. The three principal working parts of the apparatus are operated by three different strengths of current, the normal strength of current, which is also the weakest, is sufficient to actuate the escapement, controlling the type wheel by reversals of polarity, but not sufficient to withdraw the unison stop L. A certain additional strength is sufficient to effect the printing also, but not to withdraw the unison stop, which can only be done by the aid of a still stronger current, and this last is prevented from operating the printing magnet by the shunt device above mentioned. The latter part of the specification of this patent refers to the transmitting apparatus.

5206. STEAM GENERATORS, *H. J. Allison.*—*13th December*, 1880.—(*A communication from J. Mac Nicol.*) 8*d.*

The tubular heating surface of the boiler consists of the tubes A, having water within them and being

5206



inclined and fixed in the cases B, in the outer plates of which are holes for their introduction, cleaning, &c., which holes are covered by suitable doors or plugs and covers. The front case B is connected to the underside of boiler C and the back case B with the top side of boiler D, the object being to increase the circulation. For Cornish boilers, a division plate is fitted in the boiler, the water passing along one side, and back to the tubes A along the opposite side.

4847. OBTAINING OIL FROM PETROLEUM, RESIN, &c., *W. R. Lake.*—*22nd November*, 1880.—(*A communication from J. E. Borne.*) 6*d.*

A still is arranged over a furnace, and from the top a pipe leads to the upper compartment of a separator of cylindrical form divided by a partition. A pipe passes from the upper compartment to a condensing tank, where it is connected to a condensing coil. The upper and lower compartments communicate by an elbow fitted with a cock, the upper end entering the separator slightly above the partition, and the lower end entering the lower compartment and terminating just above a series of perforated plates. From the opposite side of the separator a pipe leads to a receptacle.

5199. MOWING OR REAPING MACHINES, *H. H. Lake.*—*11th December*, 1880.—(*A communication from J. Ecanno.*) 8*d.*

The part for cutting the grass or corn consists of scythe blades M rotating round a vertical shaft G

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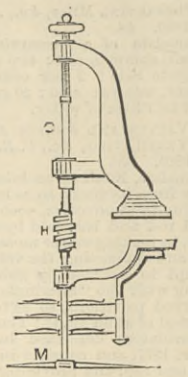

driven by worm H. The upper end of shaft G is screw-threaded so as to regulate the height of the blades M.

5203. WOOD PULP, &c., *C. E. Hæger.*—*13th December*, 1880. 6*d.*

The wood is treated in boiler A, constructed of corrugated plates, and containing a perforated casing B to

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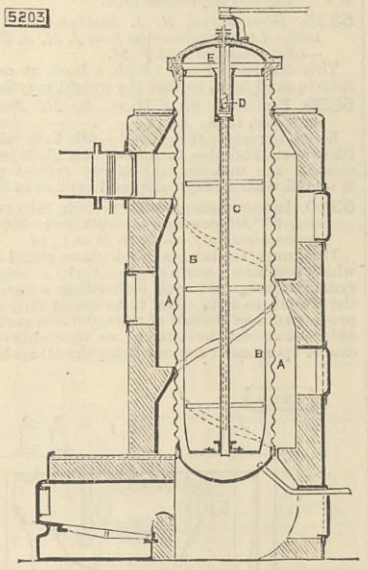

receive the wood, and a long perforated pipe C, the top of which is enlarged to receive a pipe E, having holes above a propeller D driven by a pulley and shaft, and serving to circulate the liquid for converting the wood into pulp.

5276. WINDLASSES FOR SHIPS, *G. D. Davis.*—*16th December*, 1880. 4*d.*

This consists in the combination of several old and known devices. A is the driving shaft on which the barrel B is mounted loosely; C the brake wheel solid with barrel, and having a cone on which works the purchase wheel D. A ring or flange E is fixed by pins and nuts to a screw nut X working on a hollow screw shaft F; G is the pawl ring keyed on the shaft. The

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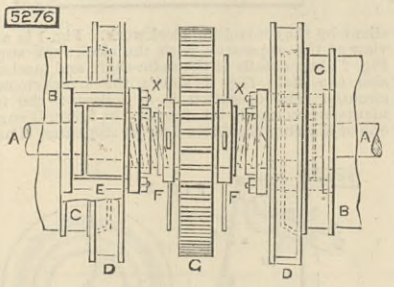

screw shaft F is fitted with hand wheels to bring the coned part of purchase wheel D and the coned part of the brake wheel C together.

5281. WORKING TRAFFIC OVER INCLINED PLANES AND STEEP GRADIENTS ON RAILWAYS, &c., *J. S. Hughes.*—*16th December*, 1880. 6*d.*

One or more ropes of steel A are laid along the line, and their ends fixed near the top and bottom of the

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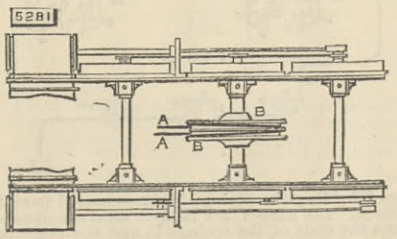

incline to a screw anchor, coupling drum, or other fastening. On the locomotive a pulley or pulleys B are mounted on a shaft and connected with the driving wheel, and over these pulleys the ropes are passed.

5291. SHUTTLES FOR LOOMS, *J. H. Pickles.*—*17th December*, 1880. 4*d.*

The object is to give increased steadiness to the tongue so as to prevent it vibrating, and it consists in providing the tongue A with a tail piece C, which when the cop is in place lies in a groove on the underside of the shuttle, and of exactly the same width as the tail piece, so that the tongue cannot vibrate. A spring E

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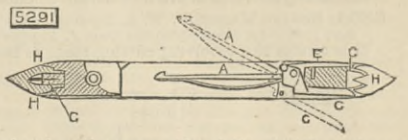

is placed on the upper side of the shuttle, and serves to keep the tail piece C in position. The shuttle tip is formed with a socket G and projections H of a serrated form fitting between projections on the end of the shuttle.

5293. FURNACES AND FIREPLACES, *E. P. Alexander.*—*17th December*, 1880.—(*A communication from C. Nikiphoroff.*) 6*d.*

This consists in replacing fire-bars by a number of rectangular perforated cast iron gratings, laid side by side and supported on bearers.

5296. EVAPORATING AND BOILING APPARATUS FOR THE MANUFACTURE OF SUGAR, &c., *C. D. Abel.*—*17th December*, 1880.—(*A communication from N. Rillieux.* 8*d.*

This relates First, to an equilibrium valve fitted upon the supply pipe of the recipient for discharge or exhaust steam for regulating the supply of steam thereto. Secondly, to arrangements whereby the boiling process with double action may be effected in pans with steam coils by steam pressure of ½ or ¾ of an atmosphere, or even greater, obtained in the first evaporating pan. Thirdly, the heating of the boiling pan by steam from the recipients of discharge or exhaust steam, or from the first evaporating pan, the steam pipes from both vessels being connected to the distributing pipe of the steam coils of the boiling pan. Fourthly, maintaining the pressure in the first pan by a valve actuated by a pressure regulator or by hand. Fifthly, to regulating the supply of discharge steam from the boiling pan, either to the first pan or to the second or third pan of a triple action apparatus. Sixthly, the use of two smaller pans in combination with the first evaporating pan. Seventhly, the use of a float discharge valve for withdrawing water from two vacuum chambers with different degrees of vacuum. Eighthly, an arrangement of pipes and apparatus to obtain a more perfect triple action process and a more perfect utilisation of the steam. Ninthly, the arrangement for drying the megasse by the furnace heat of the boilers in which it is to serve as fuel.

5299. CALORIC ENGINES, *M. P. W. Boulton.*—*17th December*, 1880. 6*d.*

This relates to improvements on patent No. 495, A.D. 1879, and consists, First, in providing means for urging the displacing piston D in both its strokes by power acting directly on it, the cam by which it is connected to the engine serving only to regulate and time its movement. For this purpose the piston rod is enlarged so that the gaseous pressure on its hot side exceeds that on its cool side, thus driving the piston when sending the charge of air into the heater H, while for its other stroke a weight acting on an arm or a spring, or compressed air may be used. The pis-

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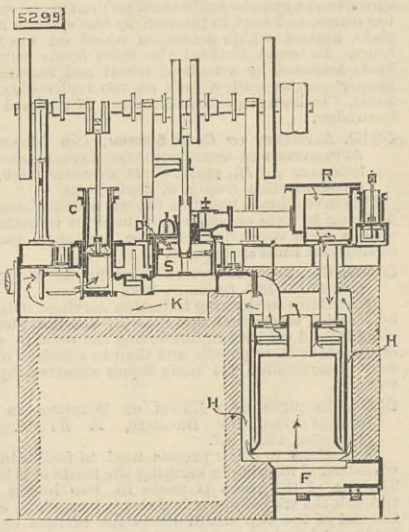

ton D is actuated so as to rest at the hot end of its cylinder, and moves slowly when near the end in both strokes, so as to give time for easy movement of the valves. The valves governing the passages between the displacing vessel and the heater are worked separately. The ends of the displacing cylinder S, and of the working cylinder C, are placed in the flue K, through which the hot gases from the furnace F pass. An air pump is attached to the passage between the displacing vessel and the regenerator in order that cold air may be occasionally forced through the regenerator R to keep its plates cool.

