THE INSTITUTION OF NAVAL ARCHITECTS.

On Thursday, the 9th inst., the proceedings commenced with the reading of a paper by Mr. W. H. White,

On the Stability of Certain Merchant Ships.

This paper gave the results of a series of calculations made at the Naval College from data furnished by drawings of several typical merchant ships, and by inclining experiments made therewith by the builders for the purpose of ascertaining the vertical positions of the centres of gravity of those ships in a completed state. From data thus obtained estimates were made of the vertical position of the centres of gravity corresponding to various conditions of loading. From the information thus furnished a number of metacentric and stability curves were constructed. Several of these curves were given in the paper, and the author explained their use in affording comparisons between naval and merchant ships, and showing the relative changes of position of the metacentre and centre of buoyancy with change of centre of gravity consequent on loss or movement of cargo or consumption of coal. He explained that with many long, narrow, and deep merchant ships the greatest care had to be taken when unloading a cargo, coal being taken in as the vessel becomes light. Reference was made to the use of water ballast in order to make up for the stiffness lost by removal of cargo and coal. It was pointed out, however, that "there seems good reason for thinking that extreme narrowness in proportion to length and draught does not promote economy of steam power; and the movement in favour of greater proportionate beam which is now taking place will have the effect of increasing the initial stability of merchant steamers in the light condition." The experiments of the late Mr. Froude were quoted as showing that with a constant length, draught, and displacement, the extreme breadth of a ship may be increased from a little over one-tenth the length to a little over one-eighth of the length, without increasing the resistance at moderate speeds, and with a decrease in resistance at high speeds. The fineing of the ends of the vessel, and the rounding out of the water lines at midships which always accompanies this change of form of the ship, gives greater moment of inertia to the load line section, or plane of floatation of the same area; the height of the metacentre above the centre of buoyancy, and above the keel, is at the same time increased. The very great difference between the conditions of stability in different types of merchant ships shows the necessity for determining those conditions for each type, and this is recognised by some builders who make a practice of experimentally determining the initial stability of the ships they build.

Mr. W. Denny opened the discussion on Mr. White's paper, and said that some firms set off the metacentric height in terms of the moulded breadth, and adopted a minimum metacentric height of 0·4 of that breadth, making the calculation on the assumption that the coal was consumed. He said that the great increasing attention now being paid to stability of merchant ships was a matter for congratulation and encouragement. Mr. Martell spoke of the great importance of the question of stability, and remarked that some of the very long narrow ships weighed 0·6 of their load displacement, and, indeed, this was shown by reference to a table in the paper which gave the light displacement of one of the vessels as 1760 tons and the load displacement as 2870 tons, or 61 per cent. of light load. Froude, he said, had showed that greater width for ships might be advantageously employed, and another speaker said that greater width should be in every way encouraged, for ship after ship is lost for want of stability only. This speaker also remarked that the construction of the lighter structures on the deck should be encouraged, so as to get the centre of gravity low. Mr. Barnes remarked that the relation of the breadth of a ship to the length might have little to do with the stability unless the depth were taken into account, the depth being the more important factor. Mr. White replied upon the discussion, and a paper was then read

On Waves Raised by Paddle Steamers and their Positions Relatively to the Wheels.

The object of the author was to consider two sources of loss of power in paddle-steamers; these were, energy absorbed in creating and maintaining waves, and the effect of this wave formation on the wheels. The first of these, due to constant wave making, is common to all vessels pushed to a speed beyond that for which their size and form fit them. It is irrespective of the description of the propeller, and, according to the late Mr. Froude, forms a large proportion of the total resistance. The author then explained that a ship requiring much propelling power sets up a wave formation which upsets the calculations upon which, with an assumed water line, the diameter and position of the wheels were theoretically fixed.

FIG. 1.

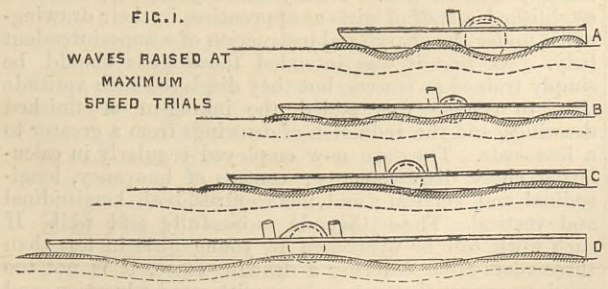
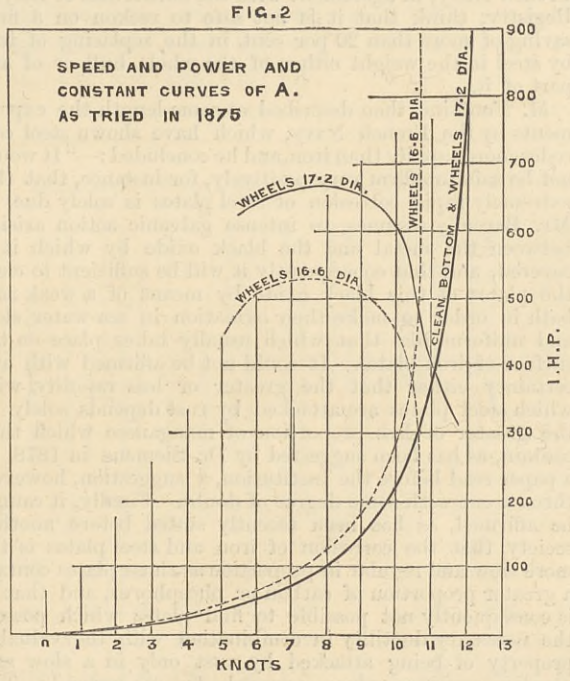


Fig. 1 was given as illustrating these causes of loss of power. It represents four vessels, marked A, B, C, and D respectively, and the waves that each sets up in smooth water at her maximum speed. The speeds are—A, 11·4 knots; B, 10·88 knots; C, 16·18 knots; and D, 17·9 knots, or 20·61 miles. Exhaustive trials on the same measured mile were made with each of the vessels. The types are widely different, and notwithstanding any imperfections that may be shown to belong to any of them, each vessel is amongst the fastest, or is the fastest, of her type and class. The first, marked A, raises three waves in the length, and brings the wheels into a wave hollow, thereby reducing the area of the paddle race considerably, and the centre wave curves too close behind the wheel to make the increased head of water of use in giving forward pressure to the vessel. The second, marked B, is a case of four waves in the length, a wave coming just in front of the wheels, the one abaft it being in this case also too far forward to be of service. The third and fourth, C and D, have about two and a-half waves in the length, the wheels working at the normal level. These vessels are of a length and form more nearly corresponding to their speeds, and so the waves once raised will travel along with the ship without a great expenditure of power to maintain their speed. In the case of the first two, however, as the dotted wave lines drawn under each vessel show, the length of rolling waves corresponding to the speed is in each case much greater than the waves made by the ship, so that short waves are made to travel at a rate beyond their natural speed, and a constant expenditure of power goes on to accomplish this.

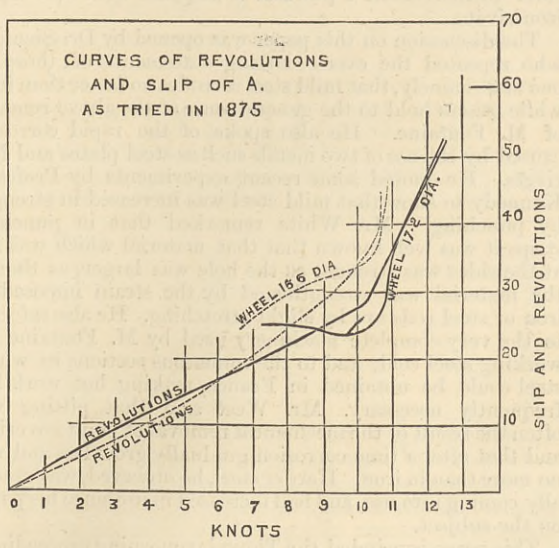
The vessel marked A is the shortest and fullest of the series, and was driven at the greatest speed in proportion to her length and form. This vessel was built in 1875 for heavy towing work abroad, and was tried on the measured mile. The speed was only about 10½ knots. The following day a second trial was made with the ship more by the head, but with no better results. The speed was not satisfactory, and, as the boiler could not apparently give sufficient steam, it was about to be condemned, and one with more fire-grate substituted. It was not, however, clear that a new boiler would improve matters, so it was determined to subject the ship to careful trials at different speeds, and to note the wave formation, with the object of discovering whether the speed could be improved by increasing the boiler power.

FIG. 2



When the speed and power curves shown in dotted lines on Fig. 2 were drawn, it was seen that no multiplication of power with the same wheel could increase the speed.

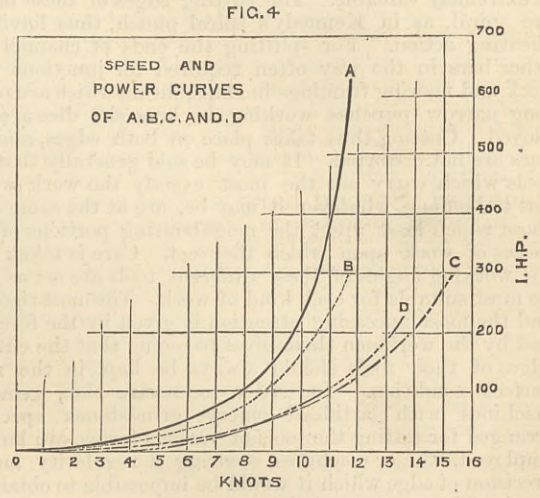
FIG. 3



Curves of revolutions and slip being made—Fig. 3—pointed to a sudden falling off in the efficiency of the propellers at the speed corresponding to the elbows in the curves, and when the wave crests and hollows, as shown in Fig. 1, were set off, the cause was explained. The water, which was at its normal level about 10 knots, fell off about 15in. at 11·4 knots, thus reducing the area of the paddle race by nearly one-half. The remedy seemed to lie in increasing the diameter of the wheels. This was done temporarily by bolting iron plates on the outside edge of each float, increasing the diameter 18in. This was done and another trial made. The other conditions were the same on this as on the previous trial, except that the vessel was put on the slip and the bottom cleaned, and painted with a mixture of half paint and half tallow. The gain in speed was three-quarters of a knot, a half knot being due to the cleaned bottom, leaving one-quarter of a knot as the result of increasing the diameter of the wheels. The curves belonging to this trial are shown on Figs. 2 and 3 by lines in full. Fig. 1 shows that broad, full vessels exert power in raising a series of waves, whereas longer vessels of narrower and sharper design are more or less free from this.

The curves in Fig. 4 give the comparative force required in each case in propelling the respective types at a given speed, assuming all the vessels to be of the same length. At 11 knots A takes four times the power of C and D, and twice that of B.

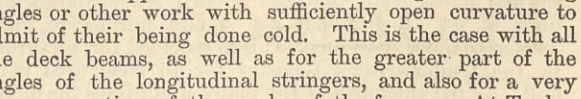
FIG. 4



The author considers that, from the data derived from the trials, his paper shows the difficulty of driving full types as compared with finer ones.

Fig. 5 is intended to show how little wetted surface affects the resistance in vessels of this class, and that surface is a most unreliable unit of comparison.

FIG. 5



While in the preceding paper reference was made to the advantage of a return to broader vessels, Mr. Hamilton concludes by saying that his paper shows "the great waste of power in wave making in short, full paddle-steamers, as compared with longer and sharper types; and that much may be gained in economy by increasing the proportion of length to breadth and depth in vessels of this class, the success of vessels of this kind depending far more on their proportions than any fanciful form of lines."

The discussion on this paper was brief, and was followed by a paper by M. Marc Berrier Fontaine, Chief Constructor of the French Navy, on

The Use of Mild Steel for Shipbuilding in the French Dockyards.

After referring to the numerous papers which have been written on mild steel and its applications in this country, the author described the parts played by France and England in the manufacture and development of mild steel, and its employment for shipbuilding amongst other work. He then went on to describe the chief elements of successful manipulation of mild steel, the principal of these being the necessary great skill on the part of workmen, who need to be encouraged in spite of the failures due to the want of experience in dealing with the new material. He next went on to consider the importance of having special tools for dealing with mild steel for shipbuilding, and especially of mechanical arrangements for taking the plates from ovens and quickly depositing them on the tables or dies upon which they have to be shaped, so that the work may be done without hurry and whilst the plate is still red-hot. Much stress was laid on the use of gas ovens on the Gorman system instead of furnaces on Siemens's system for heating plates for hot bending, the Gorman oven being simpler in construction and management. At Toulon, as soon as a piece of metal is brought to a fitting temperature, it is seized in the oven by pincers, to which a rope is made fast, which, passing over other return pulleys, passes to one of two capstans. A workman starts this by pressing his foot on a lever close to the ground, a few turns of a Brotherhood engine being enough to get the piece thus drawn on to the plates alongside of the guides upon which it is to be moulded; one of its ends being quickly fitted against these guides, the other end is clutched by a claw which is hauled upon by a cord seized upon one of the capstans. Wooden mallets and swages are used for almost all the work, but when excessively sharp curvatures, &c., are needed, and hammers have to be used, the work is afterwards carefully annealed. Annealing is not otherwise resorted to, as the work is still at a colour heat when finished.

The use of hydraulic presses gives the most satisfactory results when applied to the work of fitting and moulding angles or other work with sufficiently open curvature to admit of their being done cold. This is the case with all the deck beams, as well as for the greater part of the angles of the longitudinal stringers, and also for a very large proportion of the angles of the frames. At Toulon this work is performed by presses of graduated power from 5 tons to 100 tons, some vertical, some horizontal, to suit all possible cases. One press of 100 tons is quite sufficient for straightening and moulding double Tee-bars of iron of 350 × 150 × 15 mm., and of steel bars of 300 × 148 × 14 mm. The profiles of these are among the most rigid forms of all those yet dealt with. A press of 50 tons is sufficient for straightening and moulding almost all the

other forms used, from that of H or double Tee-bars of steel of 250 × 130 × 10 mm. Finally, the small 10-ton presses can easily mould steel angles of 150 × 150 × 15 mm., and 5-ton presses will mould steel angles of 120 × 120 × 12 mm. The consideration of the effect of ragged holes and punched edges has led the authorities to forbid the use of the punch for making cuts in the plates, whether straight or curved, by a string of holes. In that respect the exceptionally large stretch of the Toulon hydraulic shears, which is 1·50 metre, or 5ft., allows the shearing of the largest plates in any direction, and to cut sheets of any length up to 3 metres wide straight across. Curved cuts are obtained at once by means of a series of blades having graduated curvature, and brought sufficiently close to one another for them to cut out with sufficient exactness all shapes which can occur, whatever be their curvature. A collection of bent blades of this kind makes an outfit which is extremely valuable. The cutting edges of these blades are spiral, as in Kennedy's spiral punch, thus having a shearing action. For splitting the ends of channel and other bars in the way often required for junctions with deck and flooring framings in ships, shears which are really long narrow punches working in long slot dies are employed. Cutting thus takes place on both edges, and the bars are not distorted. It may be said generally that the tools which carry out the most exactly the work which has to be done, whatever it may be, are at the same time those which least upset the neighbouring portions of the pieces of work upon which they act. Care is taken that the working angles of these different tools are set as may be most suitable for each kind of work. The most rigorous and the most unceasing attention is given by the foremen and by the workmen themselves to seeing that the cutting edges of their tools should always be kept in the most perfect condition. In order to secure this, grinding machines with artificial emery grindstones specially arranged for setting the tools of various forms, are largely employed, these machines securing a regularity and a precision of edge which it would be impossible to obtain by hand. These emery grindstones are also used for taking off burrs, and finishing both plate work or moulded bars, as well as in finishing the small forged pieces, such as ring bolts, staples, hinges, and so forth, which form so large a part of modern construction. A saving of 22 per cent. has been found to be the result of long-continued trial of twist drills properly ground with emery wheel machines. The improvements in the results obtained by great care in every phase of the making of plates and moulded bars of steel has led the Constructors of the French Navy to consider the desirability of relaxing by slow degrees the severe requirements which had at first been imposed by them for the execution of work of every description to which the plates and moulded bars of steel should be submitted in the dockyards. The cases in which it is judged necessary to anneal steel plates and moulded bars are now incomparably less frequent than they used to be a few years ago, and the number is still undergoing daily reduction. A return by degrees is being made to the use of the simple punch, without annealing and without riming, for cutting holes in almost all the pieces of framework of the new constructions, reserving the use of the drill for those pieces only in which there is special reason for keeping up the greatest possible strength, having regard to the more important position that they have to take in the construction, or the exceptional strains they may have to bear. The vigorous precautions which the want of homogeneity at one time enforced are being discarded, and the most recent trials appear to prove that the loss of strength in punching and working is not much greater for steel than for iron. M. Fontaine therefore with very cautious enthusiasm remarks :—"It seems to me, therefore, to be beyond doubt that at no distant period—as soon as the breakage of steel work becomes sufficiently rare not to require greater precautions in working these pieces than those which are applied to iron, that is to say—we shall very soon get into the way of punching nearly all the steel plates and moulded bars, and of only annealing them in exceptional cases, when they may have been submitted to very violent and very trying deformations—a treatment, in fact, precisely similar to what we give to iron under the same circumstances." Owing to the more complete homogeneity and ductility of the steels, and also to the increased practice workmen have acquired with the new metal, the welding of steel plates and bars can now be effected as easily, as simply, and as satisfactorily as that of similar work in iron, without, M. Fontaine says, its being necessary to have recourse to any special process or to the use of any particular flux. "A great number of weldings of steel plates and angles have been broken as tests, and the results of these tests, in which the fracture often takes place outside the weld, have finally led us to consider the welding of thin plates of steel as being as certain and perfect as that of similar pieces of iron."