5302. REELS, &c., FOR COILING WIRE ROPES ON BOARD SHIP, *W. H. Harfield.*—*17th December*, 1880. 6*d.*

The reel is mounted loosely on the main shaft and carries a toothed ring B, gearing with a pinion E, mounted loosely on a shaft C, supported in the same frame as the reel. The pinion E may be connected to

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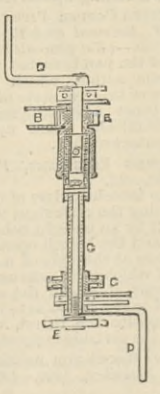

its shaft C by a friction clutch operated by the hand wheel F. On the shaft C is mounted a disc G, on which rests a nipping pawl to prevent the crank handles D, flying round when a strain comes on the rope.

5306. PREVENTING WASTE OF WATER IN WATER-CLOSETS, *T. H. Goodson.*—*17th December*, 1880.—(*A communication from H. E. T. Goodson.*) 6*d.*

Between the supply pipe and the pipe leading to the closet is fixed a valve box containing two check valves one above the other, the stem of the upper one being enlarged so as to present a larger area than the valve. The outer end of the enlarged part works through a stuffing box and butts against the underside of the front part of the closet seat, which is hinged at back. The lower valve stem slides in the upper stem, and between the two valve seats is a pipe leading to near the bottom of an air vessel. When the

upper valve is forced down by the seat, the lower valve compresses the air in the air vessel, and when released the compressed air forces water into the closet basin. A regulating air valve is fitted to the air chamber.

5304. SEWING MACHINES, *W. L. Bigelow.*—17*th December*, 1880.—(*A communication from J. Bigelow.*) 6*d.*

This relates to a revolving cutting blade to trim the

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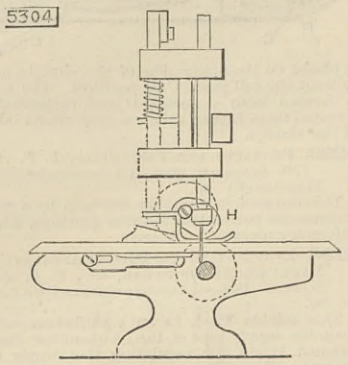

work as the sewing progresses, and consists in forming the edge of the cutter blade H excentric, so as to give a drawing cut to the work.

5308. CLIPS FOR GUTTER SPOUTING, *J. Wiley.*—18*th December*, 1880. 6*d.*

This relates to the bar or pin crossing between two horns of the clip above the gutter spouting, and consists in making it plain, with the two ends bent down at right angles to the bar. Near the top of each fork of the clip a horizontal slot is formed, through which one bent end is passed to the opposite side, when the rod turns so as to bring the bent ends in a vertical position.

5315. TACKS, PINS, &c., *E. P. Alexander.*—18*th December*, 1880.—(*A communication from W. R. Clough.*) 6*d.*

The novelty of the invention consists in manufacturing the entire tack, pin, screw, or nail, inclusive of a broad head or shoulder, from a continuous piece of wire by bending, folding, coiling and otherwise manipulating the same.

5316. BUOYS OR LIFE AND PROPERTY SAVING APPARATUS FOR SEA USE, *J. Sample.*—18*th December*, 1880.—(*Not proceeded with.*) 2*d.*

A circular steel buoy boat is formed with raised sides, the bottom being concave and divided into compartments to store provisions. Around the inside are lockers also serving as seats. It is covered by a watertight conical roof with a manhole at the top. A rudder and sail are provided.

5318. HEEL-PARING MACHINES FOR BOOTS AND SHOES, *F. Cutlan.*—18*th December*, 1880. 6*d.*

The boot is placed and held in position by screw plates. On a frame on suitable bearings is mounted a frame capable of being revolved, to which spindles are attached, around which springs are coiled. The springs act upon the knife stock secured in the revolving frame, and kept in position by the springs and a plate, against which a friction wheel on the stock bears. To breast the heel, the main frame carries a knife actuated by a toothed wheel and handle, the former gearing with a rack on the underside of the knife. To burnish, the knife stock is replaced by a burnisher.

5319. ALPHABET OF CODE SYSTEM, AND MEANS OR APPARATUS FOR COMMUNICATING INTELLIGENCE BY SIGNALS, *A. M. Clark.*—18*th December*, 1880.—(*A communication from C. G. Burke.*) 8*d.*

This invention is based on the use of four characters differing in form or colour, and used in combination with a scale consisting of three horizontal parallel equidistant lines and spaces.

5320. CLEANING IMITATION CARVING ON WOOD, *A. Guattari.*—18*th December*, 1880. 4*d.*

This relates to cleaning imitation carvings obtained by a series of gradual pressures in red hot metallic moulds, and consists in immersing the wood in a lye of caustic soda, or potash, and then in a bath of oxalic acid to neutralise the basic liquor absorbed by the wood.

5321. SECURING THE KNOTS OF BRISTLES IN THE MANUFACTURE OF BRUSHES, *E. Wright.*—18*th December*, 1880. 6*d.*

This relates to screw presses used to facilitate the operation of forming or securing the knots of bristles. The die of the press is made in two halves and through the wall of one side a slot is formed, to allow the end of the clip which binds the bristles to protrude. A key is then inserted in an aperture in the die, so as to lay hold of the protruding end of the clip, and is then turned with one hand, while the screw of the press is worked with the other. The end of the clip is then bent back and pressed down, and the knob of bristles can be inserted in a stock of any suitable kind.

5322. LOOMS, *C. Catlow.*—18*th December*, 1880.—(*Not proceeded with.*) 2*d.*

This relates, First, to means for securing on absence of weft, the stoppage of the loom when the shuttle is in the boss nearest the weft fork; Secondly, to improved bar temples; Thirdly, to apparatus for letting back the beam and taking up slack warp: Fourthly, to appliances for working the peg or barrel; Fifthly, to guide studs and plates in connection with the heald cords and heald staves; Sixthly, to improved terry weaving apparatus; and Seventhly, to the use of gear wheels and tension rollers, so as to reverse the direction of rotation of taking-up and cloth rollers.

5323. PROTECTING COPPER PIPES AND COOKING VESSELS, &c., *T. Redwood and T. F. Blackwell.*—18*th December*, 1880.—(*Not proceeded with.*) 2*d.*

The outside of the pan is coated with zinc, so as to cause a galvanic action, which by increasing the electro-negative or inactive state of the copper serves to protect its inner uncoated and exposed surface from being chemically acted upon by substances brought into contact with it.

5324. REPEATING FIRE-ARMS, *F. Nordenfelt.*—18*th October*, 1880. 2*d.*

This relates to breech-loaders of the bolt class, and it consists in causing the cartridges to be fed forward in front of the bolt by an upright tube each time the bolt is drawn back and the breech opened. The lower end of the tube enters at the side of a cylindrical casing, in the centre of which is an axis carrying a star wheel, between the arms of which the cartridges fall, and which is caused to revolve so as to bring the cartridges successively opposite the barrel, when the return of the bolt forces the cartridge opposite into the barrel.

5325. FEEDING RACKS FOR SHEEP, &c., *C. Y. Campbell.*—18*th December*, 1880.—(*Not proceeded with.*) 2*d.*

A cover is fitted over the rack so as to afford shelter to the animals, the whole being portable, and capable of being attached to a fence or other fixture.

5326. RAILS AND CHAIRS FOR RAILWAYS AND TRAMWAYS, *W. Brown.*—18*th December*, 1880.—(*Not proceeded with.*) 2*d.*

The rail is made with a single head, and its body has a curved or slightly hooked figure tapering from its junction with the head to its lowest part. The inner cheek of the chair is about two-thirds the height of the rail, and the inside cheek is the same height as the rail. The space between the two cheeks nearly corresponds with the section of the rail.

5328. SKATES, &c., *T. B. Drybrough.*—20*th December*, 1880. 6*d.*

This relates to the blade, and consists in constructing it so as to allow the natural play of the foot. This is effected either by forming the blade in two or more pieces connected by links, or by thinning the portion of the blade from below the instep to near the heel. Other arrangements are employed.

5330. STEAM ENGINES, *J. Humphreys and D. Joy.*—20*th December*, 1880.—(*Not proceeded with.*) 2*d.*

This consists principally in arranging the engines on ships so as to be perfectly balanced as to weights in all positions, for which purpose the cylinders are placed behind each other on the same centre in sets of three, with their cranks set at angles of 120 deg., whereby the three sets of cylinders thus balance each other. The valve chests are brought round to the front so as to save space.

5331. FINISHING HARD AND SOFT FELT HATS, *J. Eaton.*—20*th December*, 1880.—(*Not proceeded with.*) 2*d.*

This relates to a machine for shaving or finishing the hats, and consists of a lathe with a reversible motion, on the block of which the hat is placed. On the table is a bracket in which works a spring acting upon a two-armed lever, to the other arm of which a carriage is fixed and has a to-and-fro motion imparted to it by an india-rubber-faced wheel. Radial arms moved in a curve to suit the shapes of the hat are connected to the shaving tool.

5332. PRESERVING MEAT, &c., *J. Eckart.*—20*th December*, 1880. 4*d.*

This consists of a preserving salt consisting of 50 per cent. common salt; 47·5 per cent. of chemically pure boracic acid; 2 per cent. tartaric acid; and 0·5 per cent. salicylic acid; 20 grammes of the salt are dissolved in 1 litre of water.

5333. VALVES AND SHAFTS AND CAPS AND COWLS FOR VENTILATING, &c., *C. R. Stevens.*—20*th December*, 1880. 10*d.*

This consists, First, of an inlet valve made to open vertically from its frame so as to allow the full area of the opening to be effective, such valve being hung on a vertical rod and balanced by cross rods on centres; Secondly, in making one or more reservoirs for holding mercury and supporting the valve on floats, the valve being kept in position by guide rods; Thirdly, in combining with the "Sheringham" ventilating inlet valve curved partitions, so as to deflect the air vertically instead of at an angle; Fourthly, to exhaust and other ventilators described in patent dated 13th December, 1877, and consists in shaping the vacuum chamber and cap, and providing the ventilators with projections, so as to prevent the entrance of water or snow.

5334. BURNISHING THE HEELS OF BOOTS AND SHOES, *H. J. Haddan.*—20*th December*, 1880.—(*A communication from B. F. Larrabee.*) 6*d.*

This relates to improvements on patent No. 762, A.D. 1881, and consists, First, of an equalising pressure; Secondly, of a swivelling tool block; and Thirdly, of a tilting and adjustable jack.

5335. DUMB-BELLS, *H. J. Haddan.*—20*th December*, 1880.—(*A communication from J. M. A. Despagnat.*)—(*Not proceeded with.*) 2*d.*

This consists of a bar with a hook at each end to receive sand-bags, so that the weight may be varied.

5339. FINISHING SILK HATS, *D. M. Easton.*—20*th December*, 1880. 4*d.*

So as to restore the gloss to silk hats which have been worn, and also to impart the gloss in the first case in the manufacture highly refined petroleum is mixed with oil myrbane, and applied to the hat.

5340. IMPROVEMENTS IN TELEPHONE SIGNAL APPARATUS, *W. Morgan-Brown.*—20*th December*, 1880.—(*A communication from G. H. Bliss.*) 8*d.*

This invention relates to telephone signal apparatus which contains a series of clockworks arranged to run synchronously, and each controlling a signal bell in the circuit, so as to allow it to sound only at certain pre-determined periods of time, the said periods being different at each instrument, so that only one signal can be operated at any one time, the others being kept

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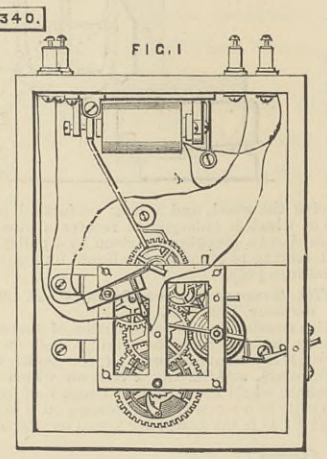
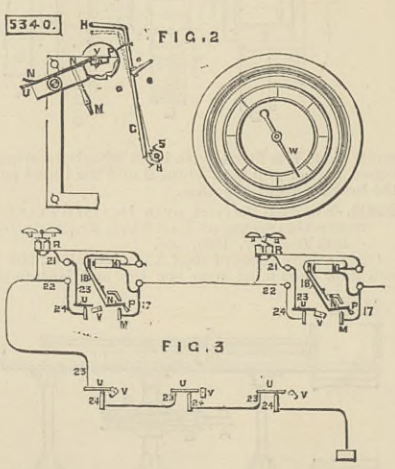


silent by the controlling clockwork. Fig. 1 is a front view of the apparatus with the clockwork stopped; Fig. 2 gives details of the main-shaft and mechanism, also the dial; Fig. 3 shows the arrangements of circuits. The operation is as follows:—the instruments are normally all stopped, the levers G engaging one of the stop shoulders 5 of the stop cams, H and the

5340.



toes P holding the springs N disconnected from the pins M. The cams V are then at different distances from the ends of the springs U, and the pointers W are at zero and vertical. Supposing it is desired to signal station 4, the operator sends a current which passes all the starting magnets, and causes them to attract their armatures, and by connected fingers to throw the levers G off from the shoulders 5 of the cams H, allowing all the clockworks to start simultaneously. As the pointer W passes through the space 1 the signalling shunt 21, 22, 23, 24 at the first station is broken by the cam V engaging the spring U, and as the said pointer passes to space 2 the signalling shunt at station 1 is closed and at station 2 is broken, and a similar operation takes place as the pointer passes into the spaces 3 and 4, while the pointer is passing through space 4, and the signal shunt at station 4 is consequently broken, the operator sends currents to line to operate signals, and the said currents in passing over the line will follow the shunts 17, M, N, 18 around the starting magnet, the said shunts being closed when the clockworks first started, and at all the stations except station 4; the said currents will also pass through shunts 21, 23, U, I, 24, 22, about the signalling magnets R, which will consequently not be operated thereby, but at station 4 the currents will be obliged to pass through the coils of and operate the signalling magnet R, since the signalling shunt is broken at this point by the cams V. The operator may continue to send the currents and operate the signal at station 4 as long as the pointer W is passing over the space 4, and the cam V at station 4 is holding up the spring U, but the moment that it arrives at the end of the said space the said currents must close, as after this moment they would operate the signal at station 5 instead of that at station 4.

5341. IMITATION LEATHER, &c., *G. W. von Nawrocki.*—20*th December*, 1880.—(*A communication from E. Fischer and M. E. Cohn and Wollheim.*)—(*Not proceeded with.*) 2*d.*

This consists in passing a fabric to serve as a backing through baths containing chromic acid salts and baths containing leather glue mixed with glycerine, which substances are deposited on the fabric, the operation being carried on in a dark room, after which it is pressed and exposed to light, so as to render the substances insoluble.

5342. MOTIVE POWER ENGINES ACTUATED BY WIND, *E. Edwards.*—20*th December*, 1880.—(*A communication from G. E. Bohmer.*)—(*Not proceeded with.*) 2*d.*

A vertical shaft is fitted with horizontal arms carrying wings or sails shaped like mussels or hollow shell shaped vessels, the arms to which they are attached being arranged opposite to each other or in a spiral or helical form on the shaft.

5343. WEIGHING MACHINES AND SCALE BEAMS, *W. B. Avery.*—20*th December*, 1880. 6*d.*

This relates to an arrangement of knife edges, whereby great accuracy of register is secured and the uncertain action caused by the lateral movements of the knife edges on the bearings is prevented. The drawing shows the application of the invention to a

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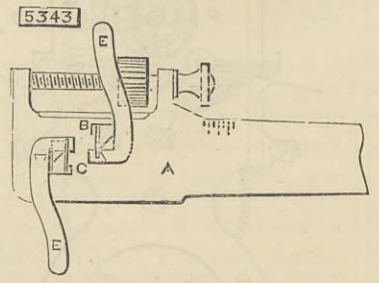

steel yard A, which is provided with knife edged bearing pieces at B and C, the former resting on a suspended shackle E supporting the whole weight of the steelyard and its load. From knife edge C hangs a shackle F, from which the load to be weighed depends. The knife edges are similar but their positions are reversed.

5348. ELEVATING AND DISCHARGING COAL, &c., *J. H. Johnson.*—21*st December*, 1880.—(*A communication from G. W. Wood.*)—(*Not proceeded with.*) 4*d.*

A sliding cylinder is fitted in a frame, and above it are two other cylinders capable of being turned round independently, the top one to receive the coal from an endless chain of buckets, and the bottom one fitted with a spout or shoot. The height of the cylinders is adjustable by a screw shaft.

5349. CASTRATING HORSES, &c., *J. Scott.*—21*st December*, 1880.—(*Partly a communication from G. L. Matthew.*) 6*d.*

The scrotum is cut open so as to expose the testicles, which drop out and remain suspended by the cords or leading strings. A clamp is then applied to both the ends of the leading strings, after which the testicles are cut off. The clamp consists of two pieces of wood fastened together at one end, and when the other ends are forced together a ferrule is slipped over and retains them. For young horses the clamps are made of steel and the parts which grip the strings are roughened.

5353. CASES OR TUBES FOR MATCH BOXES, *E. M. Dixon.*—21*st December*, 1880.—(*Not proceeded with.*) 2*d.*

A continuous strip of cardboard is fed to a pair of rollers with cutters to score it where required, and near them is a glue or gum roller from which a brush takes the glue and deposits it on the cardboards, which is then acted upon by folders, so as to force it over a mandril. The tube thus formed is acted upon by pressure rollers, after which it is cut into lengths.

5354. RESINOUS MATERIAL, &c., *T. A. Wood.*—21*st December*, 1880.—(*Not proceeded with.*) 2*d.*

This consists in treating mineral oils with nitric or other acids or substances which part freely with their oxygen, so as to produce a solid resinous substance.

5356. COMBINED WASHSTAND AND BATH, *E. de Pass.*—21*st December*, 1880. (*A communication from A. Avon.*)—(*Not proceeded with.*) 2*d.*

The bath is fitted to a frame and has a cover on which the washing basin may either be fixed or fitted into an opening therein.

5357. BOXES, CASES, &c., *P. Lawrence.*—21*st December*, 1880. 6*d.*

This relates to boxes to be sent through the post, and consists in forming them so as to be readily opened for inspecting the contents. The lid is made separate and round the body, and across the lid grooves are formed to receive india-rubber bands.

5358. PROTECTING IRON AND STEEL SHIPS FROM CORROSION, *F. M. Lyte.*—21*st December*, 1880.—(*Not proceeded with.*) 2*d.*

One or more wires connected with the negative poles of a battery convey electric currents to the part to be protected, the anode being at the same time immersed in or connected with the electrolytic solution.