The author stated that the tensile strength demanded and the inferior limit imposed by the French authorities for steel plates and bars of various sections were not the same for all thicknesses and sections, but were greater for the smaller and thinner sections. Excluding boiler iron, for which an exceptional amount of ductility is considered indispensable, the inferior limit of tensile strength required by the French Navy is as a general rule higher than that specified by the English Admiralty, by Lloyd's Registry, and even by the Underwriters' Registry. It is only, in fact, for the thicker plates of from 20 to 30 millimetres, and for the stringers and butt-straps of all thicknesses, worked across grain, that the French Navy allows a low limit of 44 kilogrammes per square millimetre, or of 28 tons to the square inch. This is specified for, all through by the Underwriter's Registry for all steel used in the hull. As the thickness of the plates diminishes the inferior limit required in the French Navy increases progressively, and for plates of from 6 to 20 millimetres in thickness, which includes nearly all those used in modern constructions, this limit already exceeds by 1 kilogramme per square millimetre that of the Liverpool Society. In order to be accepted for use in the French Navy, thin plates from 1 to 4 millimetres thick must be subjected to a minimum test of 30 tons to the square inch, or 47·25 kilogrammes per square millimetre, while the minimum tensile strength of the stringers and butt-straps tried along the grain, and that of bars of all sections with the exception of double tee-bars, tee-bars, and bulb-iron, should be of a still higher tensile strength, namely, 48 kilogrammes in place of 47·25 kilogrammes per square millimetre. In the French Navy there is no superior limit to the tensile strength of steel presented for acceptance, so that the total effect of the conditions required by it has had the effect of furnishing it with steel plates and bars having an actual tensile strength very considerably in excess of those of the similar pieces of steel which are used in the same work in the building yards of Great Britain. This superior tensile strength is not bought in the French Navy at the cost of a reduction of ductility in the steel there employed, for a minimum elongation of 20 per cent. is demanded.

As regards the calculations of tensile strength, it appears from the results of the numerous experiments a that mean figure of 48 kilogrammes per square millimetre representing the ordinary breaking strain of steel plates and moulded bars such as are actually used in the French Navy, is adopted. The usual breaking strength of the iron plates and moulded bars of ordinary and common quality which are delivered to it, cannot, on the other hand, be regarded as greater than 36 kilogrammes per square millimetre at the outside. For iron a factor of safety of 6 is used. Using the same factor for steel it is reckoned that plates and moulded bars of this metal may be safely loaded with 8 kilogrammes per square millimetre. The limiting loads of 6 kilogrammes for iron and 8 kilogrammes for steel, are to one another as 1 : 1·33, consequently the inverse ratio of 1 to 0·75 indicates the reduction of thickness, and therefore of weight, which the substitution of steel for iron allows us to introduce into the plates and moulded bars which we use. This corresponds to an economy of 25 per cent. in weight. In order to take account of the loss of strength experienced during the work—a loss which may well be of greater relative importance in steel than in iron—and in order to take account of the existence of an inferior limit below which we cannot reduce the thickness of steel plates without risking their buckling, and although there does not exist any general formal rule about this, the Constructors of the French Navy, in agreement with the authorities of Lloyd's Registry, think that it is not safe to reckon on a final saving of more than 20 per cent. in the replacing of iron by steel in the weight either of the whole hull or of any part of it.

M. Fontaine then described at some length the experiments by the French Navy, which have shown steel corrodes more rapidly than iron, and he concluded :—"It would not be safe to affirm very positively, for instance, that this extremely rapid corrosion of steel plates is solely due, as Mr. Barnaby assumes, to intense galvanic action arising between the metal and the black oxide by which it is covered, and that consequently it will be sufficient to clear the plates of this black oxide by means of a weak acid bath in order to make their oxidation in sea-water slow and uniform, like that which usually takes place on the surface of iron plates. It could not be affirmed with any certainty either that the greater or less rapidity with which steel plates are attacked by rust depends solely on the greater or less proportion of manganese which they contain, as has been suggested by Dr. Siemens in 1878, in a paper read before the Institution, a suggestion, however, thrown out with some degree of doubt. Finally, it cannot be affirmed, as has been recently stated before another society, that the corrosion of iron and steel plates is the more slow and regular in proportion as those plates contain a greater proportion of carbon or phosphorus, and that it is consequently not possible to find plates which possess the necessary ductility in combination with the valuable property of being attacked by rust only in a slow and regular manner when exposed to sea-water." The French contractors consider that the cases in which steel rivets have hitherto been used do not seem to them sufficiently numerous, nor does the experience which results from them appear to them to have been sufficiently extended, nor sufficiently conclusive, to allow them to consider themselves in a position to dispense with the use of iron rivets.

The discussion on this paper was opened by Dr. Siemens, who repeated the ever-recurring statements of those on one side, namely, that mild steel corrodes no faster than iron, while others hold to the general sense of the above remarks of M. Fontaine. He also spoke of the rapid corrosion caused by the use of two metals such as steel plates and iron rivets. He quoted some recent experiments by Professor Kennedy to show that mild steel was increased in strength by punching. Mr. White remarked that in punching strips it was well known that that material which was left at the sides was stronger as the hole was larger, as though the material was strengthened by the strain imposed, as iron or steel rods are by slight stretching. He also referred to the very complete machinery used by M. Fontaine for working steel cold, and to the numerous sections in which steel could be obtained in France, making hot work less frequently necessary. Mr. West said that pitting was often the result of the mechanical removal of paint covering, and that after a time corrosion gradually grew less and was no more than in iron. Harder steel, he observed, was gradually coming into use, and had increased in use since his paper on the subject.

This paper concluded the Thursday morning proceedings.

On Thursday evening the proceedings commenced with a paper by Mr. W. Denny,

On Local Education in Naval Architecture.

The object of Mr. Denny's paper was to draw attention to the necessity for local education in naval architecture, for the large class in some districts of young naval architects and draughtsmen who are unable to attend the Naval College, and to whom the examinations conducted by the South Kensington Department are almost wholly useless. "To educate the majority of our rising naval architects, we must bring the necessary education to their doors, and enable them to obtain it concurrently with their everyday work. On this account, I think it is the duty of this Institution to express some opinion on the manner in which the South Kensington examinations are at present conducted, and to press upon the Government, if defects can be shown to exist in these examinations, that they should be remedied promptly and effectually." A curriculum is arranged by the South Kensington Department which is spoken of as follows by the teacher, a gold medallist, of Dumbarton, who is also the head draughtsman of Messrs. Denny's firm :—"The teacher has to follow so very closely the line indicated by the questions put in each year's examination, that there is little or no time to digress for the purpose of treating matters very important in themselves, but which are not among those required by the department. A large amount of time is occupied in describing to the pupils of elementary, and indeed all the stages, matters with which they are never likely to have any practical acquaintance, and thus a good deal of the instruction becomes mere cram, the imparting of really useful information being sacrificed to the preparation of the pupils to meet the examination." In order to give some idea of the examinations arranged by South Kensington, Mr. Denny summarised the papers of 1878-79 and 1880. These showed that the chief subjects relate to wood and composite shipbuilding.

The retention of these and other subjects, which are to all intents and purposes archaic, crushes out more important elements, and excepting the questions in iron construction, which have a practical bearing, there are very few of present importance and interest. The important omissions include :—The strength of sections of steamers, involving the calculation of the neutral axis and moment of inertia of these sections. The stability of vessels treated even in the simplest form, with reference to the metacentric height, and its alterations by the combined influences of change of draught and vertical change of weight. The speed and power of steamers, Mr. Froude's law of proportional resistances and speeds, and Mr. Inglis's application of that law to the actual results obtained from speed trials. Besides these, there is the matter of trim, too often neglected in the designs of merchant steamers. How important for a pupil to know how to predict the effects on trim of coal consumption, of the addition or removal of ballast, of the fore and aft disposition of cargo, &c. All these subjects are capable of clear and direct exposition with concrete examples, and without involving the very highest and most difficult treatment. All of them are undeniably necessary knowledge for any naval architect who is to be entrusted with the design of vessels. Yet the South Kensington papers contain no hint of them or a question regarding them. These examinations are not obtaining the sympathies of practical shipbuilders, and unless a change is soon made even their best friends will be unable to support them.

Mr. Denny submitted the following recommendations : —First, that the examinations be extended from three to four stages, so as to cover a period of four years. This period would not be too long, as drawing-office apprenticeships are hardly ever less than of four years, and are generally of five years' duration. He would omit altogether from the examinations, or make optional, questions in wood and composite shipbuilding, and questions in laying off—the former as useless for mercantile yards, and the latter as likely to be well enough taught for the purposes of mercantile shipbuilding in even the most rule-of-thumb shipyards. He would divide the questions for the mercantile yards in each year or stage into two portions, the first to include construction in iron and steel, the strength of rivetted joints, and the nature of iron and steel, their manufacture, and the tests generally required of them. The second portion would include as much of the theory of naval architecture, and the calculations connected with it, as could be imparted during the year's private study to ordinary pupils. The first stage might include, for example, questions on the details of iron construction and its methods, and examination in the calculations necessary to produce an ordinary displacement curve, and to find the vertical centre of buoyancy. The second year might include questions as to the nature of iron and steel, their manufacture and tests, and examination in the calculations necessary to find the longitudinal and transverse metacentres. The third year might include questions as to the strength of rivetted joints and their disposition, and examination in calculations of trim, with concrete examples showing the use of the longitudinal metacentre. The fourth or honours year should include the calculation of the neutral axis and moment of inertia of a scantling section, and calculations as to stability, showing the use of the transverse metacentre. In the third and fourth years the necessary curves of metacentres, &c., should be supplied for the trim and stability calculations, so as to test the pupils in their ability to utilise these curves. Were such a series of examinations carried out the result would be that the pupils' minds would be awakened to all the main points of importance in naval architecture, and the minds of their teachers would be equally stimulated.

Mr. Denny went on to explain that he did not think that the scheme would be too advanced for the pupils who would present themselves; and as to the ability of the pupils, the experience of his firm justified some confidence being placed in this. Nearly three years ago his firm established a staff of girls as apprentices in their drawing-office, under the charge and instruction of a superintendent lady. At first it was intended these girls should be simply trained as tracers, but they displayed such aptitude that to tracing was added the inking-in of finished drawings, and the reduction of drawings from a greater to a less scale. They are now employed regularly in calculating check displacements; centres of buoyancy, longitudinal and vertical; and metacentres, both longitudinal and vertical. These they do successfully and well. If such work can be overtaken by young girls in less than three years from entering a drawing-office, it is not too much to expect that young men with good education, and a future before them depending upon their own acquirements, should do even better

In the discussion, Mr. Bascomb defended the South Kensington examinations, for which he prepared the papers for the Department, but under directions and restrictions. The very elementary character of the instruction and examinations, he said, was necessary to suit the class examined—youths and men usually uneducated. He had had to cancel some papers, not because they were technically insufficient—some were excellent in this respect—but because the orthography was bad or indifferent. Thus a shipbuilder's powers must be judged by his capacity to spell ipecachuana. Mr. Bascomb thought it "was one thing to produce girls who could trace and make metacentric and buoyant calculations in an office, but it was another thing to produce men to go into the shipyard and do practical work." The meeting seemed to think Mr. Bascomb's remarks somewhat amusing, if not demonstrably true. Mr. Martell spoke of the pressing necessity for a higher class of teaching and examination, to be held at the great shipbuilding centres, and also of the importance of giving precedence to iron and steel shipbuilding over wood and composite work. Mr. John sympathised with Mr. Bascomb, whose hands were tied by the Kensington Council; but he also sympathised with Mr. Denny, for he understood the necessity for a higher education, and more thorough and practical examination. We have, he pointed out, this South Kensington examination and teaching system and the Naval College, and yet the £50 scholarships lay idle for want of a thorough system of education which the numerous apprentices in shipbuilding work can attend and appreciate, as giving the instruction that is required. It was quite easy to see that a thorough contempt for the South Kensington system was only thinly veiled by the transparent praise bestowed on Mr. Bascomb's work. Mr. White spoke of the perfect accuracy with which the calculations were made by the girls at Dumbarton, and also of the great interest which Messrs. Denny took in those employed by them. He also said that the success of the young naval architects of Dumbarton was not only due to Mr. Denny's firm, but to the practical as well as theoretical knowledge and ability of their chief draughtsman, who is the teacher there under South Kensington, hampered though he is by useless instructions and restrictions. Dr. Woolley said that the paper and the discussion pointed to the necessity of recognising the fact that modern ships, shipping, and ship construction had entirely changed the character of the education necessary for naval architects and draughtsmen, that the South Kensington system of teaching and matter taught were old and totally unsuited to the times, and that the necessary subjects must be determined by those who know something about ships and shipbuilding. Admiral De Horsey occupied time by expressing his opinion that a knowledge of iron and steel shipbuilding was probably necessary, but he thought wood and composite shipbuilding was not out of date, and that it was of great importance that young men should be instructed in building wood ships, for if they were not so much built here now as formerly, young men would be glad to learn to build such ships to enable them to go to America and Canada and there make use of their information. Mr. Denny, in reply, thought there was something curious in the excuse for instruction in wood shipbuilding, that it was necessary to young men to take to America and Canada, and he asked Admiral de Horsey what ships he thought the young men were going to build out there. In the continuation of his reply, Mr. Denny urged the necessity for some such system of education as he had proposed.

A paper was then read by Mr. J. T. Milton,

On Strength of Crank Shafts.

In 1879 Mr. Milton read a paper "On Some of the Causes of the Failure of Crank Shafts," in which he showed that the bending moment constituted a considerable portion of the whole strain on crank shafts, and that when bearings get out of line the bending moment may be much greater than the twisting moment. He gave curves showing that in an engine with cranks at 90 deg., and with the second bearing slack, the strain on the shaft was increased to 1·57 times its original amount, while with the first bearing slacked, the strain was increased 2·29 times. In another engine with cranks also at 90 deg., the increase of strain was 1·60 and 2·24 times respectively. In the paper read on the 7th inst. he described the effect produced on the strains on the shafting by variations in the angles between the cranks, and also by variation in the length of the stroke. For this purpose he took the indicator diagrams of a pair of engines with cylinders of 30in. and 60in. diameter and 39in. stroke, worked at a boiler pressure of 85 lb. per square inch. From the diagrams the crank pin pressures were ascertained, allowance being made for the effect of inertia and weight of the reciprocating parts. The strains on the shafting were calculated for every 20 deg. of the revolutions of the engines in ten cases, the angles between the cranks varying from 90 deg. to 180 deg. The results of the maximum strains are given in Table I. The similar strains occurring in the engine on the supposition of the stroke being increased to 60in. were also calculated, and the results are given in Table II. The twisting moment is increased proportionately to the length of stroke, but the bending moment remains unaltered. In each case the author calculated the amount of the increased strain due to slacking back the bearing as well as the strains caused by the ordinary working. By diagrams it was shown that the least twisting strain occurs when the angles of the crank are at 90 deg.; gradually increasing with the increase of the angle between the cranks until at 180 deg. it reaches its maximum of 35 per cent. in excess of that at 90 deg. The ratio of the maximum moment to the mean, viz., 1·31 to 1 in one engine, even with the cranks at 90 deg., is greater than it is usually thought to be, but the author remarked that in a large number of cases, when the inertia and the obliquity of the connecting rod are taken into account, he rarely found the ratio to fall below 1·25 to 1. The paper was accompanied by a number of diagrams showing the relative strains on crank and screw shafts, with the cranks at different angular positions, and the bearings in and out of line. From these diagrams it appeared that the extra strain thrown on the crank shaft by increasing the angle of the cranks beyond 90 deg. is not so great proportionately as that thrown on the screw shafting, whilst the extra strain thrown upon the crank shaft by bearings not in line is less in the engines with the cranks wide apart than in that with the cranks at 90 deg. These diagrams also showed that in engines in which the strokes bear different proportions to the diameters of the cylinders, it is wrong to assume that the straining effect on the shafts varies as the twisting moment, it being seen in the two cases—*vide* Table III—that with the same useful work done in the engine with the longer stroke, the crank shaft is only strained about nine-tenths as much as in the short-stroke engine, while in the extreme cases of the shaft being unevenly supported at the bearings, this proportion becomes still less.

Table I.

Diameter of cylinders, 30in. and 60in.; length of stroke, 39in.

Angles between cranks.	Ratio of maximum twisting moment to mean twisting moment.	Ratio of maximum twisting moment to that with cranks at 90 deg.	Ratio of strain on aft crank pin to that which would be produced by the mean twisting moment.	Ratio of maximum strain on aft crank pin to that on the screw shafting.	Ratio of maximum strain of crank shaft to that with cranks at 90 deg.	Ratio of strain on second bearing, with the first bearing slack, to that which would be produced by the mean twisting moment.	Ratio of strain on second bearing, with the first bearing slack, to that on aft crank pin when bearings are lineable.	Ratio of strain on third bearing, with the fourth bearing slack, to that which would be produced by the mean twisting moment.	Ratio of strain on third bearing, with the fourth bearing slack, to that on aft crank pin when bearings are lineable.
Deg.									
90	1·31	1·00	1·63	1·24	1·00	2·61 at all angles.	1·60	2·90	1·77
100	1·40	1·07	1·60	1·14	·98		1·63	2·87	1·79
110	1·45	1·10	1·47	1·02	·90		1·78	2·82	1·92
120	1·52	1·16	1·56	1·03	·96		1·67	2·77	1·77
130	1·55	1·18	1·59	1·03	·97		1·64	2·75	1·73
140	1·61	1·23	1·62	1·01	1·00		1·61	2·72	1·68
150	1·66	1·27	1·73	1·04	1·06		1·51	2·66	1·54
160	1·66	1·27	1·74	1·05	1·07		1·50	2·66	1·53
170	1·72	1·31	1·81	1·05	1·11		1·44	2·67	1·47
180	1·77	1·35	1·84	1·04	1·13		1·42	2·67	1·45

Table II.

Diameter of cylinders, 30in. and 60in.; length of stroke, 60in.

Angles between cranks.	Ratio of maximum twisting moment to mean twisting moment.	Ratio of maximum twisting moment to that with cranks at 90 deg.	Ratio of strain on aft crank pin to that which would be produced by the mean twisting moment.	Ratio of maximum strain on aft crank pin to that on the screw shafting.	Ratio of maximum strain of crank shaft to that with cranks at 90 deg.	Ratio of strain on second bearing, with the first bearing slack, to that which would be produced by the mean twisting moment.	Ratio of strain on second bearing, with the first bearing slack to that on aft crank pin when bearings are lineable.	Ratio of strain on third bearing, with the fourth bearing slack, to that which would be produced by the mean twisting moment.	Ratio of strain on third bearing, with the fourth bearing slack, to that on aft crank pin when bearings are lineable.
Deg.									
90	1·31	1·00	1·40	1·07	1·00	1·94 at all angles.	1·81	2·04	1·46
100	1·40	1·07	1·37	·98	·99		1·98	2·04	1·46
110	1·45	1·10	1·40	·97	1·00		2·00	1·91	1·32
120	1·52	1·16	1·46	·96	1·05		2·02	1·89	1·24
130	1·55	1·18	1·48	·96	1·06		2·02	1·86	1·20
140	1·61	1·23	1·52	·94	1·09		2·06	1·81	1·12
150	1·66	1·27	1·55	·93	1·11		2·08	1·75	1·05
160	1·66	1·27	1·57	·94	1·12		2·06	1·73	1·04
170	1·72	1·31	1·62	·94	1·16		2·06	1·77	1·03
180	1·77	1·35	1·65	·93	1·18		2·08	1·82	1·03

Table III.