5359. BOOTS AND SHOES, *L. F. De Cuignier and J. N. Lang.*—21*st December*, 1880.—(*Not proceeded with.*) 2*d.*

This relates to clump soles for boots worn by cripples, and consists in forming it of hollow metal so as to make it light and durable.

5360. PRODUCING ON MARBLE, &c., IMITATION CARVED WORK, *A. Guattari.*—21*st December*, 1880.—(*Not proceeded with.*) 4*d.*

This relates to the production of imitation carvings by the percussive action of moulds or counter parts of the design to be reproduced on the marble, the percussive action being assisted by the abrasive action of emery powder or other suitable abradant introduced by means of water between the mould and the surface to be carved.

5364. MANGANIFEROUS IRON, *P. M. Justice.*—21*st December*, 1880.—(*A communication from A. Jaumain.*)—(*Not proceeded with.*) 2*d.*

This consists in making and using in the blast or other smelting furnace, a coke containing a quantity of the oxides of manganese or ores containing this metal

5365. BASIC FIRE-BRICKS, &c., *A. M. Clark.*—21*st December*, 1880.—(*A communication from J. B. M. P. Closson.*) 4*d.*

This consists mainly in the employment of a gelatinous substance of animal or vegetable origin, such as glue, gelatine, Japanese cement, fucus and their congeners, and in some cases sugar and molasses, as a binding material for the magnesia or other basic material.

5361. WOOD-TURNING MACHINE, *W. R. Lake.*—21*st December*, 1880.—(*A communication from F. Hanson.*) 6*d.*

The object is to control the path described by the rotating wood in a wood-turning machine, and hence the shape of the object cut by means of geared pattern wheels or formers of any desired shape, made to

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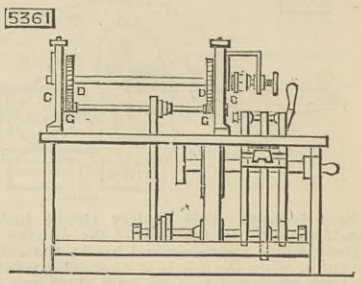

revolve in unison with and describe the same path as the wood. The pattern wheels D are mounted on a shaft capable of sliding up and down in the uprights C and are driven by pinions G, the shaft being fitted at one end with appliances to hold the wood.

5362. REGULATING THE SUPPLY OF STEAM TO STEAM ENGINES, *J. D. Churchill.*—21*st December*, 1880. 8*d.*

This relates to governors that will operate equally well whether the driving shaft is driven in one or in the opposite direction. The drawings show an arrangement of gear for use in an apparatus such as described in patent No. 4977, A.D. 1879. A is part of a

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FIG.1.

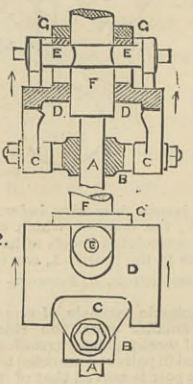
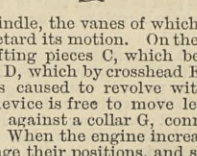


FIG.2.



vane or break spindle, the vanes of which revolve in a liquid, so as to retard its motion. On the crosshead B are pivotted shifting pieces C, which bear against a connecting piece D, which by crosshead E fixed to the driving shaft F is caused to revolve with the latter. The connecting device is free to move lengthwise on the driving shaft against a collar G, connected to an adjustable load. When the engine increases in speed the pieces C change their positions, and shift the connecting piece D, and so operate the regulating valve.

5366. COKE BREAKING OR SPLITTING MACHINE, *W. F. Anderson and G. Mant.*—22*nd December*, 1880. 6*d.*

A moving jaw A is actuated by crank B through rod C, and is furnished with spikes or chisel points. A fixed jaw D has its front roughened and behind it are packing pieces shaped like magnets, and serving to adjust the size of the material to be broken. A second

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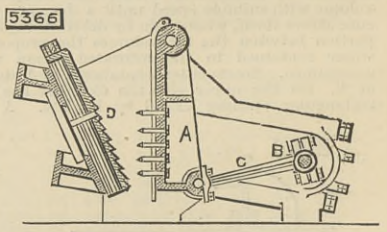

arrangement shows the movable jaw working on a pivot in the centre of its length and fitted with knives on either side, which operate alternately in combination with two fixed jaws or roughened surfaces.

5367. WOOD-TURNING MACHINERY, *W. R. Lake.*—22*nd December*, 1880.—(*A communication from F. Hanson.*) 6*d.*

The object of the invention is to control the approach of the tool towards the work at the same time as it is moved along its side by means of a stationary pattern provided with a toothed edge. A is the frame, B a sliding bed plate carrying the

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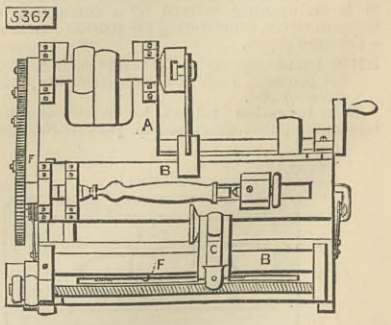


mechanism for holding and rotating the work, and B¹ a sliding bed plate carrying the cutter head C and its operating mechanism. With the former or pattern F gears a wheel by which the motion of the cutter is regulated. The drawing is a plan view of the machine.

5368. REVERSIBLE CRESSET GRATE, *J. H. Owen.*—22*nd December*, 1880.—(*Not proceeded with.*) 2*d.*

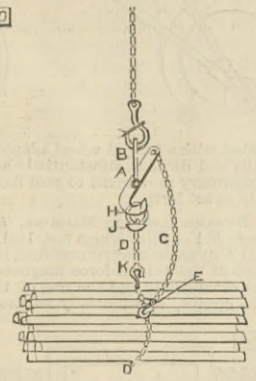
The coals are contained in an iron cresset having the front and back formed of iron bars, the sides of iron either open or close, hung on pivots, so that by reversing it the top will become the bottom and the front the back.

5373. SPADES, SHOVELS, &c, *J. M. Parsons*—22*nd December*, 1880.—(*Not proceeded with.*) 2*d.*

A plain piece of wrought iron bar is placed in a plater's or roller's fire, and when sufficiently heated the middle part is placed between two dies, which press up the metal, so as to form a recess on each edge of the bar, in the middle thereof, and thickening up the metal at the middle flatways, and also drawing it lengthways, after which the bar is placed in a die and hammered, so as to flatten the thickened part, and also indent parts of the wider ends, such parts forming the coffer for the handle when the halves are welded together.

5370. DISENGAGING HOOK, LINK, AND CHAIN AND SLING, *J. Brown.*—*22nd December*, 1880. 6*d.*

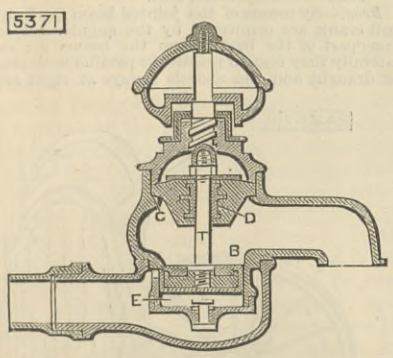
This consists of a link B to which the tumbling hook A is pivotted, and to its shank end is attached a pendant chain C serving to assist the tumbling of hook A. The end of chain C has a hook E with an eye in its bend. D is the sling, the chain of which has a single or double eye H at one end, which is attached to the chain in a cup J. The other end of the chain has a



hook K with an eye in its bent part. The link B is hooked over the hook of the crane; the sling D is passed round the weight to be lowered, and the hook K hooked round the chain forming a running noose. The ring H is hooked on to the hook A, and the hook E on the chain C is hooked through the noose.

5371. VALVES, COCKS, OR TAPS, *J. B. Denans.*—*22nd December*, 1880. 6*d.*

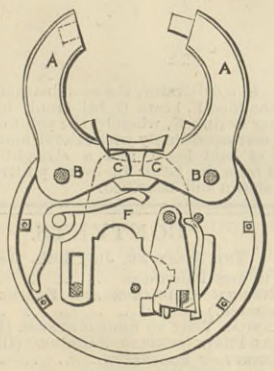
This relates, First, to the application to taps of plugs or obturators composed of para-caoutchouc supported internally by metallic membranes rendered adherent to the caoutchouc by vulcanisation; Secondly, to the arrangements and applications of such plugs and



obturators. The drawing shows one application of the plug, consisting of the metal core or stem T with shoulders or membranes D extending into the caoutchouc C. The stem T is operated by a screw movement, the caoutchouc causing the return motion and also serving as a stuffing-box. On the end of stem T is a plug moving as a piston in tube E, in which it opens or closes suitable openings.

5376. PADLOCKS, *A. Linley.*—*22nd December*, 1880. 6*d.*

The bow or loop is made in two pieces A pivotted at B, and each having an extension C taking between



projections forming part of a sliding plate F operated by the lock mechanism.

5377. MANUAL LEVER HAMMER, *J. Cuthbert.*—*22nd December*, 1880.—(*Not proceeded with.*) 2*d.*

An anvil is placed on the base of the machine, and above it a hammer head moves in guides, being actuated by a chain attached to a quadrant worked by a lever.

5378. CHAFF-CUTTING MACHINES, *C. T. Burgess.*—*22nd December*, 1880.—(*Not proceeded with.*) 2*d.*

The feed rollers are actuated by a worm, parts of which on opposite sides cross the axis at right angles, so that while such parts are gearing with the teeth of the wheels on the rollers, the latter will stand still and not feed. So as to vary the length of the cut in rollers with ratchet wheels the pawls are actuated by a rod moved to and fro by a lever caused to rock on its fulcrum by a crank, and by varying the relation between the distance of the fulcrum from the point where the rod is connected to it, and the distance of the fulcrum from the point where the connecting rod from the crank is connected to it, the length of feed may be altered.

5379. SCISSORS FOR CUTTING HAIR, *J. F. E. Mullett.*—*22nd December*, 1880.—(*Not proceeded with.*) 2*d.*

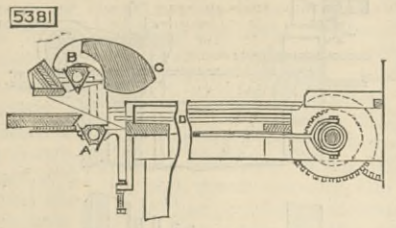
Combs are combined with the scissors, and are adjustably mounted one on each side of one blade, a short distance from the cutting edge, and serve to protect the head and hold the hair in position for cutting.

5380. TREATING WOOD PULP, &c., *E. C. T. Blake.*—*22nd December*, 1880. 4*d.*

Blood is mixed with a quarter of an ounce of nitrate of potassa for each pint, and mixed with wood pulp so as to form a soft pulpy mass, which is put into moulds and placed under a light continuous pressure, so as to form it to the desired shape.

5381. MANUFACTURE OF BARRELS, *W. Morgan-Brown.*—*22nd December*, 1880.—(*A communication from E. and B. Holmes.*) 1*s.* 2*d.*

The cutting or dressing mechanism of the staves consists of an under cutter A, composed of a triangular head fitted with adjustable concave cutting edges, and rotating on a shaft, and an upper cutter B, also composed of a triangular head with adjustable concave cutting edges and rotating on a shaft. The adjustable weight C presses on the work which is supported on table D. The stave is drawn through the machine by suitable feeding mechanism. The invention further relates to a jointing machine, to the windlass which operates to draw the flaring stave ends together to receive the second trussing hoop, and to a machine for levelling the staves of a barrel



body and for driving the truss hoops at one complete operation.

5382. SPECTACLES, *G. W. von Nawrocki.*—*22nd December*, 1880. —(*A communication from P. Goerz.*) 6*d.*

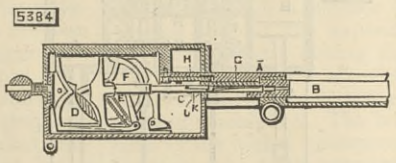
This consists in making the bridge of the spectacles movable or changeable, so as to bring the centres of the glasses exactly opposite the pupils of the eyes.

5383. SHIPS, &c., *J. Tangye and R. J. Cunnack.*—*22nd December*, 1880. 6*d.*

So as to reduce the friction between vessels in motion and the water, water is by suitable pumps drawn in from openings in the stem and forcibly ejected through openings near the bow of the ship, such openings being adjustable and arranged so as to throw the currents of water backwards.

5384. MACHINE GUNS, *W. Gardner.*—*22nd December*, 1880. 8*d.*

This relates to improvements in machine guns as described in patents No. 881, A.D. 1876, and No. 2735, A.D. 1878, and is designed to adapt the mechanism to guns having a series of barrels. A series of breech pins or plungers C, each having a rear extension to receive the crank pin D, operated by a crank handle, and the main firing pin and main spring E are retained as in the former patents. To cause the



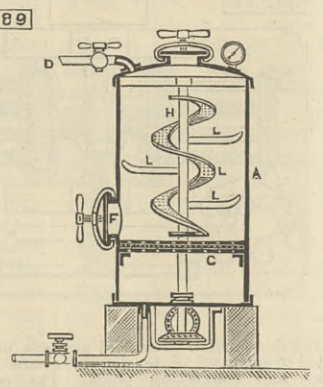
cartridges to drop in front of plungers C from the cartridge feeder or reservoir, a sliding plate G is free to move transversely across the space behind the barrels B, the cover A of the gun having apertures to allow the cartridges to fall on to the slide, which is then traversed by a T-shaped lever H operated through other levers actuated by two independent cams, one on each end of the crank shaft. Below slide G is a bed-plate J, with channels in which plungers C work. Each plunger is fitted with an extractor K; L is the lever which operates the firing pin, and is operated by the disc F. An improved sighting device is described.

5385. EXTRACTING GOLD FROM AURIFEROUS DEPOSITS, *W. R. Lake.*—*22nd December*, 1880.—(*A communication from O. Bailey.*)—(*Not proceeded with.*) 4*d.*

A tank nearly full of water contains a box set at an angle of 15 deg., the bottom of which is curved and formed of grating covered with screen wire. An axle carrying a row of stirrers in the form of a screw carries the refuse to the upper end of the box, where they are discharged, the finer earth and precious metals falling through the screen into the bottom of the tank, from whence it is conveyed to an upright tank containing a series of amalgam plates arranged on an incline and forming a zig-zag passage.

5389. EXTRACTING JUICES AND SACCHARINE MATTERS FROM SUGAR CANE, &c., *A. M. Clark.*—*22nd December*, 1880.—(*A communication from B. Odio and F. Perozo.*) 6*d.*

The substances are placed in an upright cylindrical vessel A, in the cover of which is a steam supply pipe D, and at the side an opening F to remove the bagasse after the extraction of the sugar and juices. Within cylinder A is a perforated diaphragm G, preferably con-



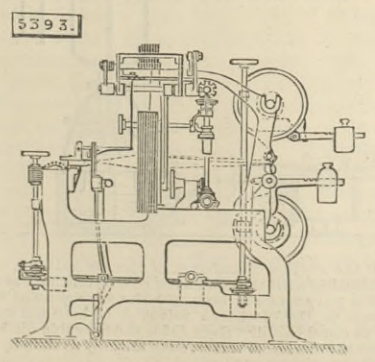
sisting of two plates with a filtering medium between. A shaft H passes through the cylinder and carries perforated blades L, arranged in spiral form to agitate the substances and assist in the expression of their juices, which pass through the diaphragm to the bottom of cylinder A.

5391. CLEANING AND SWEEPING ROADS, &c., *F. H. F. Engel.*—*22nd December*, 1880.—(*A communication from O. C. Barchmann.*)—(*Not proceeded with.*) 2*d.*

Dry or wetted sawdust is employed to absorb the mud or dust, and is delivered from a suitable reservoir on a car, after which a brush removes the mixture of mud or dust and sawdust to the side of the road, or on to an endless cloth which conveys it into a box.

5393. CARTRIDGE BELT FABRICS AND LOOMS FOR WEAVING THE SAME, *J. H. Johnson.*—*23rd December*. 1880.—(*A communication from A. Mills.*) 6*d.*

This cartridge belt fabric is a heavy double fabric



laced together with a small portion of the warp called "binders," the fabric being similar to what is known as a "back binding" producing when the "binders" are not used a hollow or tubular fabric. The loops or thimbles are woven on one thickness, and extend only partly across the fabric, leaving at each edge a selvage of the full thickness of the double fabric. It is preferred to omit the binders for four or five dents of the reed at each edge of the fabric, so as to form rounded and comparatively soft edges to the belt, the selvages being tubular. The drawing represents a loom to be used in manufacturing these belt fabrics.

5392. MICROSCOPES, *J. M. Moss.*—*22nd December*, 1880. 6*d.*

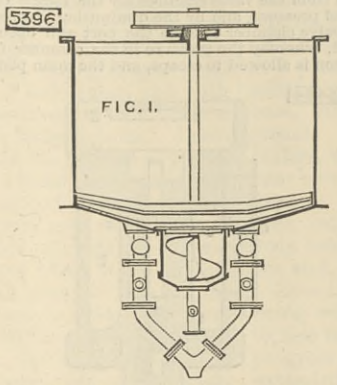
This consists in mounting the body carrying the lenses on a stand capable of presenting the instrument together with the objective in every possible position with regard to an illuminating ray proceeding in a fixed direction, so that every possible variety of illumination from direct front light to the last degree of obliquity at which a ray will enter a surface of glass can be obtained without the use of any substage and without once losing sight of the object or the light. For this purpose the body is mounted together with the stage upon an arm capable of rotation in a vertical plane, the centre of which rotation is exactly in a horizontal line with the object when the latter is in the focus of the objective.

5395. SCREWS AND SCREW-DRIVERS, *J. F. Lackersteen.*—*23rd December*, 1880.—(*Not proceeded with.*) 2*d.*

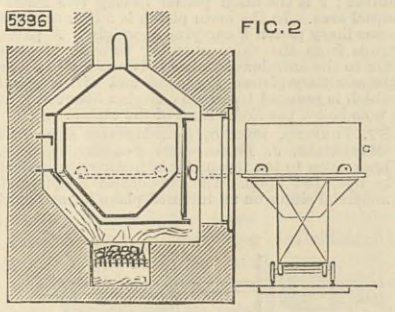
On the screw a spiral groove is cut similar to that on a gimlet, and which begins at the point, passes through the threads, and ends in one edge of the slot on the head. The screw-driver has on its spindle a movable appliance carrying clips, which grasp the under part of the screw head when the driver is inserted in the slot.