Table showing the ratio of the strain in Engine B to that in Engine A for the same twisting moment exerted.

Angle between cranks.	After crank pin bearings lineable.	Second bearing, with first bearing slack.	Third bearing, with fourth bearing slack.
Deg.			
90	·86	·74	·70
100	·86	·74	·71
110	·95	·74	·68
120	·94	·74	·68
130	·93	·74	·68
140	·94	·74	·67
150	·90	·74	·66
160	·90	·74	·65
170	·90	·74	·66
180	·90	·74	·67

Although this paper is on a very important subject, the discussion elicited no information upon it except that the Board of Trade some years ago made an empirical rule for the strength or diameter of crank shafts and the strains upon them; and that long stroke cranks were capable of withstanding a greater amount of work, because their length gave greater elastic flexure.

Mr. Milton's paper was followed by one by Mr. C. Stromeyer,

On the Influence of the Cut-off and Length of Stroke on the Working of Steam Engines.

Taking a number of theoretical diagrams, the author of this paper calculates the loss due to guide friction and crank pins, and gives tables of constants representing the mean normal pressure on guide bars and mean pressure on crank pins for single, double, and treble engines, with different lengths of stroke, different ratio of connecting rod to stroke, and with cut-off varying from 0·10 to 0·90 of the stroke. From a full discussion of the elements involved in these points he derives approximate formulæ for guide and crank pin friction and for the loss due to friction. From these, by aid of the tables of ratios and mean pressures and certain coefficients, simple rules for practical application are deduced. He takes into consideration the momentum of the oscillating masses, and gives rules and constants for finding the inertia in foot-pounds of the revolving masses of an engine necessary to prevent the speed from varying beyond certain limits of average speed, and to find the weight of a fly-wheel which will secure the same degree of uniformity. This paper it would be impossible to condense into a short abstract and at the same time give the tables and formulæ deduced by the author. There was no discussion upon the paper. Mr. Kirk spoke of the great value of such papers as subjects for discussion, but said it was wholly impossible that any one should after glancing through papers of the kind be prepared to discuss the points raised. He thought that such papers should be taken as read, or circulated sufficient time before the meeting to permit their being carefully read. Mr. McFarlane Gray, who had been referred to in a few remarks by Mr. Ravenhill, said that about twenty years ago he had read a paper on engine friction before the Institution. Mr. Stromeyer's paper concluded the proceedings of Thursday. Several papers of importance were read, as we have shown, but no visitor could fail to be impressed with the waste of good papers and waste of time at these meetings. A batch of papers is placed on the programme for reading, many of which are singly of sufficient importance to test the patience and attention-giving power of any audience. The number of papers read at one time makes it necessary to curtail the discussions, even when the papers and subjects admit of and demand discussion. Session meetings and reading batches of papers are mistakes.

CANAL DREDGER.

We have recently had an opportunity of inspecting a somewhat novel form of dredging machine, erected and worked on the premises of Messrs. Rennie, Blackfriars. This dredger is of a small size and intended for excavating canals in British Guiana—Central America—and is made for the Crown agents of the colonies. As will be seen from our illustration, page 276, the ladder is pivotted on a crane-post at the bow of the ship, and is traversed from side to side as the dredger vessel advances forward in a straight line. It thus cuts the channel the breadth required for the canal, while the vessel only moves in one direction. The vessel is to be made of timber in the colonies, and has a length of 48ft., breadth 13ft. 10in., draught of water 2ft. 9in. The engines are of the two-cylinder vertical description. The ladder is made of iron, and of sufficient length to excavate 9ft. depth of water. There are seventeen buckets of a capacity of 1¾ cubic feet each, and thirty-three discharge per minute into shoots on either side to discharge on the banks of the canal, and this is further facilitated by a centrifugal pump with a 12in. fan throwing a large supply of water into the mud. The buckets are made with cast steel backs and links, and work over a top tumbler with ten sides; every other side of the tumbler has steel teeth to catch and pull round the links between the buckets. The result is that the usual thump of the buckets falling on the tumblers is quite obviated, and the bucket chain moves round like a chain over a sheave. The forward motion of the dredger boat and the traversing motion of bucket ladder is effected by an especially-arranged windlass worked by a separate engine, so that either motion may be put in gear at pleasure. The engines for working the buckets as well as for the windlass are furnished with steam from a boiler of ample proportion for burning either coal or wood.

Messrs. Rennie are perhaps the oldest makers of steam dredgers in the country, some of their earlier dredgers worked by steam dating as early as 1806. In these the general arrangement of buckets, ladders, and gearing is much the same as now made though not of the large size and strength of modern machines. They were worked by a Boulton and Watt steam engine and a wagon boiler built in brickwork. About ten years ago Messrs. Rennie sent a screw propellor dredger of 70 nominal horse-power for use in the new harbour of Buenos-Ayres, and they are now building a somewhat similar one but of more powerful construction, having buckets of 15 cubic feet capacity each. The vessels are 175ft. long and 31ft. beam, and dredge to 32ft. Five hopper barges, propelled by the screw, to carry 350 tons, or 200 cubic metres capacity, together with a smaller dredger of about half the above size, are being supplied by the same firm. One of the most successful dredgers made is the "Teredo" for the Bombay Trust.

Dimensions:

Length between perpendiculars	160ft.
Breadth moulded	29ft.
Draught of water	7ft.
Length of bucket ladder, from centre to centre	79ft. 6in.
Number of buckets on ladder	35
Capacity of each bucket	10½ cubic feet

The machinery is constructed so as to discharge fourteen buckets per minute, and is capable of dredging to a depth of 32ft.

Engines, compound:—

Diameter of cylinders	high pressure	24in.
	low pressure	42in.
Stroke		2ft. 6in.
Nominal horse-power		70
Nominal revolutions of engines when dredging		36½
Nominal revolutions of engines when using screw propeller		68

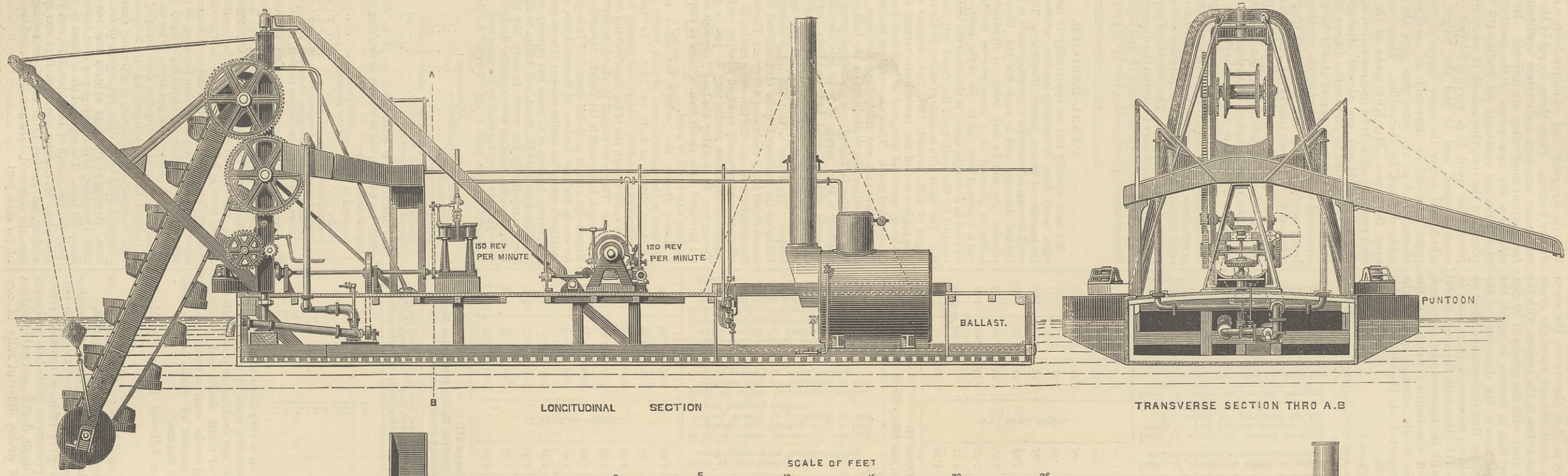
Boilers, two in number, adapted for 60 lb. steam.

The speed of the dredger when using the screw propeller was tried in England before leaving:—Mean speed of four runs at the measured mile at the Lower Hope, 5·68 knots; mean indicated horse-power during trial, 253·5-H.P. The dredger steamed out to Bombay, *viâ* Suez Canal. The results of dredging at Bombay were as follows, during the first month of working:—Working days, twenty-four; number of hours dredging, 215; mean indicated horse-power when dredging, 90; consumption of ordinary coal in 215 hours, 44,800 lb., being at the rate of 2·3 lb. per indicated horse-power per hour. The coal was of inferior quality. Average of twenty-four days' dredging:—Total amount of dredged material delivered into the hoppers in twenty-four days' dredging, or 215 hours, 59,500 tons; ditto per ton of coal consumed, 2975 tons; ditto per pound of coal consumed, 1·32 tons. Average of two days' delivery into hoppers, on 27th and 28th December, 1876:—Per day of nine hours, 4000 tons; per hour, 450 tons. The report of the engineer to the Bombay Port Trust for the month of December, 1876, and for the month of December, 1877, states the work done over thirty-six months working, the amount lifted out of the cutting being 2,122,350 tons, the coals used, 1612 tons 16 cwt., and the cost of dredging 2d. per cubic yard

CANAL DREDGER FOR BRITISH GUIANA.

MESSRS. RENNIE, BLACKFRIARS, ENGINEERS

(*For description see page* 271.)



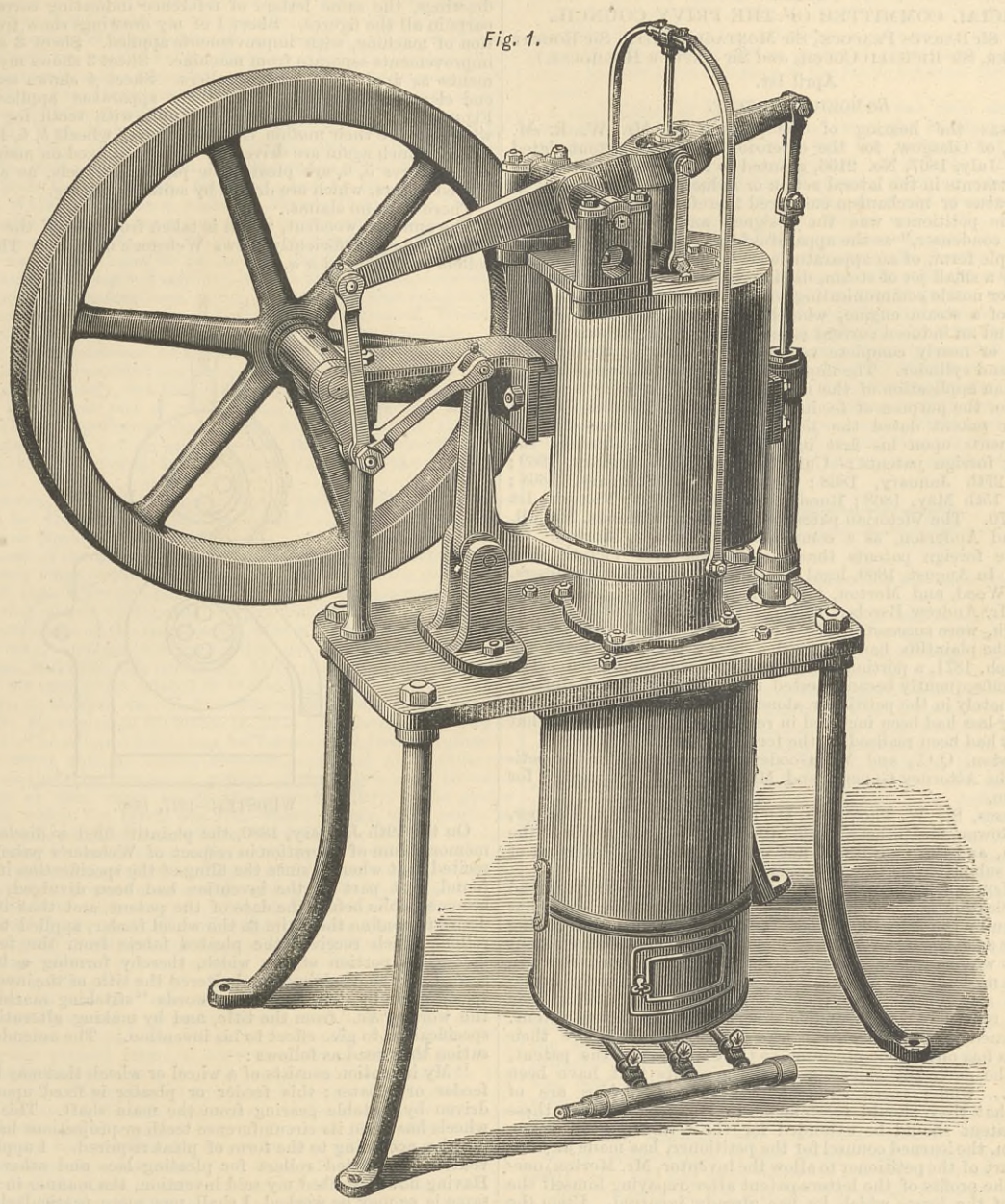
LONGITUDINAL SECTION

TRANSVERSE SECTION THRO A.B

TRANSVERSE VIEW

ERICSSON'S HOT AIR ENGINE.

Fig. 1.

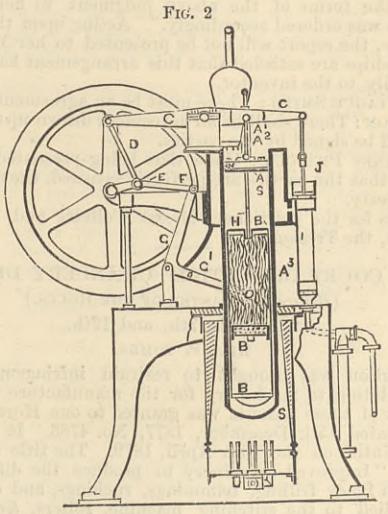


THE BUILDING EXHIBITION.

In our notice of the Building Exhibition which was held last year for the first time, we had very little to say that was favourable. It was very unsatisfactory in many respects. Writing adverse criticism never forms a pleasant task, and we are glad to find that the exhibition is this year well worthy of a visit, especially from a builders' point of view. Mr. Black has succeeded in forming a representative exhibition, and has excluded almost all articles which have not a legitimate claim to space. The arrangement is satisfactory, and the catalogue is complete, with the exception of the subject matter index. Mr. Black will, however, do well to excise the word "Patent" from this index. As a leading word it is misleading and confusing, and as a descriptive word it is totally unnecessary. The catalogue is prefaced by some interesting essays, is sold at half the price charged last year, and includes the useful feature of a space for visitors' notes opposite each column of descriptions of articles exhibited.

A noticeable feature in this exhibition is the number of illustrations of the application of concrete in the formation of the parts of house and cottage structures, and the construction of cottages with concrete slabs, panels, or bricks; the construction of cottages on the monolithic system being less numerously represented than last year. The system of construction by means of blocks, slabs, and panels, seems to offer several advantages. The concrete may be more uniform in texture and strength, and a finished structure may be more rapidly built. Various forms may be given to the component parts, and an ornamental character more easily given to the design. Of the leaders in this system of construction, Mr. W. H. Lascelles, of 21, Bunhill-row, seems to occupy the most prominent place. He not only developed a system of building cottages with slabs fastened to a wood framing, but he has made his concrete in various colours, so that window-cills, heads, and mullions, and plaques, and medallions made of it harmonise with red brick and other structures. Thus, among other parts of buildings exhibited are the parts of large and small windows designed by Mr. R. Norman Shaw, Mr. A. Waterhouse, and Mr. A. W. Blomfield; chimney-pieces, in red and green concrete, and paving slabs, copings, finials, and string courses. Mr. Lascelles also exhibits some excellent specimens of joinery work. Mr. J. M. Tall exhibits a part of a cottage built of panelled slabs of coke breeze concrete, the exterior panels being finished in rough cast, and the inner panels finished in various ways and colours. The slabs are about 7in. thick at the edges, and 3in. in the sunk panels, and are about 3ft. 6in. by 2ft. 6in. Substantial cottages with plain or bay windows may be quickly built on this system and at very low cost. Nails for hanging pictures or for fixture purposes are easily driven without damage into this material. Mr. T. Potter, Messrs. C. Drake and Co., and Mr. A. D. Daunay, show apparatus for building monolithic concrete houses, and several others exhibit concrete building slabs, paving slabs, and various parts of structures, showing how much attention is now paid to the application of this material. Amongst the machinery exhibited there are several novelties. The first of these is a new form of small air engine, designed by Mr. John Ericsson, who has done so much for the so-called caloric engine. The engine is illustrated in Figs. 1 and 2. The general character of the engine may be gathered from the perspective view, and the construction may be gathered from the sectional illustration. From these it will be seen that it is of that class of air engines in which, by the action of a piston, which may be termed the "exchange piston," working in a cylinder at or near one end of which is the working piston, and at the other end of which is the fireplace, the same air is over and over again transferred from each end of the cylinder to the other alternately, being heated and expanded during its transference in one direction, and being cooled and contracted during its transference in the other direction, the piston also performing the office of a regenerator. One feature is the mechanism for transmitting motion from the working piston to a crank and to the exchange piston, by which, with a short stroke of the working piston, a long crank and a long movement of the exchange piston are obtained. The engines are specially adapted for pumping small quantities of water, as the water pumped may be employed for the effective and economical cooling one part of the air cylinder by means of a water jacket.

Fig. 2



In Fig. 2 S is the cylinder of the engine open at the upper end, and containing two pistons, viz., the working piston A and the exchange piston B. The lower part of the cylinder is closed and intended to be heated by gas or other fuel, with a burner or fireplace. Fig. 1 shows the cylinder heated by Bunsen burners. The exchange piston B, which is of considerable axial length, is smaller than the cylinder, so that an annular space for free passage of air is left between its exterior and the interior of the cylinder. This piston is hollow, and its upper part, which is farthest from the heat, is partly filled with cotton or other fibrous material, as seen near A^3, below which is a stratum B of powdered charcoal or other such non-conducting material as will protect the fibrous material from taking fire by the heat to which the bottom part of the piston is subjected. The working piston A is connected by a hollow rod or trunk A^1, and short side links A^2, with a beam C above the cylinder, the connection being at a short distance from the fixed centre of oscillation of the beam. The beam is connected at a much greater distance from the other side of the centre by a connecting rod D with the crank E on the main shaft of the engine. This crank is also connected by a rod F with one arm G of a bell-crank lever G, G^1, which has a fixed centre of oscillation, and the other forked arm G^1 is connected by side rods on opposite sides of the cylinder by a yoke with the head. The piston rod of the exchange piston B passes through the hollow rod or trunk A^1 of the working piston, and is packed air-tight by a stuffing-box in the top of the hollow rod or trunk. The movement of the pistons is as follows:—During the upward movement of the exchange piston the cool air from the upper part of the cylinder will be transferred by the piston through the annular space between it and the cylinder to the bottom and lower part of the latter, which is heated as above described. The air so transferred becoming heated expands in the lower part of the cylinder, and its expansion causes it to force the working piston upward. The movement of the exchange piston is about three-fourths completed before the working piston commences its upward movement by which its work is done; and when the working piston has nearly completed the upward or working stroke, the exchange piston begins to descend and force the hot air back from the lower heated to the upper cool part of the cylinder, completing its stroke by the time the working piston has made about one-third of its return stroke. The working piston is thus actuated by the air which is confined in the cylinder, and which is caused to be heated and cooled alternately by the motion of the exchange piston, which transfers it from the heated to the cool and from the cool to the heated part of the cylinder. Owing to the large surface presented by the outside of the long exchange piston and inside of the long cylinder, a rapid change of temperature of the piston takes place, the exchange piston thus performing the office of what has been termed in air engines a "regenerator." I is a pump arranged on the opposite side of the cylinder S to the crank shaft, and represented as delivering its water through a jacket K which surrounds the upper part of the cylinder. Two of these engines are at work in the Exhibition, a nominal ¼-horse and a ½-horse power. The former is said to be capable of lifting 350 gallons of water 50ft. high per hour with a consumption of about 30 cubic feet of gas, while the ½-horse power engine is said to lift 800 gallons 50ft. high per hour with a corresponding quantity of gas. One engine is shown with a fire-clay furnace instead of the gas-burners.

Although these engines are nominally ¼-horse power, and ½-horse power, the effective pumping work they are said to be competent to perform is only equal to 2916·6 and 6666·6 foot, pounds per minute or 0·0884 and 0·202-horse power respectively. Of course the engines may be capable of performing more work than this, but makers do not usually much understate the power of their engines. Taking the consumption of gas at 30 cubic feet per hour for the smaller engine, Mr. Ericsson's latest child cannot be said to perform its work with any approach to economy.

Mr. F. W. Turner, of St. Albans, exhibits another new gas engine, which is a considerable improvement on the simple engines he has previously exhibited. This engine is illustrated by Figs. 3, 4, and 5. From the first of these the general appearance of the engine is seen, the section Fig. 4 illustrating the arrangement of the valves and ports.

Fig 3

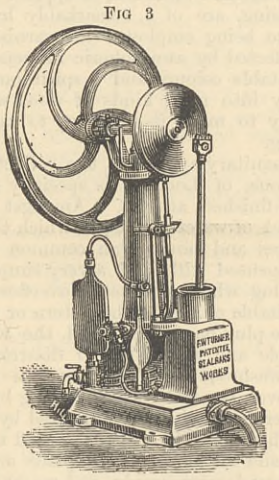


Fig. 5 is a part sectional plan of a horizontal double-cylinder engine, one cylinder being for compressing the charge of air and gas. The general construction of the vertical engine is seen from Fig. 4. There are two slide valves, one F, a simple single-ported plate, to regulate the entrance of gas and air into the cylinder, and the other G an exhaust valve. Behind the exhaust valve is a hollow back plate, through which water circulates, the air being admitted through the double port, indicated by the arrow in the back plate. The valve F is worked by an excentric and rod, while the valve G is worked by trip gear, pretty clearly shown in Fig. 3, both valves being thus worked by one excentric. With the exception of the click made by this trip the engine is perfectly noiseless. It is, moreover, simple in construction, and occupies little room. The igniting port is seen midway in that part of the back plate which is next the exhaust valve which contains a corresponding port. At I is a small air cylinder or dash pot provided with a piston J, by which the motion of the valve G, under the influence of the spring shown, is regulated. In Fig. 5 A is the power cylinder and P the compressing pump, the piston B and the trunk plunger Q of these being connected to one crosshead S, which is connected to the crank by the rod T. The admission valve is within a back plate, which contains the igniting flame, the valve being worked by an

Fig. 4.

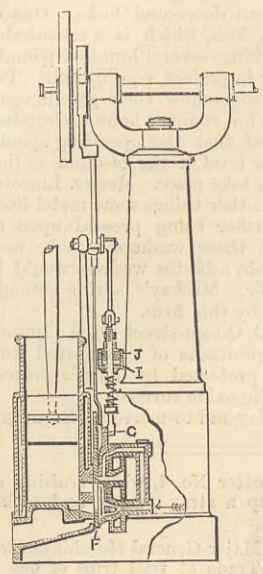
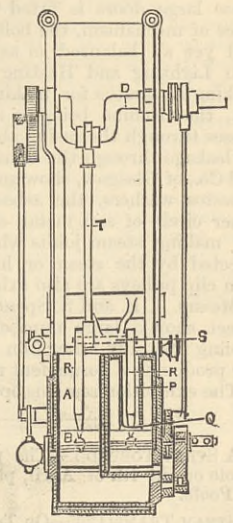


Fig 5.



excentric on the crank shaft, while the exhaust valve, a spindle valve, is worked by means of gearing and an excentric on a stud shaft, the exhaust taking place either once a revolution or once in two revolutions. By means of the arrangement of the valves in Fig. 4 the foul gases are completely drawn off from the cylinder at every revolution, and in this way Mr. Turner has succeeded in obtaining as many as 230 ignitions in a minute.

We understand that Messrs. Thomson and Sterne will soon reappear as gas-engine makers, several months having been successfully occupied in experimental work with engines similar to that shown at Kilburn. Another new gas engine is exhibited, but as it would not work on the day of our visit, we need not say anything of it.

Of steam engines there are several, but none exhibiting any novelty. One 8-horse power horizontal engine by Mr. E. S. Hindley, of Bourton, Dorset, is at work driving wood-working machinery during the day, and a Gramme dynamo-electric machine for an electric lamp during the evening.

Messrs. Charles Powis and Co. exhibit a considerable number of wood-working machines, amongst which is a new mitreing and mortising machine of simple construction for hand-power. The slide carrying the mitreing blade is adjustable for different angles, and by the addition of a small socket tool holder, the machine becomes a very handy, simple, and cheap hand-power mortising machine. We shall probably illustrate it in another impression. Messrs. Reynolds and Co., of Southwark, also exhibit a considerable number of wood-working machines, some in operation. Messrs. W. Olley and Co., of Rockingham-street, S.E., are also exhibitors in this class. Messrs. Waygood and Co., of London, exhibit a number of their now well-known hoists and lifts, and Messrs. S. and E. Ransome and Co. exhibit, among other things in a numerous collection of builders' tools, a new portable crane on three wheels. That exhibited will lift 6 cwt., and is a very useful tool in workshops, packing yards, mason's yards, and other places where small weights have to be lifted 5ft. or 6ft. and then moved from one place to another. The jib is adjustable through a short angular range. In the Exhibition Laurence's releasing block is shown in connection with this crane. A concrete mixing machine, which should meet with extensive use now that concrete is so largely employed, is shown by Messrs. Reynolds and Co. It consists of an inclined revolving polygonal chambered barrel, into the upper part of which the materials are charged, the mixed concrete falling continuously from the lower end.

Messrs. Pontifex and Wood exhibit a large collection of pumps of various kinds, water fittings, and closets and other sanitary apparatus, the products of their works in Shoe-lane and in Derby; and also a collection of the products of their varnish, colour, lead, zinc, and copper works at Millwall. The specimens of their wood stains and varnishes, as applied to plain pine and deal without sizing, are of a remarkably high character and beauty. No size being employed the varnish is not likely to crack or to be affected by atmospheric influences; the stains are made with vegetable colours and a spirituous liquid, and thus penetrate deeply into most kinds of wood without raising the grain sufficiently to make it necessary to sandpaper the work before varnishing.

Amongst the sanitary apparatus, the collection of Messrs. W. Smeaton and Sons, of London, is specially noticeable for the number of well-finished articles. Amongst other things are several new forms of water-closets, in which the levers and bell-cranks and wires and moving pan common to the old design of closet are dispensed with, and a very simple arrangement of rapped hollow plug which acts as an overflow is employed. A simple valve, suitable either for the cistern or constant supply, is opened when the plug handle is lifted, the whole arrangement being very simple and not liable to disarrangement. A very simple form of wash-out closet is shown, in which there is no apparatus whatever, the water supply being by means of a small cistern, the water from which is admitted by a valve operated by a suspended handle. The pan is attached to one of Smeaton's cast lead traps, and the outflow takes place on the admission of water. This closet is very simple, and we are informed that it is being very largely used for hospitals, hotels, and public buildings. Mr. Bostel, of Brighton, also shows a very simple and efficient wash-out closet without any moving parts. Several simple and ingenious water waste-preventing valves in small cisterns are exhibited, amongst which we may mention those of Messrs. Purnell and Sons, Westminster, and of Mr. D. D. Ward, of 182, Upper Thames-street.

Messrs. Hobbs, Hart, and Co. show a large collection of their safes and fireproof and strong-room doors and locks. One of these large doors is fitted with a lock, which is a remarkable piece of mechanism, the bolts weighing several hundred pounds, and yet all balanced so as to be in perfect equilibrium. The Sun Lighting and Heating Company show their gasoline gas-making apparatus for making gas for country houses, churches, &c., the machine being so arranged that the operating spindle passes through the casing above the level of the gasoline, so that no leakage through the bearing can take place. Messrs. Lincolne and Co., of Glasgow, show amongst other things some metal-lined asbestos washers, the asbestos washer being pressed upon an inner circle of soft metal, so that these washers may be used for making steam joints where plain asbestos washers would be affected by the steam or hot water. Mackay's spring wrought iron clip pulleys are also exhibited by this firm.

Messrs. J. E. and S. Spencer, of 3, Queen-street-place, Cannon-street, show a large number of specimens of corruguted iron, roofing tiles, and other iron work, protected by Barff's process, for producing a permanent magnetic oxide surface.

The exhibition remains open to-day and to-morrow—Saturday.

A Stray Torpedo.—The pilot cutter No. 4, while cruising off Poole on the 4th of April, picked up a stray torpedo and took it to Poole.

Steam Tramways.—On Tuesday Major-General Hutchinson was present on behalf of the Board of Trade at trial trips of one of Messrs. Kitson's locomotives on the tramway line between Edinburgh and Portobello, a distance of three miles. He expressed himself satisfied with the working of the engine.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—Edward Inch, engineer, to the Pembroke, additional for service in the Cockatrice; Leonard Buckler, chief engineer, to the Repulse; William Annan, engineer, to the Repulse; Henry Coller, engineer, to the Repulse, for service in the Ariel; Nathaniel E. Green, assistant-engineer, to the Repulse.

Otto *v.* Linford.—We are requested to state that Mr. Otto has determined to appeal against the decision of Vice-Chancellor Bacon in this case, recently reported in our columns. Mr. Robert C. May, M.I.C.E., writes to make the following correction in our report of the case of Otto *v.* Linford—before Vice-Chancellor Bacon—which appeared in our impression of the 1st. He says, "In answer to the usual preliminary questions of counsel, I am made to state that I am 'Marine assessor to the Board of Trade,' what I did state was that 'I am one of the engineer assessors to the Marine Department of the Board of Trade.'"

LEGAL INTELLIGENCE.

JUDICIAL COMMITTEE OF THE PRIVY COUNCIL.

(*Present:* Sir Barnes Peacock, Sir Montague Smith, Sir Robert Collier, Sir Richard Couch, *and* Sir Arthur Hobhouse.)

April 1st.

Re Morton's Patent.

This was the hearing of the petition of Mr. W. R. M. Thomson, of Glasgow, for the extension of letters patent dated the 18th July, 1867, No. 2106, granted to Alexander Morton, for "Improvements in the lateral action or induction of fluids, and in the apparatus or mechanism employed therefor," of which letters patent the petitioner was the assignee and proprietor. The "Ejector condenser," as the apparatus is generally called, consists, in its simple form, of an apparatus wherein a jet of water, assisted or not by a small jet of steam, discharges itself through a conoidal chamber or nozzle communicating with the exhaust passages of the cylinder of a steam engine, whereby the exhaust steam is condensed, and an induced current is set up to so great an extent that a partial or nearly complete vacuum is created in the exhaust passages and cylinder. The improved injector also covered by the patent is an application of the same method of creating a partial vacuum for the purpose of feeding boilers. Mr. Morton obtained a further patent dated the 15th February, 1869, No. 456, for improvements upon his first invention. He also obtained the following foreign patents:—United States, 19th January, 1869; France, 27th January, 1868; Belgium. 7th February, 1868; Holland, 15th May, 1868; Russia, 15th July, 1869; Victoria, 1st April, 1870. The Victorian patent was granted to Messrs. McCall, Black, and Anderson, as a communication from A. Morton. Of the above foreign patents those for Russia and Victoria had expired. In August, 1869, legal proceedings were taken by Messrs. Neilson, Wood, and Morton, the then proprietors of the patent, against Mr. Andrew Barclay, which, after trial in March, 1870, at Edinburgh, were successful. It was stated that notwithstanding success, the plaintiffs had incurred a heavy pecuniary loss. On 20th March, 1871, a portion of the invention was disclaimed. The patents subsequently became vested in the petitioner and Morton, and ultimately in the petitioner alone. It was stated that a heavy pecuniary loss had been incurred in respect of the patent, and that no profits had been realised on the foreign patents.

Mr. Aston, Q.C., and Mr. Goodeve were counsel for the petitioner; the Attorney-General and Mr. A. L. Smith appeared for the Crown.

Witnesses, Sir W. Thompson, Dr. Siemens, Mr. E. A. Cowper, Mr. D. Rowan, and others, were called to prove the merit of the invention, and the Crown did not oppose upon the statement of accounts submitted by the petitioner.

Their Lordships gave the following judgment:—Having read the specification in this case, and heard the explanation which has been given by the learned counsel for the petitioner, and having heard the evidence of Sir William Thompson and the other eminent engineers who have been called as witnesses, their Lordships can entertain no doubt that this was a very meritorious and useful invention. It also appears clear that no sufficient profits have been made by reason of the invention described in the letters patent. The learned Attorney-General who has appeared before their Lordships has offered no objection to the extension of the patent, nor does he make any objection to the accounts that have been rendered. Under these circumstances their Lordships are of opinion that they should recommend to her Majesty that these letters patent should be extended for the term of seven years. Mr. Aston, the learned counsel for the petitioner, has made an offer on the part of the petitioner to allow the inventor, Mr. Morton, one-half of the profits of the letters patent after repaying himself the amount of the losses which he has already incurred. Upon the petitioner entering into a proper undertaking that after recouping himself out of any profits hereafter to be derived from the letters patent, the amount of losses already incurred by him—their Lordships referred to the sum shown by the accounts—one-half of the profits shall be paid to the inventor, Mr. Morton, we shall advise her Majesty that the letters patent shall be extended for seven years. In this their Lordships are acting upon the principle which was adopted by the Judicial Committee in the case of *Russell's Patent* (2 Moo. P.C., 496). In that case the judgment required "that the certificate should be signed by the Petitioner's agent in court—we shall not require that—and a proper annuity deed prepared—that would be a deed carrying out these terms—which being approved of on the part of the inventor, notice of such approval was forwarded to the Council-office, and a report being made in the terms of the above judgment to her Majesty in Council, it was ordered accordingly." Acting upon that principle in this case, the report will not be presented to her Majesty until their Lordships are satisfied that this arrangement has been made satisfactorily to the inventor.

Sir Montague Smith: There must be an agreement.

Mr. Aston: There shall be an agreement drawn up to that effect which shall be signed by the parties.

Sir Barnes Peacock: Upon that being presented here for a certificate that the parties are perfectly satisfied, the report will go to her Majesty.

Solicitors for the petitioner, Messrs Collette and Collette; for the Crown, the Treasury.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

(*Before the* Master of the Rolls.)

April 5th, 7th, and 12th.

Hill *v.* Tombs.

This action was brought to restrain infringement of two patents relating to machinery for the manufacture of frilling.

The first of these patents was granted to one Horatio Webster, and was dated 15th December, 1877, No. 4783. It was assigned to the plaintiff on the 10th April, 1879. The title of the invention was "Improved machinery to produce the different pleats required in fancy frilling, trimmings, ruchings, and other articles to be applied to the stitching machine, rollers, &c.," and the provisional specification was as follows:—

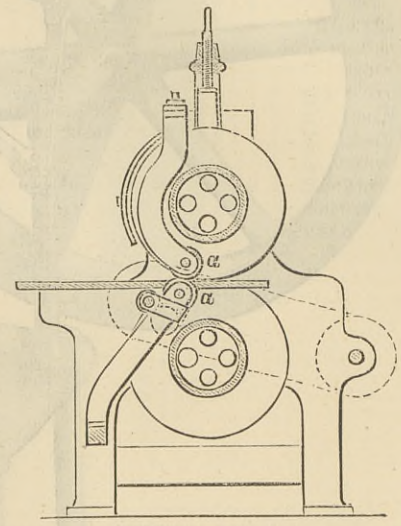
"My invention consists of a wheel or wheels, that may be called a feeder or pleater, upon the circumference of which are fixed a quantity of spikes or projections shaped according to the nature of the material to be acted upon, and having their position regulated according to the form of pleat required. This feeder or pleater is fixed upon a shaft connected to the main shaft by a worm wheel acting upon a double spur and bevel wheel, and may have its speed regulated according to the size of the wheels. I may also use a reciprocating feeder or pleater, placed in the table of the machine; for this purpose I have placed a double feeder, *i.e.*, the one now in ordinary use, and a second, which, by working at a different speed, produces the required effect. For pleating some material I find it of advantage to combine the circular and the reciprocating feeder, or employ a double circular feeder."