5396. TREATMENT OF COPPER ORES, &c., *J. H. Johnson.*—*23rd December*, 1880.—(*A communication from P. G. L. Designolle.*) 8*d.*

This relates, First, in the application of the system of electro-chemical amalgamation, described in patent No. 507 A.D. 1880, for the purpose of extracting the copper from ores containing precious metals, and also



for extracting the precious metals from such ores; and Secondly, to the means for separating the copper and precious metals from the complex amalgam, obtained either by electro-chemical amalgamation or by trituration with metallic mercury. Fig. 1 is a section of a pugging apparatus for treating the amalgam, and Fig. 2 a section of the apparatus for effecting the distillation of the amalgam and the separation of the precious metals. The ores reduced to a



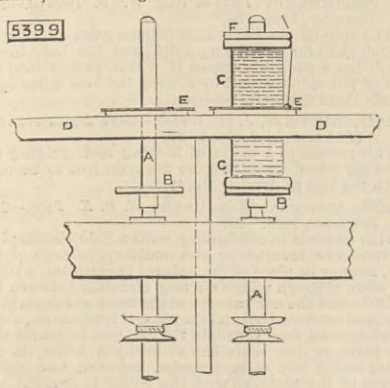
fine state are treated with bichloride of mercury, with the addition of sodium chloride in the presence of metallic iron. Metallic mercury is added so as to render the amalgam pasty to enable it to adhere to amalgamating plates. The greater part of the amalgam produced is separated by decantation, subsidence, and filtration, the precious metals contained in the complete amalgam being separated in the distilling apparatus by volatilisation or distillation by which the metals most tenacious of mercury gravitate, while the copper ascends to the surface.

5398. SECURING STOPPERS OF BOTTLES, *W. C. Eaton.*—*23rd December*, 1880. 6*d.*

A ring is secured round the bottle neck, and is provided with a spring lock. A ring or clasp is connected to the stopper, and has a chain attached to it carrying the lock staple, which, when inserted in the lock and the key turned, prevents the removal of the stopper.

5399. ROVING AND DRAWING OR FINISHING FRAMES, *J. Farrar.*—*23rd December*, 1880. 4*d.*

This invention consists in dispensing with the flyer and long spindle, and in substituting "rings and traveller" and short spindles. A are the short spindles, with a flange B on which rest the bobbins C.



D is the lifting rail with rings and travellers E, so that as the lifting rail is moved up and down, the yarn is wound on the bobbins. F is a flange placed on the top of each bobbin to keep the yarn off the upper rim.

5400. TRAVELLING TRUNKS, *J. J. B. Toussaint.*—*23rd December*, 1880.—(*Not proceeded with.*) 2*d.*

The top, bottom, sides, and ends of the trunk are all formed in two parts hinged together, and capable of folding inwards, so as to reduce the size of the trunk when required.

5401. GAS GOVERNORS, *F. G. Hamer.*—*23rd December*, 1880.—(*Not proceeded with.*) 2*d.*

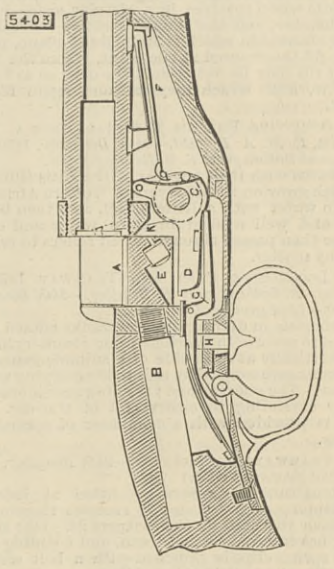
The gas is made to enter a chamber with an inlet valve, an outlet and flexible diaphragm connected with the inlet valve, so as to open it more or less as the pressure of gas varies, the flexible part of the diaphragm having the shape of a narrow ring produced by joining two equal truncated cones with their smaller bases.

5402. "SYRUPING" AERATED BEVERAGES, &c., *J. McEwen and S. Spencer.*—*23rd December*, 1880. 6*d.*

This relates to a "syruping pump," and consists in mounting the cylinder so that it is capable of oscillating, and in actuating the piston by an excentric provided with a slot and mounted on a sleeve loose on the shaft. The excentric can be shifted so as to regulate the throw. The sleeve has a lug, and the shaft a catch arranged so that when the shaft is turned forwards in filling a bottle the catch coming against the lug moves the excentric with it, and works the pump, but on rocking the shaft the reverse way it can make a quarter of a turn before acting on the excentric, so that in filling bottles with internal stoppers the bottle can be rocked slightly so as to bring the stopper into position without working the syrup pump.

5403. BREECH-LOADING MECHANISM AND SIGHTS FOR SMALL-ARMS, *D. Fraser.*—*23rd December*, 1880. 6*d.*

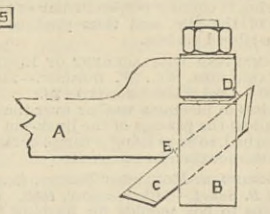
The breech block A is rectangular, and fitted to slide vertically in the breech shoe, which is a massive box, fitted to the stock by bolt B, the end of the barrel being screwed into its front part. The breech is opened and closed by an external lever on spindle C, which also carries an internal lever connected by a link to the breech block. The hammer D is also mounted



on spindle C and acts on, the striker E being cocked by the same lever that opens and closes the breech. The main spring F is placed beneath the barrel in front of the breech shoe, and is connected by a link to the fore part of the hammer. The sear G is in the form of a horizontal lever centred near its middle, its forward end engaging the spur on the hammer, and its rear end acted upon by the trigger. H is a safety slide which engages the trigger boss and is acted upon by the end of the hammer; K is the extractor lever also actuated by the hammer. The sight apparatus is made to occupy a recess in the top of the stock, and it is fitted with a shade.

5405. CUTTER HOLDERS FOR MACHINE TOOLS, *F. M Newton.*—*23rd December*, 1880. 6*d.*

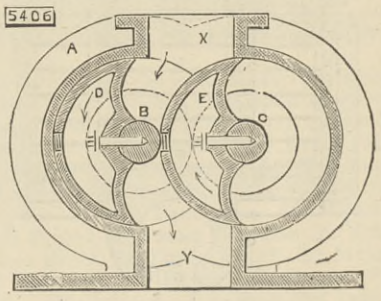
The holder consists of the bar A to secure it in position, and the slotted bolt B in which the tool C fits loosely. The bar A has two conical surfaces D and E, and the bolt B has a screwed part passing through the



end of A and fitted with a nut, by tightening up which the top edge of the tool is brought into contact with the surfaces D and E. The tool may be adjusted to any angle with the holder before tightening up the nut.

5406. ROTARY BLOWER, EXHAUSTER, PUMP, &c., *P. Goldschmidt, G. Hahlo, and A. Heussy.*—*23rd December*, 1880. 8*d.*

The drawing shows an apparatus to be used as a rotary force pump. Within the double cylindrical cast iron casing A the shafts B and C are caused to revolve and carry the drums D and E respectively.



The shafts are geared together, and during one half of each revolution each drum will act alternately to draw in air, gas, or other fluid through opening X and expel it at Y.

5407. FOLDING BEDSTEADS, &c., *H. G. Grant.*—*23rd December*, 1880.—(*A communication from C. C. Held.*)—(*Not proceeded with.*) 2*d.*

The bedstead consists of flat strips of steel jointed together, so as to fold up when not in use, and forming the frame supported on feet at either end. A canvas sheet is stretched across the frame and forms the bed.

5409. BROOCHES, *G. H. G. Pendleton.*—*23rd December*, 1880.—(*Not proceeded with.*) 2*d.*

The back plate has a piece punched out to form the joint and catch, which are bent to the required form, and a spring is punched out of the plate at right angles to the joint, and is so bent as to bear against it and keep the end of the tongue in the catch.

5410. VELOCIPEDES, *W. Hillmann.*—*23rd December*, 1880. 6*d.*

This relates, First, to transmitting motion from the pedal so as to drive both side wheels with equal or different speeds, by which means the steering is effected; Secondly, to self-adjusting bearings; Thirdly, to the mode of steering velocipedes with two steering wheels mounted on fixed studs at the front or rear of the vehicle; and Fourthly, to the pedals of velocipedes.

5411. METALLIC KNOBS OR HANDLES, *J. S. Edge and J. Deeley.*—*23rd December*, 1880.—(*Not proceeded with.*) 2*d.*

The body and neck are stamped from sheet metal,

and in the back of the body where it is to be joined to the neck an internal collar is formed and joins the body by a sunken shoulder, leaving round the collar a seat against which a flange on the neck fits. This flange may be soldered to the seat or left loose, in which case both the body and the neck are screwed on to the end of the spindle.

5413. METALLIC FRAMES FOR WASHING AND WRINGING MACHINES, &c., *H. H. Andrew and W. Lockwood.*—*23rd December*, 1880. 6*d*.

The frame is made of steel bars, of T, U, H or other suitable section bent into a skeleton frame, parts of which act as springs to put the pressure on the roller.

5414. APPARATUS FOR GIVING ALARM AND SECURING DOORS, WINDOWS, &c., *A. C. Farrington.*—*23rd December*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to a spring bolt, which, when liberated by opening the door or window, either explodes a detonating cap, strikes a gong, or operates a bell crank.

5417. FLUID MOTORS OR METERS, *W. P. Thompson.*—*24th December*, 1880.—(*A communication from J. Merrylees.*)—(*Not proceeded with.*) 2*d*.