The final specification was very little fuller. It stated as follows:—

"My invention consists of a wheel or wheels, that may be called a feeder or pleater; this feeder or pleater is fixed upon a shaft driven by suitable gearing from the main shaft. This wheel or wheels has upon its circumference teeth or projections, having their position according to the form of pleat required. I sometimes use a reciprocating feeder or pleater, fixed in the table of machine; for the purpose I have placed a double feeder, *i.e.*, the one now in ordinary use, and a second, which, by working at a different speed, produces the required effect. I find it of great advantage in pleating some material to combine the circular and the reciprocating feeder, or employ a double circular feeder. I also apply my invention to heated rollers for pleating lace and other material. Having now described my said invention, the manner in which the same is or may be worked, I shall now more particularly describe the same, and for this purpose shall refer to the annexed sheets of drawings, the same letters of reference indicating corresponding parts in all the figures. Sheet 1 of my drawings show front elevation of machine, with improvements applied. Sheet 2 shows my improvements separate from machine. Sheet 3 shows my improvements as applied to heated rollers. Sheet 4 shows section and end elevation of rollers, having my apparatus applied. *a*, *a*, Figures 1, 2, 3, 4, 5, 6, are the wheels with teeth for pleating, which receive their motion from two bevel wheels *b*, *b*, Figures 1, 2, 3, 4, which again are driven by worm *c*, affixed on main shaft *d*. *a*, *a*, Figures 5, 6, are pleaters or pleating wheels, as applied to heated rollers, which are driven by suitable gearing."

There were no claims.

The annexed woodcut, which is taken from one of the specification drawings, sufficiently shows Webster's machine. The feeding rollers are shown at *a a*.



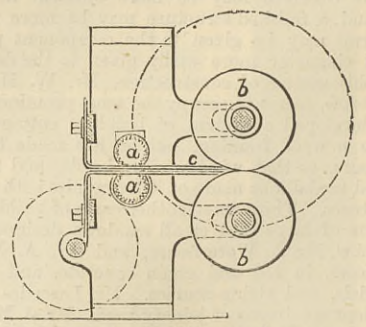
Webster—1877, 1880.

On the 19th January, 1880, the plaintiff filed a disclaimer and memorandum of alteration in respect of Webster's patent, which recited that whereas since the filing of the specification it had been found that part of the invention had been divulged, and had become public before the date of the patent, and that it was his desire to confine the claim to the wheel feeder, applied to pressing rollers which received the pleated fabric from the feeder, and flattened a portion of the width, thereby forming a band, and accordingly he disclaimed and altered the title of the invention and specification by striking out the words "stitching machines" and the words "&c." from the title, and by making alteration in the specification to give effect to his invention. The amended specification then read as follows:—

"My invention consists of a wheel or wheels that may be called a feeder or pleater; this feeder or pleater is fixed upon a shaft driven by suitable gearing from the main shaft. This wheel or wheels has upon its circumference teeth or projections having their position according to the form of pleat required. I apply my invention to heated rollers for pleating lace and other material. Having now described my said invention, the manner in which the same is or may be worked, I shall now more particularly describe the same, and for this purpose shall refer to the annexed sheets of drawings, the same letters of reference indicating corresponding parts in all the figures. Sheet 1 shows my improvements as applied to heated rollers. Sheet 2 shows section and end elevation of rollers having my apparatus applied. *a*, *a*, Figures 1 and 2, are pleaters or pleating wheels, as applied to heated rollers which are driven by suitable gearing."

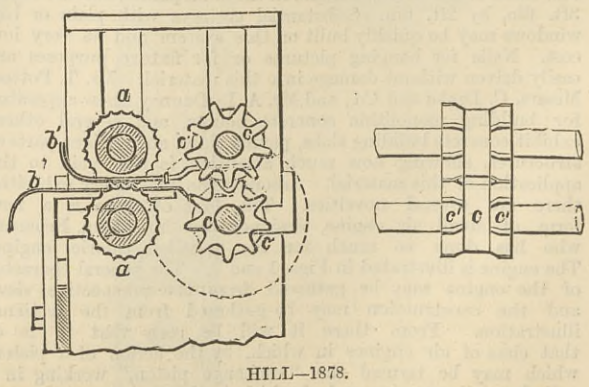
The drawings relating to the stitching machine were omitted, and a drawing, differing in some respects from the similar drawing in the original specification, were given of the frilling machine.

The second patent was granted to the plaintiff himself, and was dated 10th September, 1878, No. 3591. It purported to be for "improvements in the production of frilling and gathered work, and in apparatus to be used for these purposes." It comprised a variety of apparatus; but that which was the chief subject of consideration, and which was most like what the defendant had done, was that shown in the accompanying woodcuts, and covered by the following claims:—"The combination of crimping or other feeding rollers or instruments with guides and with pressing rollers in such manner that, the speed of the feeders being greater than that of the pressers, the fabric is accumulated and frilled between the guides, and whilst so held a portion to form the band or bands is pressed substantially as described;" and "the pressing rollers and the roller recesses, the roller recesses serving to place or form the pleated or goffered fabric without crushing the pleats or goffers, whilst the rollers, with the aid of heat and moisture, set into a band parts adjacent to the forms given by the roller recesses, which forms are thus rendered permanent, substantially as described."



Hill—1878—Fourth Claim

In the cut showing the machine covered by the fourth claim *a a* are the feeding rollers, *b b* the presser rollers, and *c* the guides.



Hill—1878.

The other woodcut shows a somewhat similar machine having the recesses in the presser rollers. In this cut *a a* are the feeding

rollers, *c c* the presser rollers, *c*¹ *c*¹ the side recesses, and *b b* the guides.

The defendant after setting out the usual formal pleas, disputed the validity of both patents. It was alleged that Webster's patent was bad, because of insufficiency of specification and want of conformity with the provisional specification; that the disclaimer was void, as extending the invention, and as supplying the insufficient description; that the invention was not new, having been anticipated by the prior specifications of Edward Tombs, 17th May, 1858, No. 1095; Wm. Muir, 27th August, 1867, No. 2439; John Mabson, 21st May, 1867, No. 1516; Edwin Whitehall, 31st July, 1876, No. 3060; W. B. West, 2nd November, 1865, No. 2823; F. Rath, 26th October, 1875, No. 3717; and by the prior user of Messrs. Whitehall, Hudson, and Co.; Messrs. Birkin Bros.; Mr. E. Whitehall; Thomas Adams, and Co., Limited; Mr. Joseph Hind; and Messrs. Dunicliffe, and Co., all of Nottingham. The second patent was also alleged to be bad on the ground of insufficient specification and want of conformity with the provisional specification, and also as having been anticipated by the above-mentioned specifications, to which was added the specification of Webster, No. 4783, and the prior user by the above-mentioned persons.

Some of the defendant's machines, which were complained of as infringements resembled very closely the plaintiff's machines, and others not so closely, but they all had presser rollers, and feeding rollers, with some sort of guide, either in the shape of a plate or metal rib or a goffering chain and plate; indeed at the trial infringement was not seriously denied, the whole strength of the defence being directed to the impeachment of the plaintiff's patents.

Mr. Aston, Q.C., Mr. Webster, Q.C., and Mr. Carpmael were counsel for the plaintiff; Mr. Davey, Q.C., Mr. Lawson, and Mr. Chadwyck Healey for the defendant.

So much of the action as related to Webster's patent was decided at an early stage of the case. It was contended, on the part of the plaintiff, that Webster's patent was for a combination of feeding or pleating wheels with heated rollers, but his lordship held upon the construction of the specification, that what was claimed was the feeder only, and not its application to other instruments or machines, and upon this ruling Mr. Aston decided to withdraw that part of the case which related to Webster's patent.

Mr. E. A. Cowper was the first witness called on the part of the plaintiff. He explained the action of Hill's machine shafts shortly to be this:—The crimped fabric was fed between the feeding rollers to the pressure rollers, which, however, revolved at a different speed, so that the crimps or goffers of the fabric were crowded together as they came up to the presser rollers. The guides between which the fabric was fed—that is to say, wire guides at top and table at bottom—kept the crowded fabric flat and regular. As it came to the presser rollers a damped thread was placed on both sides of the fabric, and as the latter came under the rollers the central rib pressed or ironed the centre of the fabric, and caused the threads to adhere to it. He stated that the machines complained of by the plaintiff worked in the same way. In one the fabric was fed in between rollers, and carried between a plate and an endless chain to the pressing rollers, the plate and chain acting as guides, as in Hill's machine. The witness was cross-examined as to the use of the guides, and he admitted that generally speaking no particular shape of guide was necessary. Two flat plates would do, or bars, or even the threads used for holding the pressed fabric, if they were strong enough and held under sufficient tension. A table might be substituted for the bottom guide. The plaintiff had himself, in his specification, suggested the use of threads or guides. As far as he knew threads so used were not new at the date of the invention. The witness was referred to a machine, produced on the part of the defence, and subsequently dealt with as "Caporn's machine," in which there were side plates or guides outside the feeding rollers, and he explained that in that machine the guides were not necessary, because the feeding rollers and the presser rollers were placed closer together than in the plaintiff's machine. The fabric did not rise or get out of place, because there was no room for it so to do, and the guides were not wanted, an answer which called forth a question from the judge, "Then what becomes of your invention?" The witness then said that the work would not be so good when the rollers were closer and there were no guides, and thereupon occurred the following discussion:—

The Master of the Rolls: It has come down to a very simple point.

Mr. Davey: It is nothing more than an addition of guides to Webster's.

Mr. Aston: And a separation of the feed and presser rollers.

The Master of the Rolls: You must be careful about that. I do not see that put out in the specification.

Mr. Davey: There is nothing about that.

Mr. Aston: The drawings show that distinctly.

The Master of the Rolls: It may be an accident. How does he tell the public they must be at a distance?

Mr. Aston: We say we must have guides.

The Master of the Rolls: But you say nothing about distance.

Mr. Aston: Wherever we have guides.

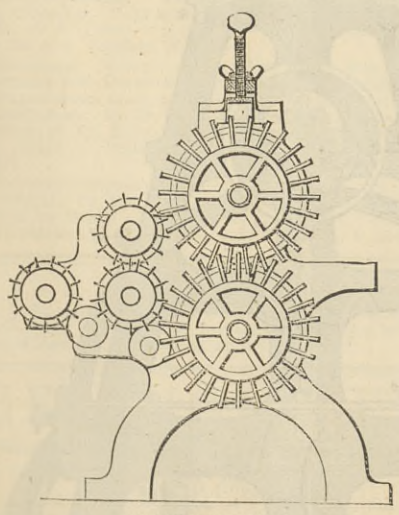
The Master of the Rolls: Of course, if you claim a specific distance you must mention it.

Mr. Aston: We do not; we only claim the interposition of guides between the feeding rollers and the pressing rollers.

The Master of the Rolls: As I understand, it has come down to that and nothing else. That is the whole point in the case. As I understand, if the rollers are very close to one another in the machine it will work without guides.

A number of machines were in court, and they were worked, and the frilled fabrics submitted to his lordship.

In further cross-examination, Mr. Cowper's attention was directed to a machine, distinguished as the Adams machine, an

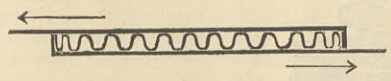


ADAMS' MACHINE.

engraving of which is annexed. He admitted that in that machine there were two feed rollers, and two pressing rollers. Threads were supplied above and below the fabric, passing as to one pair under the top feeding roller, and as to the other under the bottom feeding roller. Round the pressing rollers were collars of spikes or pins which threw the fabric up and down at the edges, and so made larger frills. They acted in the same way as the side recesses in the rollers in Hill's machine. There were no guides properly so called; but there were double threads used with weights. If the threads were strong enough they would act to a certain extent as guides. Another machine, used for making what was known as "Bazaine" frilling, was then submitted to the witness, and he admitted that pieces of metal there placed between the feeding and pressing rollers would act as guides if there were a differential speed, and consequent fulling of the fabric between the two sets of rollers.

A modification of the Caporn machine was then shown to the witness. It was called from its owner the Birkin machine. It differed from the former only in that the bottom feed wheel was removed. The upper wheel worked on a table. The witness explained that it worked like Webster's machine, and there was not sufficient interval between the feed and pressing rollers to require guides to keep down the frilled work. Mr. Cowper was then cross-examined upon Hill's specification, with the view to the argument of the defendant, that the provisional and final specification were not in conformity as to the side recesses in the pressing rollers, and also that the use of guides was an after thought; but his Lordship intimated that in his then view he did not attach great weight to the argument. He was disposed to be liberal as to development of the provisionally specified invention.

Mr. Cowper was then questioned by the Master of the Rolls as to the state of knowledge at the time of the plaintiff's invention, and whether or not the hand reefing instrument which the witness had previously described was not in effect made up of two guides. This machine consisted of two pieces of wood, between which the fabric was frilled by sliding one on the other thus—



He was also asked as to the use of guides for analogous purposes in embroidering and other machines.

Mr. C. G. Hill, the plaintiff, was next called. He stated that prior to the year 1878 he did not know of any frilling machine in which were used feed rollers, guides, and pressing rollers. He did not know of Webster's invention when he devised his machine. Webster's machine would not satisfactorily frill a delicate fabric. He admitted to the judge that if in Caporn's machine the feeding and pressure rollers were farther apart the plates between them would act as guides. The plates were really put on as side guards, but they would act as guides. He did not think threads would be satisfactory guides. Sufficient tension could not be put upon them. They might do if the material were delicate and the accumulation small.

The Master of the Rolls, at the close of the plaintiff's evidence, intimated that if the defendants' counsel proved the machines they put forward he should stop the case, and upon that Mr. Aston decided not to call further evidence, but to allow the defence to deal with that part of the case.

Mr. A. L. Caporn was then called and examined by Mr. Davey. He proved that the machine produced in Court, and called the "Caporn" machine was made in 1878 by Messrs. Whitehall, Hudson and Co. for his firm. He produced the receipted invoice for it. It had never been out of the custody of his firm, and had been in constant use, and the frilling made by it had been sold in the course of business. No alteration had been made in the machine beyond slightly altering the position of the guides, which had been done the first day it was worked. The witness was cross-examined as to whether certain named persons, had not been in his employ, and whether during the time of their service the machine had not been worked without guides; but he repeated that it had always been worked in its present state. He had had other machines made with guides in them.

Mr. Hudson, of the firm of Whitehall, Hudson, and Co., of Nottingham, stated that his firm had manufactured the machines in Court for Messrs. Caporn and Sons. They were delivered in February and March, 1878. They had guides and were generally in the state in which they left his works, wear and tear excepted.

Mr. Chas. Willcox, a fitter in the employ of the last witness, gave confirmatory evidence, and persons in the employ of Messrs. Caporn and Sons gave evidence of the continuous use of the machines, and that they had not in any way been altered.

Witnesses were then called on behalf of the plaintiff to rebut their evidence. Some former workmen of Messrs Whitehall, Hudson, and Co., and former servants of Messrs. Caporn and Sons came forward to say that the machines in question had no guides when they were supplied to Messrs. Caporn and Sons.

This practically concluded the case, but before judgment some further evidence was put in on behalf of the defence. Mr. E. Whitehall proved the Adams machine which had been made by him, and also the Bazaine machine, and Mr. W. Stanley stated that he had used the Adams machine with weighted threads since 1876.

The MASTER OF THE ROLLS then delivered judgment as follows:

I have no doubt whatever upon the facts. As regards Caporn's machine, I have no hesitation in saying that I give credit to the witnesses for the defendant. I am of opinion that the machine was made, and was used, before the date of Hill's patent. As regards Adams' machine, I think there has been no evidence except that of Mr. Whitehall, who says he made it; and I have no doubt he did make it, in the shape in which we have got it there. For all substantial purposes that must be taken to be made according to his manufacture. I do not rely on the evidence of the last witness, because he is not a man who paid sufficient attention to the different parts of the machine in detail at the time he saw it to be able to state positively. I think, therefore, that machine is proved. As regards Adams', that is also proved. It was not used formerly with spikes, but without spikes it was used a considerable time. The plaintiff is in a very unfortunate position, and I really feel, if I may say so, a great deal of sympathy for him. What he has done is this: He has made by himself a very valuable invention. That I am quite satisfied of. He says he invented the whole of it, and I give full credit to what he says, that he did invent the whole of it, in ignorance of Webster's machine. Unfortunately for him Webster's machine was invented before, and although he swears he made a better machine than Webster's, when he came to take out his patent he was told of Webster's machine, and then the patent agent did the best he could for him. I have no doubt finding Webster's machine, which was a substantial part of the invention, was in his way, he altered the description of the invention, so as to get rid of that portion of it which is comprised in Webster's machine. When I say Webster's machine I am giving no opinion as to whether Webster's was or was not an original invention. That is a question which becomes unnecessary for me to decide, because the case as to Webster could not be maintained. As I have said, therefore, his patent was withdrawn from the case, but we have called it Webster's machine, and have had it described. This being the position of matters, the plaintiff takes out a patent to save as much as he can of his invention. I think it would have been better if it had been described as an improvement on Webster's machine by the improvements which he has pointed out, but it was not so described. It comprised a great many things, several of which appear to me to be substantial improvements on what Webster invented, and especially in that machine which was produced, and which has been called the Bazaine, which is a very clever invention. I am sorry I cannot say that it is entitled to be treated as a new invention, because an objection to the patent is that one material part was bad, namely, that which is claimed by the fourth claim—"The combination of crimping or other feeding rollers, or instruments, guides, and pressing rollers, in such manner that, the speed of the feeders being greater than that of the pressers, the fabric is accumulated and frilled between the guides, and whilst so held a portion to form a band or bands is pressed substantially as described." Now, that is the claim. The objection to that is, that before the date of this invention frilling machines, or crimping machines, or crimping or feeding rollers, and so on, with guides between the feeding rollers and the pressing rollers, were known and in use, and so the plaintiff's patent is bad for want of novelty. It appears to me that the machines which have been produced and proved to have been in use, are clearly machines which fulfil all these conditions, and have the whole of this combination in them, and consequently the patent must fail for want of novelty. But I also think it fails for want of invention, which is a different point to some extent. I will assume for the present purpose that the use of guides was known in machinery generally for the purpose of keeping down the work, so as to keep it on a level when passing through the pressing rollers. It certainly was so known, and Mr. Cowper admitted that it was known in a great variety of machines. The one most familiar to me is undoubtedly the sewing machine, but there are several other machines in which it exists with which I am acquainted, and particularly the wool combing machine and a vast number of others. Therefore it is common knowledge that if you wanted to keep your material down from passing between two parts you use a guide. Now, supposing this were a real improvement, which it was not—that is it was not in this sense, that it was an invention independently of Webster—but supposing it would be an improvement, that is to say, the man had Webster's before him and wanted to improve it, and he had found that by separating the feeding rollers, they being quite close to the presser rollers, that the material did not rise to any material extent, but when he separated his rollers, and he found his material to rise or pucker so as to get irregular, and he wanted to keep it level, any machinist would have said at once, "Use a guide," that is the method adopted to keep the material down. There could be no invention in that, because that was the use of known means for an analogous purpose. The same thing would undoubtedly happen if he knew of the machines in Court. Although their guides were not so good as his guides, it would only make the case stronger. It is not that the guides were used for an analogous purpose, but, I may say, for the same purpose—that is to say, for making frilling. That would make the case stronger as regards invention, quite independent of anticipation. There would not, therefore, be, looking at the cases, sufficient to be found to support the invention. I am not saying anything about the other part being meritorious. This is one of these cases in which I cannot but regret that I cannot maintain the good part of the patent, notwithstanding the badness of the rest. However, that is not the law, as the plaintiff has chosen to claim this as a substantial part of the combination to the monoply of which he claims to be entitled, I am compelled to hold that the whole patent is bad for the reasons I have mentioned, and I therefore give judgment for the defendant with costs.

Solicitor for the plaintiff: Mr. T. W. Nelson; for the defendant, Mr. J. Henry Johnson.

April 9th.

Re JOHNSON'S PATENT.

THIS was a petition by the Badische Aniline and Soda Fabrik of Mannheim to the Master of the Rolls, in the matter of letters patent granted to John Henry Johnson, dated the 25th February, 1878, No. 786, for "Improvements in the production of colouring matters suitable for dyeing and printing," a communication from H. Caro. The petitioners were the registered owners of the patent, and they now sought to correct a clerical error in the specification by the substitution of the word "nitrite" for "nitrate." It was proved that in the draft specification the word "nitrite" was correctly inserted, but that the copyist had made a mistake while engrossing the filed document.

The petition was presented by leave of the Attorney-General.

Mr. Aston, Q.C., and Mr. Chadwyck Healey appeared in support of the application.

His Lordship made the order for the correction in the terms of the prayer of the petition, and directed notice of it to be given to the Commissioners of Patents.

Solicitors: Messrs. Wild, Brown, and Wild.

LETTERS TO THE EDITOR.

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

AVELING *v.* MCLAREN.

SIR,—Referring to the letter which appeared in your journal of the 8th inst., headed "Aveling *v.* McLaren," I wish to state that I much doubt whether your general readers do take so lively an interest in the differences of opinion as to the validity of the patent in question as suggested, but should the employers of your anonymous correspondent, "Draughtsman," decide to manufacture their engines with the side plates of the fire-box extended upwards and backwards, as described in the patent referred to, they will find that I shall lose no time in giving them an opportunity of explaining their views to a jury. THOS. AVELING.

Rochester, April 12th.

WOOD-CENTRED RAILWAY WHEELS.

SIR,—I have not only followed with interest what has appeared in your journal upon this subject, but I have given considerable thought to the matter, and it appears to me that your correspondent, Mr. Richardson, has taken the most practical view I have yet heard expressed, for the fact seems to be entirely lost sight of by the majority of people that this class of wheel is weakest in a lateral direction, and such being the case, it would appear that Mr. Kitson's arrangement of wheel does not provide against this circumstance so efficiently as Mr. Cleminson's method. Indeed, it is difficult to see how more thoroughly the inherent weakness in this direction of the wood-centred wheel can be more completely eliminated than by the arms employed by Mr. Cleminson, because these arms have their greatest strength in the direction of the greatest weakness of the wheel, and whilst securing this advantage the arms are of such proportions as to be capable of resisting the strain resultant from the torsional effect of brakes. But Mr. Richardson does not seem to have realised what strikes me as a very important factor, viz., the elimination of all possibility of the tire slipping round, and laterally upon the centre. This does not appear to have been provided for in Mr. Kitson's wheel, if, as I take it, that gentleman's best arrangement is given in the illustration in your issue of the 18th ult. In Mr. Cleminson's wheel it seems to be accomplished in a very simple way.

I am aware that it is affected to treat this feature as one of little importance, and, indeed, that it is even asserted that tires do not slip on the centres; but if they do not do so on wood-centred wheels, why has so much effort and ingenuity been spent in devising means to prevent tires slipping on iron-centred wheels, which are far less likely to be reduced in bulk or diameter by the heating action of the brake blocks than wooden centres?

It seems to me that this subject has hardly been sufficiently investigated, and its attendant dangers realised; and I am quite prepared to learn that properly instituted tests representing every-day working conditions would show that the tire not only slips round on the centre, but is frequently displaced laterally. I fail to agree with Mr. Richardson in advocating a larger number of arms, because, as I see it, the four arms act in unison in resisting torsional strains by reason of their being connected by the retaining rings, and hence no one arm can be strained in the direction of torsion without the other three being called upon to exert their powers of resistance. Possibly it might be an advantage to use six arms in order to reduce the number of segments from the present numoer ot sixteen to twelve; they would be heavier, however, and I doubt if the little economy effected in labour and number of parts would not be more than counterbalanced by the difficulty experienced in getting the larger segments of uniform weight and density. ROBT. W. DAVIDGE.

April 4th.

ELECTRO DYNAMOMETER FOR U.S. TORPEDO STATION.

(*For description see page* 280.)

Fig. 1.

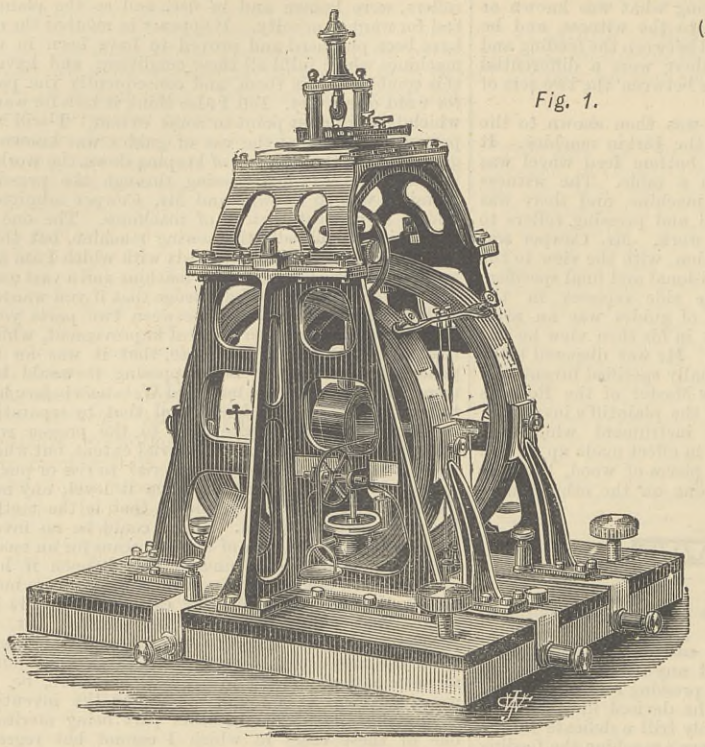


Fig. 2.

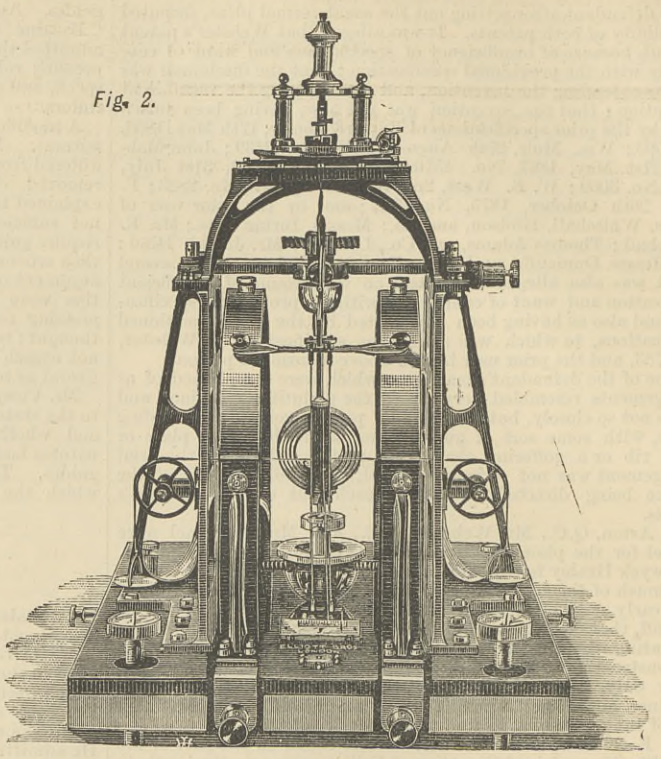


Fig 3.

CROSS SECTION THROUGH CENTRE

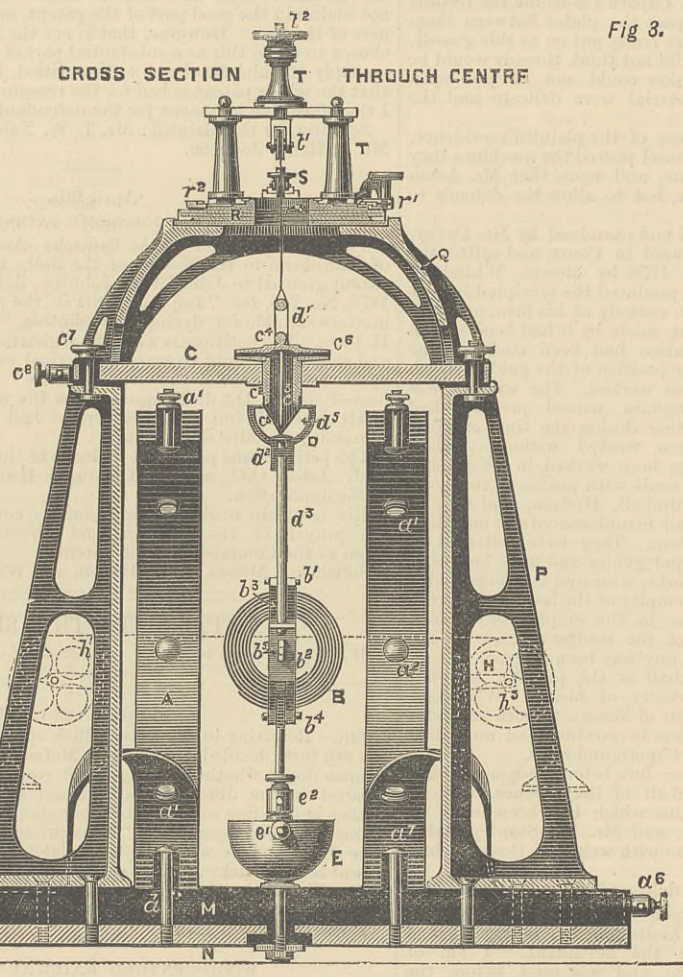
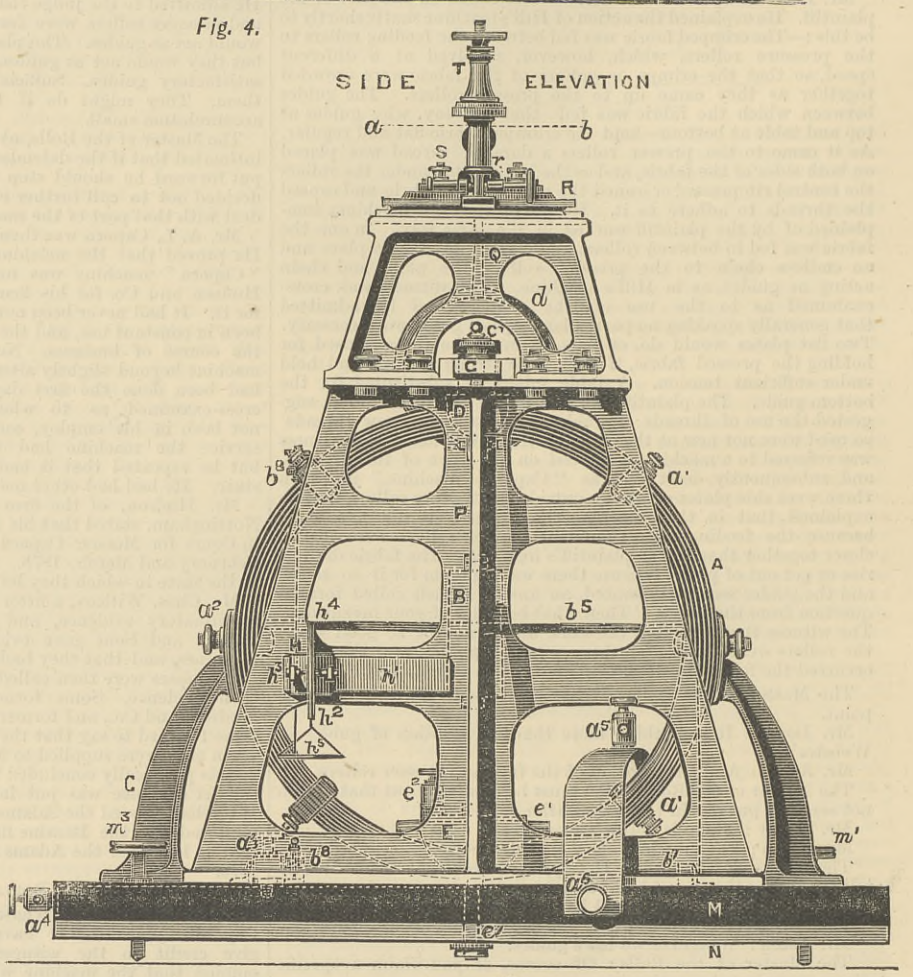


Fig. 4.

SIDE ELEVATION



SECTIONAL PLAN THROUGH *a.b.*

Fig 5.

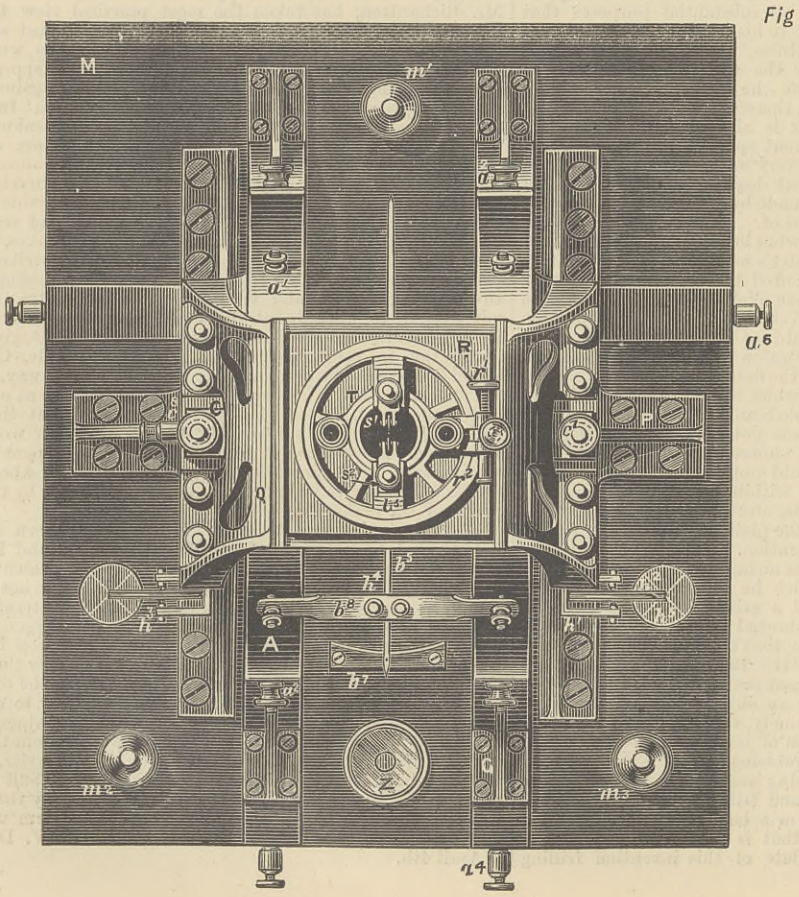
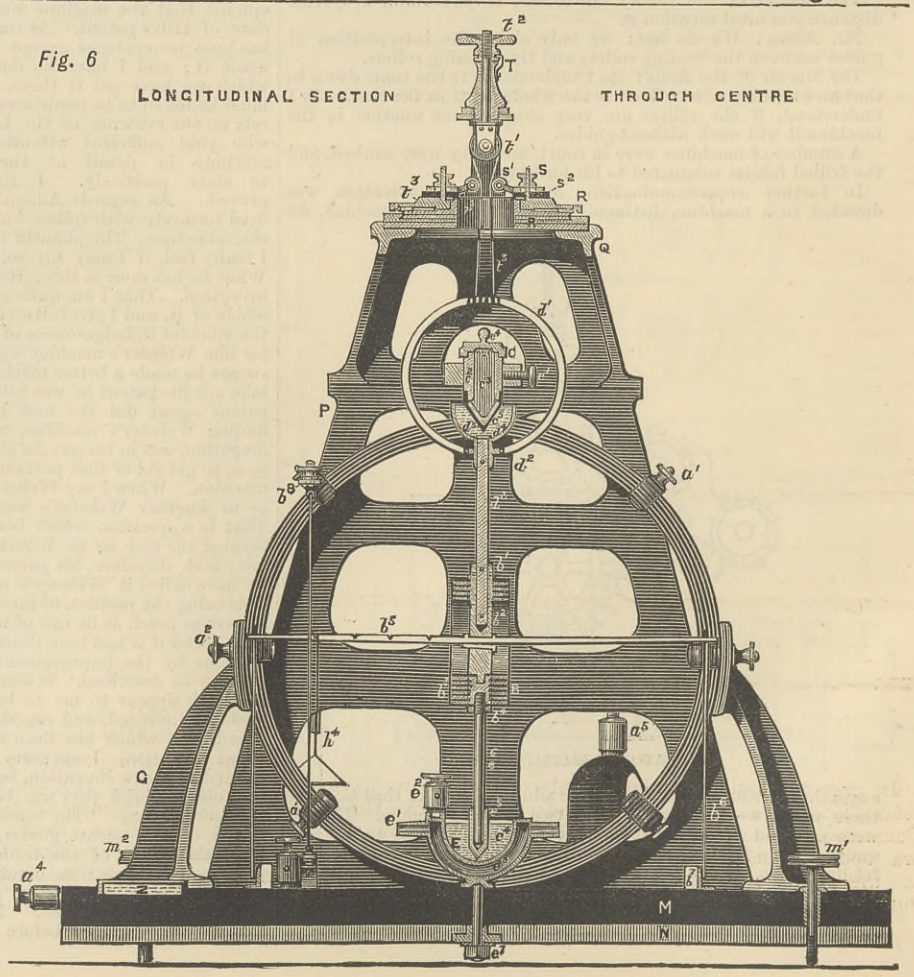


Fig. 6

LONGITUDINAL SECTION THROUGH CENTRE



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TO CORRESPONDENTS.