A casing is made in three parts, one forming the lid, the middle one containing the index and counting mechanism, and the lower one the channel way and measuring or motive power apparatus. The disc of a flat paddle wheel revolves in a circular space in the lower chamber, and the hinged paddles move in an annular channel in which is an inclined plane, placed so as to fill the channel at one point, where the vanes are bent till they lie flat against the disc, so as to pass the point, after which they fall and again fill the channel.

541 . OBTAINING FIBROUS MATERIAL FROM A PALM TREE, *R. M. A. Duguid.*—*24th December*, 1880.—(*A communication from S. S. Herring.*) 4*d*.

The leaves with their petioles of the Elais Guineensis (which grow on the oil rivers of Western Africa) are boiled in water with a little alkali, and then beaten lightly and well washed in clean water and dried. They are then passed through fluted rollers to remove the fleshy matter.

5419. LOCOMOTIVE CARS AND TRAMWAY LOCOMOTIVES, *E. Latham and F. Bradley.*—*24th December*, 1880.—(*Not proceeded with.*) 2*d*.

This consists in driving dummy cranks affixed to an axle free to revolve in bearings from steam cylinders placed vertically at each side of a suitable generator. These cranks are coupled by rods to the carrying wheels of the car. The starting and reversing gear is operated by rods extending to either end of the car. The engine is provided with a condenser of special construction.

5420. TRAMWAYS, *J. Leathwood.*—*24th December*, 1880.—(*Not proceeded with.*) 2*d*.

The longitudinal sleepers are fitted at intervals with gripping boxes placed in recesses therein, and into which the ends of the sleepers fit. One side of the box has internal ratchet teeth, and a sliding piece having spring clips is provided with a bolt screwed to the rail, so as to hold it in position.

5421. SUBSTITUTE FOR GUMS AND RESINS, &c., *C. Estcourt and F. C. Eastwood.*—*24th December*, 1880. 2*d*.

The residue from the distillation of hydrocarbon oils is treated with substances which give up oxygen readily, preferably nitric acid, and produces a solid matter which may be used to replace gums and resins, and also an oily matter which may be used for lubricating or other purposes.

5422. PILED VELVET, &c., *J. Perkins, jun.*—*24th December*, 1880. 4*d*.

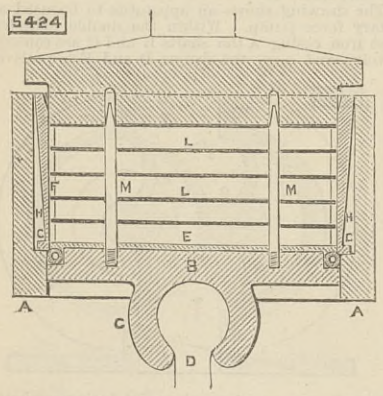
So as to produce a piled velvet with the pattern woven into it, the tappets acting upon the healds and the jacquard machine are arranged to operate as follows:—The jacquard machine raises the figure or pile with the half of the ground warp and remainder of figure heald up, and the weft is inserted here with the cutting wire. The other part of the ground warp is then raised, also a third warp, and a pattern or binder shoot or weft inserted, which raises the cutting wire, ensuring it coming perpendicular so as to cut in the centre of the pile, and thus produce a smooth instead of a ribbed surface.

5423. PREVENTING DISPLACEMENT OF LINCH-PINS OF GUN CARRIAGES, &c., *W. Gardner.*—*24th December*, 1880.—(*Not proceeded with.*) 2*d*.

This consists in placing a washer over the axle with a notch to allow the passage of the linch-pin when the washer is turned, so as to bring a flange or rim over the pin, which cannot then be removed.

5424. PRESSING OR MOULDING BRICKS, &c., *H. Johnson and B. Suart.*—*24th December*, 1880. 6*d*.

This relates to box moulds for forming bricks by pressing by steam or hand power, and its object is to form them with nibs thereon or holes therein for pegs or nails. A is the outer die or box, B the bottom plate of the press formed with a boss C forming a socket for the head of rod D, by which it is raised and lowered. E is the bottom of the box mould screwed to plate B, and F are the sides and ends of the mould connected to the bottom by hinges, and are mitred so



as to close together at their angles. H are grooves in the outer die A to guide studs G, so as to keep the box mould in position when being raised or lowered into the die. Pins M are attached to plate B, with which they rise and fall, and pass through holes in the bottom and in the separating plates, and serve to form holes through the articles; L are the separating plates, and may be either plain or embossed.

5425. MINERS' SAFETY LAMPS, *W. Crossley.*—*24th December*, 1880. 6*d*.

The lamp is entirely closed excepting an outlet at top for the products of combustion, the air to support combustion being supplied to the flame from a reservoir beneath the oil reservoir, into which a charge has been previously forced under pressure.

5426. BRAKE OR SKID APPARATUS FOR WHEELED CARRIAGES, *W. M. Hill.*—*24th December*, 1880.—(*Not proceeded with.*) 2*d*.

The object is to facilitate the releasing of the brake or skid without necessitating the backing of the horses, and consists in attaching the shoe to the frame in advance of the wheel by a chain long enough to allow it to lie on the ground in the rear of the wheel. To the same point of the frame links are fitted, and when secured to the shoe keep it in position for skidding, but when detached the shoe can pass behind the wheel.

5428. KNITTING MACHINERY, *J. Imray.*—*24th December*, 1880.—(*A communication from La Société Poron Frères Fils et Mortier.*)—(*Not proceeded with.*) 2*d*.

This relates to the construction and arrangement of the needle bar, and of the connections working it, so that a number of the needles which it carries can be simultaneously thrown out or brought into use as required for different patterns.

5429. DERIVATIVES OF BENZOLE, *J. A. Kendall.*—*24th December*, 1880.—(*Not proceeded with.*) 2*d*.

This consists in the manufacture of nitro-benzole and dinitro-benzol from the gaseous compounds obtained in the process of the destructive distillation of coal and other carbonaceous substances by means of nitric acid or a mixture of nitric acid or nitrates and sulphuric acid.

5430. HORSESHOES, *W. Job.*—*24th December*, 1880.—(*Not proceeded with.*) 2*d*.

A groove is formed on the underside of the shoe, and along its edges spaces are formed at intervals by forming curved notches therein, preferably of an open U shape, whereby the raised parts or ridges are, as it were, rendered intermittent.

5431. MOTIVE POWER ENGINES AND WATER METERS, *A. Andrews, jun.*—*24th December*, 1880.—(*Not proceeded with.*) 2*d*.

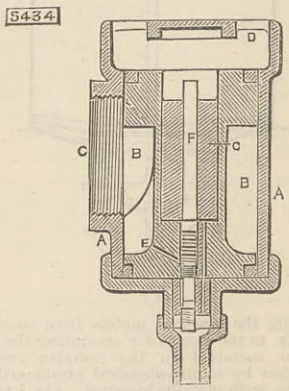
This relates to a special arrangement and combination of the valves for reversing the action of reciprocatory motive power engines and fluid meters.

5433. ROUNDABOUTS, *P. Everitt and C. Burrell, jun.*—*24th December*, 1880. 6*d*.

This relates to means for enabling persons on roundabouts to perform gyrations in groups after the manner of waltzers, such groups, while moving in a circle common to all, turning to the right or left as desired.

5434. SAFETY VALVES, *W. R. Lake.*—*24th December*, 1880.—(*A communication from G. W. Copeland.*) 6*d*.

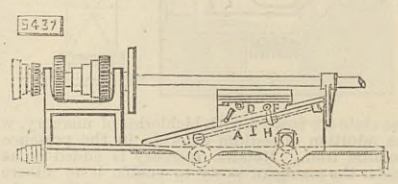
This relates to safety valves in which a weighted auxiliary piston or slide valve controls the operation of the main piston or valve, by being actuated by the excess of pressure in the valve chamber to open a port and close an exhaust, whereby the pressure in the valve chamber is allowed to enter a chamber below the main piston and lift it, thereby opening a passage from the valve chamber for the escape of the excess of pressure, and by the diminution of pressure in the valve chamber to close the port and open the exhaust, whereby the pressure in the chamber below the piston is allowed to escape, and the main piston is



moved by the pressure in the valve chamber to close the direct passage. A is the valve casing; B, the valve chamber; C, passage connecting it with the boiler; D, the direct escape port from the valve chamber; F is the main piston having two heads of unequal area. In the main piston is a hole to receive the auxiliary piston F carrying a weight. A passage extends from the valve chamber through the main piston to the annular chamber between the two heads of the auxiliary piston, the lower end of the spindle of which is reduced to form a chamber between it and the hole below the lower head of the piston.

5437. TURNING, BORING, &c., METALS AND OTHER MATERIALS, *J. Evans.*—*24th December*, 1880. 6*d*.

This relates to the means for adjusting the material to be operated upon. The support or holder D for the material slides on an inclined plane formed on the



upper surface of the traversing saddle A worked in the usual manner, the position of the holder upon the saddle A being regulated by a worm turned by a winch and gearing with a wheel H moving on the screw I.

5438. TREATING LIQUID THAT HAS BEEN USED IN WASHING WOOL, &c., *W. R. Lake.*—*24th December*, 1880.—(*A communication from F. Prévost.*) 6*d*.