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

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

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

J. N.—*A copy of your little book on the "Slide Rule" has been received.*

W. S. (Manchester).—*Persian wheels are not made in this country. They are of native manufacture.*

L. J.—*All arches exert a thrust on the abutments, and it is not easy to see how this thrust could be dealt with in your design.*

W. E. S.—*So many solutions of the problem have already appeared in our pages, that we think it hardly necessary to publish yours.*

J. W. B.—*Australia appears just now to be like every other place, overstocked with professional men. If you have interest you will get employment, perhaps; if you have none, you will get nothing to do, certainly.*

G. F. P.—*Newton's fusible alloy, which melts at* 201 *deg. Fah., consists of* 2 *parts bismuth,* 1 *of lead, and* 1 *of tin. Another alloy melting at a somewhat lower temperature consists of* 4 *parts bismuth,* 2½ *parts lead, and* 1½ *tin.*

Inquirer (King's Lynn).—*What you refer to is known in the United States as a "petticoat pipe," and is supposed to equalise the draught through the tubes, making the lower rows act as well as the upper rows. It is never used in England.*

X. X.—*The valve acts in the way you describe because its virtual area is increased the moment it lifts. Consequently when it has once been opened at all, it opens fully, blows off a good deal of steam, and shuts again as soon as the pressure has been reduced a pound or two.*

An Old Subscriber (Tipton).—*Galvanised corrugated iron makes a bad roof for a foundry. It will be eaten into holes in a few months by the sulphurous fumes from the coke. Tiles or slates are much better. If you must use iron, do not have it galvanised, but give it a couple of coats of oxide of iron paint.*

PROBLEM IN DEFLECTION.

(To the Editor of The Engineer.)

Sir,—I notice in last week's issue the length of the first beam in my query has been printed b instead of l; and L ($> b$) should have been L ($> l$). Kindly enter this in your next, or the error may lead to some confusion. S. R.

Manchester, April 11th.

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Advertisements cannot be Inserted unless Delivered before Six o'clock on Thursday Evening in each Week.

*** *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.*

MEETINGS NEXT WEEK.

Institution of Mechanical Engineers.—Thursday, April 21st, and Friday, April 22nd, at 7.30 p.m., the following papers will be read and discussed:—"On Rivetting, with special reference to Shipwork," by M. Le Baron Clauzel, of Toulon. "Results of Experiments on Rivetted Joints," made for the Institution of Mechanical Engineers, by Professor A. B. W. Kennedy, of London. "On Thrashing Machinery," by Mr. W. W. Beaumont, of London. "On Meters for Registering Small Flows of Water," by Mr. J. J. Tylor, of London. "On the Bazin System of Dredging," by Mr. A. A. Langley, of London.

The Meteorological Society.—Wednesday, April 20th, at 7 p.m.: "On the Frequency and Duration of Rain," by Dr. Wladimir Köppen. "Results of Experiments made at the Kew Observatory with Bogen's and George's Barometers," by Mr. G. M. Whipple, B.Sc., F.R.A.S., F.M.S. "On a Discussion of Mr. Eaton's Table of the Barometric Height at London, with regard to Periodicity," by Mr. G. M. Whipple, B.Sc., F.R.A.S., F.M.S.

Chemical Society.—Thursday, April 21st, at 8 p.m.: "On Fractional Distillation," Part II., by Mr. F. D. Brown. "On the Estimation of Hydric Peroxide by Means of Potassic Permanganate," by Mr. W. E. Adeney. The Oxidation of Sulphurous Acid," by Mr. H. B. Dixon.

DEATH.

On the 9th inst., suddenly, at Morton House, Tynemouth, Francis Charlton, C.E., aged 65 years, only surviving son of the late William John Charlton, of Hesleyside, Northumberland. R.I.P.

THE ENGINEER.

APRIL 15, 1881.

BRIGHTON BEACH.

In previous articles under the above heading we have referred to the extensive works undertaken by the Hove Commissioners to stay the inroads being made by the sea upon the beach at Cliftonville. We then referred to the want of conjoint operation between the local authorities and those of the adjacent town of Brighton, and expressed our opinion that the works then in progress for protection at the threatened spot would necessitate the construction of further similar works towards the eastward, until the limit of the Hove district was reached and the danger turned on to the Brighton section of the beach.

We have recently again inspected the beach, and were not in the least surprised to see that our anticipations as to the course which would have to be followed had been fully realised. Some six or seven groynes, connected by massive concrete sea walling not yet fully completed, have been constructed in close contiguity opposite to Queen's Gardens, and so far these appear to have answered their intended purposes, and beach is gradually, though very slowly, accumulating again at that point. But beyond that, and up to almost the extremity of the parish boundary, we found further and extensive groynes in progress of construction. These are of very massive design, and appeared to be set at a slight angle corresponding with the flow of the tide eastward—a plan which we referred to as desirable when first writing on this subject. Residents in Brighton inform us that it has been evident to them for some time past that the beach at this point is being worked in upon by the sea, and we presume that, seeing this to be the case, Mr. Ellice-Clark, the engineer to the Hove Commissioners, has deemed it advisable at once to take steps to check its further progress. As we have said, it was evident to us when we saw the first commencement of these works that such steps would ultimately become necessary, and it was because we foresaw them, that in our first article we strongly urged that there should be established some system of concurrent operation which should prevent as far as possible the injury extending to the beach in Brighton parish.

No such system appears, however, to have been determined upon, and we are left to the conclusion that there exists an antagonism between the Hove and Brighton authorities which makes the former perfectly careless of how far, while protecting their own interests, they sacrifice those of the neighbouring town. The two most eastward groynes, now being constructed by Messrs. Cheesman and Co., the contractors, are not as yet sufficiently far advanced to enable us to judge as to the distance seawards to which it is contemplated to carry them. It is well-known to all who are practised in works of this nature that there is a tendency for the sea to cut sharply in round the head of a projecting groyne, and scour away the beach to the leeward of it. If the two east groynes are carried out beyond the present line of beach in the endeavour to restore the lost line, or to cause further accumulation, it is pretty certain that, unless the angle at which they are built should suffice to obviate it, denudation on the leeward side of them will be induced. Now if these groynes are carried only so far as the existing normal line of the beach, and terminate at its edge at the same level, no obstruction will be offered to the waves or to the tidal flow, and then leeward scouring action will not be set up, and so, while preserving the present beach line intact by arresting all movement eastward, that further on towards Brighton will not be affected. Should, however, these groynes be carried out as those have been that are situate opposite to Queen's Gardens, and more especially that one close to the parish boundary and almost opposite to the Brighton town toll-house, the scouring action will, we are sure, at once become apparent on the beach between it and the new pier. It will be too late then for the Brighton authorities to express regret that they had not taken our advice, and called in to their aid the opinion of some distinguished engineer upon whose *dictum* parliamentary interference might have been sought. It will then be apparent to them that there is no alternative but to pursue within their length of beach—extending we believe some two and a-half miles—a similar course to that which the Hove Commissioners have had forced upon them, viz., to construct groyne after groyne at invervals until the action of the sea is finally turned on to the base of the chalk cliffs between Kemp Town and Rottingdean.

If it is desired to avert the enormous expenditure to which such steps must put the municipality, it is not yet too late to seek the advice of experts, and see if the adoption of our suggestion to stop these groynes at the normal beach line may not prove successful. It is of course very difficult to predict with certainty anything in connection with so variable an element as the sea, and the results of ebb and flow of tidal currents; but as, to stop the works at the point suggested can cause no expenditure, and may suffice to obviate it, such a course should at least be tried. We are amazed at the apparent apathy of the Brighton Town Council on this subject. They have in their local engineer, Mr. Lockwood, a gentleman of such large practical experience, and, as the condition of their town shows, of such great energy and ability, that we cannot but feel surprised that no steps that we can hear of have been taken under his advice. Brighton is already an exceedingly heavily rated town, and there is a good deal of grumbling among the inhabitants during these times of trade depression. We may venture with certainty to predict that that grumbling will increase tenfold, and with good cause too, if within a few months Mr. Lockwood should come before the authorities with the statement that a large sum must at once be provided for further protective works on their shore. We were somewhat puzzled, when going over the works already completed and those in course of construction, to see that only about one in three of the groynes built so close together opposite King's Mansions, and by the terrace across the beach down to the sea was of concrete, those intervening having been executed in timber. We presume, however, that Mr. Ellice-Clark deems that, when the latter have served their purpose of accumulating beach, they may be allowed to decay, and that having been once established, the shingle will be sufficiently held together by more widely spread groynes of concrete. Such an idea, if we are correct in supposing Mr. Ellice-Clark to hold it, appears to us to be justifiable, and the great expense of the concrete works has naturally induced him to use them as sparingly as he considers, to be safe to effect the objects he seeks to secure. We are unaware of the exact cost of these groynes, but presume the largest concrete groynes were not built much under £2000 each, while we should roughly guess the timber groynes of the same length to cost about £600 each. Such a difference in expense would certainly justify the running of some risk of the timber groynes requiring reconstruction at a future date.

The work put into the concrete groynes by the contractors seems to us all that can be desired, and they appear, as far as we were able to judge, to be carried down to a sufficient depth to secure them against the possible result of sand being undercut from them by the action of the numerous land springs which flow below the beach level. It may even be that they are bedded on the rock, which we believe to underlay most of the shingle along that part of the coast. We approve strongly of the method adopted for facing these works. Cubes of concrete are moulded, the outer face of which is formed of large boulders, closely fitted and pointed in Portland cement. This leaves but small surface exposed for weather wear or attrition by wave action. On the old sea wall which supports the Marine Parade of Brighton, we notice that the small shingle of which its face is composed has yielded very much to the action of weather, and we should presume that it has cost a good deal for maintenance. We would strongly recommend the method of facing such works we have described being adopted in all cases of external concrete construction. There are several fine instances of such construction in the high walling erected on the new drive between Hove and Preston, near its junction with the London-road, and we believe that ere a few years have passed it will be found necessary, if these walls are not covered by a quantity of ivy or similar parasitic protection, to coat them at great expense with Portland cement. Had facing blocks been built in, having their external sides protected by pointed boulder work, this necessity would never arise. We noticed, also, that these facing blocks, as adapted to the groynes, are arrissed so that they may be strongly keyed together when placed *in situ*. Altogether, the design of the details of these works is most creditable, and we should have no cause for writing in terms of complaint or warning as to them, if we could think that ultimate effects were foreseen and judiciously provided against.

But now, when once again raising the voice of warning, we must still, and even more strongly as results are becoming apparent which justified our first reference to these works, protest against the supineness of the Imperial Government in leaving such important matters altogether without that control which should provide for harmonious working, a neglect which leaves it open to any one town to adopt a course, which, while securing itself, is sure to cause injury to a neighbour.

MAGNETO AND DYNAMO ELECTRIC MACHINES.

Before the construction of a machine is attempted, some study ought to be given to the principle upon which the action of the machine is founded. Romagnesi in 1802, and more particularly Faraday in 1831, made public the principle upon which magneto-electric machines are based. The former discovered the action of an electric current upon a magnet, the latter discovered the converse action of a magnet upon a conductor. Faraday's conception of "lines of force" enables us to discuss with a considerable amount of confidence actions that would otherwise be difficult to understand. If any reader desires to know the opinions of mathematicians on this conception of Faraday's, let him consult "Papers on Electrostatics and Magnetism," by Sir W. Thomson; "Electricity and Magnetism," by the late Prof. Clerk Maxwell, and similar books. We may, however, without going outside the aim of this article, make one or two quotations. Clerk Maxwell, vol. i., p. 147, says:—"Now, the quantity of electricity in a body is measured, according to Faraday's ideas, by the number of lines of force, or rather of induction which proceed from it. These lines of force must all terminate somewhere, either on bodies in the neighbourhood, or on the walls and roof of the room, or on the earth, or on the heavenly bodies, and wherever they terminate there is a quantity of electricity exactly equal and opposite to that on the part of the body from which they proceeded." On the next page, he says, "The lines of force due to a single centre of force are straight lines radiating from that centre." Sir W. Thomson defines a line of force thus, "A 'line of force' is a line drawn through a magnetic field in the direction of the force at each point through which it passes, or a line touched at each point of itself by the direction of the magnetic force."

Now let us consider for a short time the second quotation from Clerk Maxwell. Let us suppose A to be a single centre of force, and the lines of force to be represented by straight lines B C D, &c., drawn in every direction from it. As the lines radiate equally in every direction, there will be the same number in any given area at equal distances from the point. For example, suppose a circle E, with centre A, the number of lines reaching each quadrant of E is equal; the same is true of a circle F, with radius longer than that of E, but the number of lines cutting any given length, say ·05in. of E is not the same as those cutting ·05in. of F or any other circle nearer or farther off the centre than E. Instead of imagining these circles, let us imagine such a centre of force and such lines of force, and that a wire with diameter ·05in. is brought into this field of force. Then when the wire is placed at the distance E from A, a number of lines of force will terminate at that wire, according to the first quotation from Clerk Maxwell. Suppose further, that each line of force has equal influence on whatever terminates it, then evidently the total influence of the lines of force on such a wire is equal to the product of the number, say n lines of force terminated, and the influence, say x, of each line of force $= n\,x$. Now move the wire from E to F, and we get an alteration of influence due to the fact that F being further from the centre than E, a less number of lines of force terminate in the wire, and therefore the product $n'x < nx$. If, however, the wire be moved nearer the centre A, then $n''x > nx$. The influence in the wire at any point equidistant from A is unaltered; and therefore if

the wire was moved through the whole equidistant space no change could be observed in it. Reference to books will show that the surface so described is, as is well known, an equipotential surface. So long as the wire has terminating in it the same number of lines of force, so long the influence is unaltered; but change the number so terminating, either to increase or diminish, and we get a corresponding change of influence.

We have previously said that Faraday discovered that a magnet induced a current in a wire brought near it. Suppose the point A to represent the pole of a magnet, and the lines radiating from it to represent the lines of force radiating from A, then the influence of A upon a wire brought into the field is such as we have described, and depends entirely upon the number of lines of force terminating in that wire. Further, we may suppose the so-called positive and negative currents of electricity to be the currents indicating the influence exerted by an increase or a diminution respectively of the number of lines of force terminating in the wire. The case we are discussing is hypothetical, but nevertheless we trust it will help in fixing certain ideas which we think all those who trouble themselves about electrical machines should possess. From the reasoning we have followed it will be seen that the greatest influence upon a wire would be when all the lines of force of the field terminated in it, and the greatest change would be from this condition to the one when no line of force terminated in it. In the one case, according to our assumption, we should have the maximum positive current, in the other the maximum negative current.

Indulging in a little transcendentalism, we may easily indicate how the maximum effects would be obtained with a given field of force. In the first place all the lines of force must be concentrated into one line, the influence of this one line equalling the influence of all the lines—*i.e.*, there must be no diminution of force in the concentration. We remember from our schoolboy days that a line is length without breadth. Then, secondly, the wire in which this line of force is to terminate must also be diminished to a line, so that it at once passes from the maximum state on the one side to the maximum on the other; and further, if we could have a ring of such wires, so that the passage was continuous across a series of such lines of force, we should manage to obtain something very near perfection. It is well known that, by an arrangement of magnets, it is possible to deflect, and to a certain extent concentrate, the lines of force; but there is evidently a point past which such concentration will not be economical. We may also point out that to magnetise and demagnetise a core, to induce a current in a wire and to return that wire to its normal condition, takes time; and so it devolves upon the constructors of this class of machines to consider a somewhat complicated problem. That it will long remain impossible to specify the construction of a machine required to produce certain results under certain conditions we deny; but hitherto no such specification has been written. Are electricians agreed that the generation of a current of electricity in a wire is due to the termination in that wire of a certain number of the lines of force of the magnetic field? If so, it is certain that the greater the number of such lines of force cut by the wire and so terminating in the wire in a given time, the greater the current obtained in the time. Our object, then, should be so to arrange the machine that the lines of force cut by the wire shall be a maximum, and that these lines shall be cut in the least time. The next object is to return the wire to its normal condition as soon after the greatest effect is obtained as possible, and so in the wire produce these conditions without loss of time. As yet, so far as we know, no investigation has informed us how many times a current in a wire may be economically induced in a given period. If, again, we cannot know the absolute we may, at any rate, have an idea as to the comparative number of lines of force in any portion of the field of any magnet.

THE STEPHENSON CENTENARY.