The water is introduced into reservoirs of bricks lined with Portland cement, and into it is poured an acid liquid prepared for the purpose of neutralisation and decomposition, and consisting of 20 kilogrammes sulphuric acid at 66 deg. B., 60 kilogrammes sulphuric acid at 53 deg. B., and 20 kilogrammes hydrochloric acid at 22 deg. B. The fatty matter floats on top and the magina passes through filters, and is afterwards boiled and sawdust added, the mass being afterwards pressed so as to obtain a crude oil which is then purified.

5439. ATTACHING DOOR KNOBS, &c., TO THEIR SPINDLES, *H. Payton and W. S. Dackus.*—*24th December*, 1880. 6*d*.

The spindle is square and tubular, the portion on which the knob fits being split, and the hole in the knob has a partition across it which passes into the slit of the spindle, and by forcing the two sides apart binds them firmly in position.

5440. TRICYCLES, *J. H. Walsh.*—*24th December*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to a mode of locking and guiding the steering wheel, so as to leave the arms free to be used with the legs in driving the tricycle.

5453. ARTIFICIAL EAR DRUMS, *H. P. K. Peck.*—*28th December*, 1880. 6*d*.

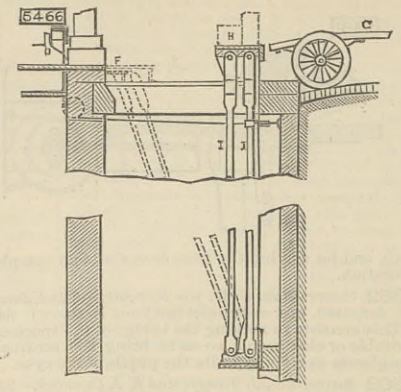
This consists in combining with a thin elastic plate or disc to be inserted in the auditory passage of the ear, near or in place of the natural tympanum, a tubular stem through which air may circulate between the outside and the ear passage at the back of the plate or disc, and between that and the natural tympanum, if still existing, and thus ventilate the ear, and in connecting the plate or disc with the stem by a collar on the inner end of the stem inserted between two thicknesses of the plate, so that the collar is covered and cushioned and cannot come in contact with the tympanum, and cannot irritate and inflame it.

5463. STAINING OR COLOURING WOOD, &c., *E. A. Brydges.*—*28th December*, 1880.—(*A communication from A. Thimm.*) 4*d*.

Solutions of a metallic salt are applied to the wood and allowed to dry, after which the wood is placed in an air-tight room, and gas admitted, such as sulphuretted hydrogen or ammoniacal gas. The metallic salts are precipitated in the pores of the wood, and sulphides or hydroxides formed, so that a durable stain or colour is produced.

5466. TRANSFERS FOR FREIGHT, &c., *A. E. McDonald.*—*29th December*, 1880. 6*d*.

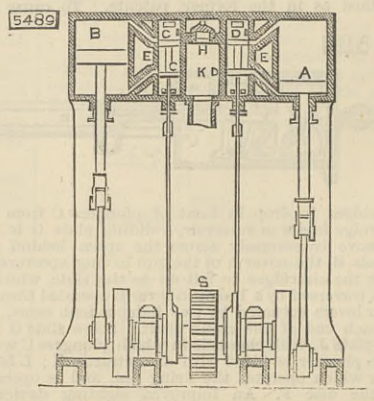
This relates to means for transferring goods across foot pavements to or from vans, and between warehouses and the outer edge of the foot pavement. The platform H is mounted on levers I, pivotted at their lower ends and passing through slots in the side walk. By moving the levers by means of the winch D the platform on which the goods are placed can be moved



from the step of the warehouse F to the vehicle G or *vice versâ*.

5489. STEAM ENGINES, &c., *H. Davey.*—*30th December*, 1880. 6*d*.

This relates to the construction of a small engine to be used to work the valves of a main engine, so that the direction of rotation and speed of the latter are governed thereby. A and B are the cylinders actuating shaft S. Between them is a space containing two cylindrical slide cases and a chamber between them divided into compartments, the back one H receiving steam supply, and the front one K divided by horizontal partitions into three compartments, the middle one serving as the exhaust. The slide cases contain double piston slides C and D, worked by ex-



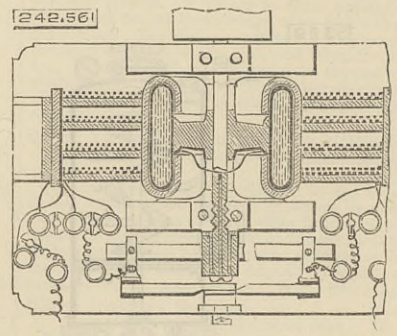
centrics. From the slide cases central passages lead to the top compartment of K, and end passages I lead to the lowest compartment of K. The partition between H and K has three ports, opening respectively into the three compartments of K, and are governed by a D slide moved by hand, so as to reverse the motion. To control a main engine the shaft of this engine is connected to the slide valve of the main engine, stops being provided, so that the subsidiary engine cannot outrun the main engine.

SELECTED AMERICAN PATENTS.

From the United States Patent Office Official Gazette.

242,561. DYNAMO-ELECTRIC MACHINES, *Henry C. Sample and Franz Rabl, Philadelphia, Pa.*—*Filed February 21st*, 1881.

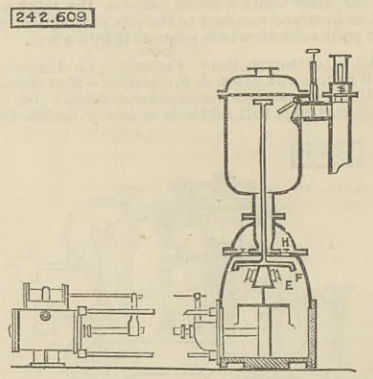
Brief.—The field magnets are formed of tubular cores, one enclosed within the other, with pole pieces nearly enclosing the armature. The armature core is formed of alternate layers of wire gauze and per-



forated sheet metal. The field magnets may be connected in quantity or tension by means of suitable plates and connecting plugs. The commutator brushes are independently carried upon adjustable arms.

242,609. STEAM PUMP, *Charles P. Deane, Springfield, Mass.*—*Filed March 5th*, 1881.

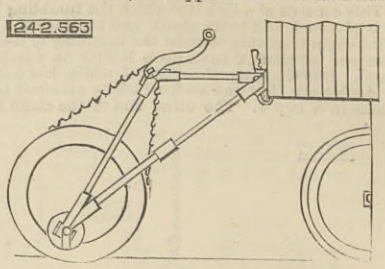
Claim.—(1) The combination with the air valves *f* in the pump chamber, of the pipe *g*, extending to an opening for inlet at that part of the condenser E where the air therein tends to concentrate, substantially as and for the purpose described. (2) The combination, with the suction valves *e*, communicating



with the suction chamber *a*, of the air valves *f*, communicating with the condenser E, substantially as and for the purpose described. (3) The arrangement with respect to the discharge valves *h* of both the water valves *e* and the air valves *f* at a considerable distance below the discharge valves, substantially as shown, and for the purpose described.

242,563. CAR-MOVER, *Will S. Seymour, Townsend Sager, and Thomas T. Croft, Janesville, Wis.*—*Filed April 26th*, 1881.

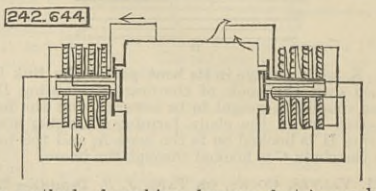
Claim.—A car-pusher or mover consisting essentially of a frame adapted to be attached or connected with the car at one end, the opposite end of said frame



being provided with a flanged wheel adapted to engage with the rails and devices, substantially as described, for imparting rotary movement to said flanged wheel, substantially as set forth.

242,644. DYNAMO-ELECTRIC MACHINE, *Paget Higgs, New York, N.Y.*—*Filed March 3rd*, 1881.

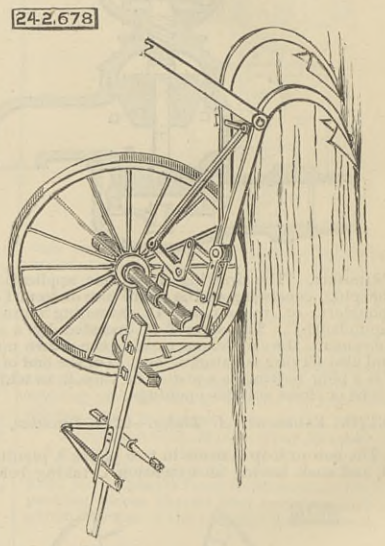
Claim.—(1) A dynamo-electric machine, in which the cores of some of the field-of-force magnets are placed in the shunt circuit only and the rest of the cores are in the main circuit, substantially as described. (2)



The method of working dynamo-electric machines which consists in magnetising a part of the field-of-force magnets by the main current and a part of them by the current of a shunt circuit, substantially as described.

242,678. CULTIVATOR, *Isaac S. Mussetter, Oakland, Ohio.*—*Filed April 4th*, 1881.

Brief.—By means of the jointed beam the link and bell crank are connected by the angular bar to the rear part of the beam, when the beams are swung laterally they remain practically parallel with the line of draught and the shovels always at right angles.



Claim.—In a cultivator, the combination, with the clip D, of the link F, beam G, bell-crank lever H, rod I, and lever or link K, whereby the point of the beam is moved correspondingly with lateral movement of the handle of said beam and a straight-line draught secured from the latter in every position, substantially as shown and described.

CONTENTS.

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