It is proposed to celebrate in June the centenary of the birth of George Stephenson; and on the Tyne the movement is being taken up with great fervour and enthusiasm. Several proposals have been made for the due expression of the northern feeling on the recurrence of the hundredth year since the birth of the most famous of the dwellers on Tyneside; and from the decisions that have already been arrived at, it is certain that the occasion will be fittingly commemorated—possibly on the lines of the celebration of the railway jubilee at Darlington, though with a more definite aim in view. The justification for this northern movement is greater even than for that of five years ago, for the results of the work of Stephenson on the Tyne are greater and more varied than the more local effort on Teesside, though the latter had its unquestioned value in proving the practicability and the financial success of public railways. But without touching on debateable ground, it may be fittingly said that Stephenson not only made the crude attempts of earlier engine builders in great degree available for general use, but he did more. He established locomotive building as an industry; and Wylam, Killingworth, and the South-street Works at Newcastle, are amongst the names that bring up the early history of the construction of locomotives. The North has not been unmindful of what it owes to the illustrious father and son, who may be said to have been its most famous railway engineers. It has, on the site of the cottage George Stephenson once occupied at Willington—the birthplace of his son—raised a useful memorial school; it recognises in its chief town the connection he had with it, and at Killingworth it preserves in fair condition the house he occupied when fame was coming to him. But his birthplace at Wylam shows traces of the hundred years that have passed away; and it might be worth the consideration of the Centenary Committee whether it might not fittingly be put to a use similar to that of the cottage at Willington, and so make an enduring memento of the great engineer in the actual place of his birth. It cannot be desirable to allow it drift into the decay that seems now likely to seize it; and though the policy of centennial commemorations may be doubtful, it is desirable that when this has been resolved on, it should result in benefit to the especial village where the event actually occurred which suggests it. The Tyne has perhaps more cause to be grateful to the Stephensons than any other district. They gave to its commerce an enduring addition; they placed it on the great road north; enabled the pits in its coal country to be worked; and have established in it that industry which is one of the most valuable of those on the banks of the river. Whatever may be the steps that may be taken fittingly to celebrate the event, it is to be hoped that they will include some one which will place prominently the great locomotive building industry in its history, by example, before those who muster to do honour to the best known of the early builders of the locomotive. In the Darlington Jubilee this was attempted in some degree successfully; but whilst the Tees district was the "hospital of the locomotive," the Tyne might be called its birthplace and nursery, and any celebration would be defective in which this was not recognised. The early locomotives are passing away, but there remain enough fittingly to illustrate the changes that "threescore and ten years" have witnessed in their construction; and it will be well if types could be congregated on Tyne-side, where Stephenson's early labours were devoted to their building and repairs.

THE SOLWAY VIADUCT.

Major Marindin's report to the Board of Trade on the Solway Viaduct has been issued. The particulars of the destruction of this viaduct between the 29th of January and the 2nd of February have already been reported in our pages. Major Marindin first describes the construction of the viaduct, and then details the nature of the injuries which it has sustained. It will be remembered that the viaduct, which was begun in October, 1865, and finished in June, 1868, carries a single line only, although the foundations and a portion of the piers for a double line are there. The total length of the viaduct is 1940 yards, and it has 181 single and 12 double piers. Of the spans, 192 are of 30ft., and 12 over the double piers are 5ft. each. The height from low water to the rail line is 35ft. It will thus be seen that the viaduct constitutes a species of gigantic strainer across the river, and past this strainer the ice could not readily get, as it was carried in huge masses up and down by a tide said to run at as much as 10 miles an hour. One block of ice, measured about the time of the catastrophe, was 27 yards square, and 6ft thick. These masses were pounded against the piers during the running of each tide up and down with such violence that pier after pier was broken; and in all forty-five of these, of which two are double, have now fallen down, and the girders of thirty-five spans of 30ft., and two spans of 5ft. have followed their example. We quite agree with Major Marindin that it was to some extent a mistake to construct this bridge with piers so close together that ice had not a clear way of escape; but it must not be forgotten that there does not seem to be any precedent for the occurrence at this period which caused the destruction of the bridge. Never before had the ice broken up in the same way, and at no previous time had the safety of the structure been endangered by ice. The lesson is instructive, because it once more enforces the statement often repeated, that with rivers the impossible is sure to happen, and must be provided against. In India some years ago a bridge was put up across a river. The bed was narrow and deep, and signs were not wanting that during the monsoons heavy floods would come down. The engineers were very cautious, and made all possible inquiries. The natives, however, assured them that at no time had the stream risen higher than a certain tree stump, about 20ft. above the tiny rivulet which now ran at the bottom of the gorge. So to make assurance doubly sure the engineers threw their bridge—a small one of about 50ft. span—across at a height of 30ft. above the bed of the stream, and the bridge was not completed two years when a flood came down more than 40ft. deep, and did not leave a vestige of the bridge behind it. The case of the Solway Viaduct seems to have been very similar. It is easy to be wise after an event; and it is possible that, if Mr. Brunlees had to design the viaduct over again, he would leave more room for ice. As it is, Major Marindin points out that there is no reason why the bridge should not be repaired again and made quite safe. But dolphins or fenders of some kind must be provided to prevent the ice from touching the piers. There ought to be no trouble about this; but such things are apt to cause a scour in the bed of a stream, and their foundations will in future require to be carefully watched.

LITERATURE.

The Construction of Gas Works, and the Manufacture and Distribution of Coal Gas. Originally written by Samuel Hughes, C.E. Sixth edition: re-written and much enlarged by William Richards, C.E. London: Crosby Lockwood and Co. 1880.

The fact that a book which was written no less than thirty years ago seems to a man of Mr. Richards' experience to be worth re-writing, is strong testimony in its favour. The great merit of the book is that it is not only almost invariably sound and trustworthy, but that being a small octavo of 388 pages, it can be sold at a very moderate price. Mr. Hughes' book is so well-known to all who are interested in gasworks, that it would be mere waste of time to describe the contents of the volume under notice. Mr. Richards has, however, added a good deal to the original work, and of this something may be said.

Additions may be found in various places throughout the vol., and in many instances new matter has been substituted to some extent for old. The most generally interesting of the additions are those referring to what has recently been done in improving gas burners, and in gas heating. Our author deals at some length with Sugg's improved burners, brought out at the time that gas companies held that their interests were endangered by the electric light. Sugg's huge Argand triple burners were used largely in the City and other portions of the metropolis, and with much success. They gave some trouble, however, at first from the melting and destruction of the glass chimneys, a fact to which Mr. Richards does not allude, and by the time this difficulty had been overcome and good glass was obtained, the wish for these lamps had died out, and few of them are now to be seen in the streets. Mr. Witham's light is described. It consists of a number of small fish-tail burners arranged in concentric rings; at the lower part is a cone to admit air, and immediately above the jets is a talc chimney to give a draught. Mr. Richards says that this "gives a splendid light equal to about four candles per foot for ordinary sixteen-candle gas, and it is well adapted for large areas such as docks, squares, wide streets, or where several roads meet." Mr. Richards speaks very reasonably on a subject of much importance to every householder, and on which dense ignorance seems to exist among makers of gas fittings. The globes used for ordinary fish-tail burners have a lower orifice about 2½in. and an upper about 4in. in diameter. Air is always rushing into the globe at the bottom and escaping at the top, "consequently," writes our author, "this current impinges on the flame and cools it in such a manner, that if 4ft. or 6ft. of gas issue from the burner no difference is observed in the flame, and by these simple means frequently one-third of the gas consumed passes away in waste." As a partial remedy for this defect, he advises that the hole in the bottom of the globe should be made larger; but this will not cure the evil; but it ought to be within the power of the makers of chandeliers to produce a light which, even when shaded by a globe, shall burn the gas supplied to it to the best advantage.

A chapter is devoted to the use of gas for heating and cooking, and at the outset we find in this a statement which requires qualification. Mr. Richards tells us that the atmospheric—Bunsen—burner, "when lighted emits neither smoke nor smell." A very extended experience with perhaps every atmospheric burner in the market, and several others constructed for experimental purposes, has taught us that although there is certainly no smoke, there may be a very disagreeable smell, due to the production of acetyline, which always takes place when coal-gas is burned at a very high temperature. With plenty of ventilation, the odour is carried off, and is not unpleasantly felt, but in its absence the smell is very disagreeable. In some cases atmospheric burners will, however, work for days without the evolution of acetyline, and then, apparently without cause, will begin to smell strongly. Further investigation into the precise nature of the products of combustion from atmospheric burners is much needed. Concerning gas engines, Mr. Richards has but little to say, and we add with regret that this little seems to be an extract from one of Messrs. Crossley's circulars. He adds, however, an interesting bit of information, namely, that he has recently heard of a gas engine so small that it would suffice to drive a sewing machine. Such an engine would, no doubt, meet a large want and command a ready sale; but nothing of the kind has, to our knowledge, been made.

Concerning gas explosions our author makes some very curious statements, which may tend to mislead. Thus, he asserts that a mixture of gas and air cannot explode while under pressure. This is of course exactly the opposite to the truth, for pressure facilitates explosion. Thus, in gas engines an otherwise non-explosive mixture of air and gas being compressed becomes explosive. What Mr. Richards wanted to say is, that so long as there is pressure enough in a vessel containing an explosive mixture to cause that mixture to rush out through an orifice, the gas may be burned at the orifice without danger. He does not say, however, that the rate of issue of the mixture must be greater than that at which flame can travel back through the hole or else an explosion will take place—an important omission. We should like to have some confirmation of the assertion that "the richest gases are the most destructive when exploding." The few words which our author has to say concerning the electric light, recently as they were written, are already out of date.

The faults of this work are very few, the information it contains is valuable for its quantity, condensation, and general accuracy. The paper and printing are good; most of the engravings are more or less old acquaintances, but they are well printed and serve their purpose well. We strongly recommend this book to young engineers. They may think it highly improbable that they will ever have anything to do with gasworks; bue engineers are supposed to know everything, and students will find enough in its pages to prevent them from making mistakes should they be called on to give a little advice, or chance to converse with men who have made the production of gas a life-long study.

BOOKS RECEIVED.

Text-Book of Systematic Mineralogy. By Hilary Bauerman, F.G.S. London: Longmans, Green, and Co. 1881.

Practical Photography, being the Science and Art of Photography Developed for Amateurs and Beginners. By O. E. Wheeler. London: The *Bazaar* Office. 1881.

Lathe Work: A Practical Treatise on the Tools, Appliances, and Processes Employed in the Art of Turning. By Paul N. Hasluck. London: Crosby Lockwood and Co. 1881.

The Export Merchant Shippers of London, Manchester, Liverpool, Birmingham, Wolverhampton, &c. &c. &c., with their Respective Trading Ports and Class of Goods they Customarily Ship, and to which is added an Export and Import Guide, &c. London: Dean and Son. 1881.

Transactions of the National Association for the Promotion of Social Science. Edinburgh meeting, 1880. London: Longmans, Green, and Co. 1881.

Lessons in Elementary Mechanics Introductory to the Study of Physical Science, Designed for the Use of Schools and Candidates for the London Matriculation and other Examinations. By Philip Magnus, B.A. Seventh edition. Longmans, Green, and Co. 1881.

Graphical Determination of Forces in Engineering Structures. By James B. Chalmers, C.E. London: Macmillan and Co. 1881.

Minutes of Proceedings of the Institution of Civil Engineers, with other Selected and Abstracted Papers. Vol. LXIII. Edited by James Forrest, Assoc. Inst. C.E., Secretary. London: Published by the Institution.

Questions on Stewart's Lessons in Elementary Physics. R. F. H. Core. London: Macmillan and Co. 1881.

The Statistical Atlas of England, Scotland, and Ireland. Edited by G. Philips Bevan, F.S.S. Part III. Industrial. London: W. and A. K. Johnston. 1881.

Universal Scantling Diagram for Stiffness. Designed and computed by W. H. Mackesy, Lieut.-Col., A.I.C.E. London: E. and F. N. Spon.

Cries, in a Crisis, for Statesmanship, Popular and Patriotic, to Test and Contest Free Trade in Manufactures. Compiled by R. A. Macfie, F.R.S.E. Second edition. London: E. Stanford. 1881.

Glass Eyes.—From particulars supplied to the reporter of a Chicago paper by a dealer in glass eyes in that city, it appears, says the *Times*, that there are as many as a thousand wearers of these eyes in Chicago, and that from 600 to 800 eyes are sold there every year. The best eyes are made at Uri, the manufacture being favoured by the occurrence there of fine silicates and other minerals required. At Uri are also made large quantities of eyes used in mounting animals, besides a superior quality of glass marbles, known to boys as agates. The artificial eye is a delicate shell or case, very light and thin, and concave, so as to fit over what is left of the eyeball.

RAILWAY MATTERS.

A company was formed recently in Brooklyn, to promote rapid transit by an underground railway.

At the close of last year there were 1234 miles of railway open in New Zealand, namely, 404 in the North Island and 830 in the South.

The Pennsylvania Railroad Company owns or operates railroads having a total mileage of nearly, if not quite, 7000 miles. The rolling stock consists of more than 1000 locomotives, and more than 40,000 cars.

The average cost of Irish lines, including rolling stock, is given at £14,150 per mile. The fares and rates are much higher than in England, and the number of passengers and goods carried vastly less in proportion to the population.

It is announced by the *Colonies and India* that the Government of Victoria have invited tenders for the supply of 13,000 tons of "steel iron." Has the Victorian Government settled the question of "weld iron" *v.* ingot iron, and mild steel *v.* ingot iron?

On six of the principal French railways, having an aggregate mileage of 9478 miles, the mean carriage mileage is 23,952 miles; mean weight of carriage is 6·16 tons; average capacity, 38·52 passengers; and the average proportion between places occupied and seats offered is 0·240—this proportion not varying much on any of the lines.

An interesting and useful paper on light railways, or remunerative railways for thinly-populated districts, was read before the Institution of Civil Engineers of Ireland, by Mr. C. F. Green, M.I.C.E. A supplement to a paper previously read on narrow-gauge railways was also read by Mr. W. Lewis, M.I.C.E.I. The latter deals chiefly with the gauge question, while the former deals with the light railway question generally.

The Trans-Sahara Railway will have received a severe check by the massacre of Colonel Flatter's surveying expedition. Intelligence was received in Paris on the 10th inst. from Tripoli confirming the news of the massacre of Colonel Flatter's exploring expedition. It is added that all the Frenchmen belonging to the party were killed, after a most courageous resistance against the overwhelming numbers of the Touareds of Hoggar.

On the six principal railways of France each ton of wagon, if fully loaded, would convey 1·91 tons of goods; but partial loading and empty wagon mileage reduce the actual load to 40 per cent. of the capacity when full, the average load carried per ton of wagon being only ·76 ton. As goods trains often have two engines, and some engines are wholly employed in shunting, the goods engine mileage is from 9 to 24 per cent. in excess of the goods train mileage.

The Borsig Locomotive Works at Berlin, when there is an ordinary demand for engines, employ 3000 men, and can turn out 200 to 250 locomotives a year. The first locomotive was turned out there in 1841. The second, turned out in 1842, shown at a Berlin industrial exhibition, Borsig named after Professor Beuth, who not many years before had, it is said, dismissed him from the Royal Polytechnic Institute for his lack of interest in chemistry, which was the occasion of entering upon his career as an engine-builder. In 1846 Borsig completed his 100th locomotive; in 1854 his 500th; in 1858 his 1000th.

A noteworthy feature in the consumption of manufactured iron in 1880 is the iron sleeper. In this country it has only been used experimentally, but in Belgium and Germany it has been employed for a considerable time. In the past two years it is calculated, say Messrs. Bolling and Lowe in their report, that nearly 130,000 tons have been placed on the German railways. It is only natural to suppose that its adoption will follow in this and other countries. It may be remarked, however, that in Germany there are many hundred miles of line running through sandy districts for which the iron sleeper is well suited. The thin iron sleepers would not fare as well on the coarse broken limestone and other rocks used on many parts of several of the great lines of this country.

The German Railroad Union has adopted a set of leading characteristic properties and conditions to be satisfied in the steel rails used. The tests to be made in the works are these: A rail placed on two supports, 1 metre apart, must bear a load of 20 tons for several hours, without permanent flexure. In like position it must bear, without breaking, two strokes of the monkey of a pile-driver, a weight of 500 kilogs, falling 4 metres, and without any injury, a fall of the monkey 2·50 metres. The rail must be capable of being bent in the cold state either way to the extent of 50 mm. in the length of 1 metre, without showing injury or cracks. It must be capable of bearing a curvature which will give a versine of 22·5 cm. in 3 metres of length, or about 9in. in 10ft.

The connection alleged to exist between the operations of railways and the amount of rainfall is again being discussed in America. It is regarded as a remarkable fact that before railways were extended to the Pacific, the country lying between the Sierra Nevada and Rocky Mountains was subject to an almost continuous drought. Since then, however, the region has been visited with frequent falls of rain. What has produced the change? is the question. Some suggest that it is due to a change in the electrical state of the atmosphere, produced by the conduction of electricity into the region by the iron rails. Others assert that it is caused by the atmospheric disturbances arising from the frequent passing and re-passing of trains. It is shown that up to 1854 the United States had been periodically visited by great and general droughts, but since that year there has been no such visitation; or, in other words, that the building of such a vast network of railways as has been constructed in the past quarter of a century has been accompanied by an increased fall of rain. Since the general introduction of railways in Europe, also, there has been no drought such as previously at short intervals caused widespread distress. In England, at least, it is remarkable that although the climate has been always humid there has been a growing excess of rainfall during the railway period until now we usually get far more than is beneficial, especially in the past few years.

Cast iron railway wheels, as is generally known, are little used in Europe, and are generally regarded as very dangerous, and especially unfit for use under passenger cars. The *Railroad Gazette* says:—"We might suppose this opinion to be founded on ignorance, were it not that some cast iron wheels have been used for many years, especially in Austria, there being some Hungarian ironworks famous for the 'chilling' property of their iron. But, as in spite of this long experience the opinion prevails there that cast iron wheels are not only inferior, but positively unsafe, so much so that we believe many companies will not permit cars with cast iron wheels to pass over their roads, though loaded with freight for stations on or beyond their lines, it has naturally been supposed in this country that the European chilling iron must be greatly inferior to ours. But it now seems questionable whether the cast iron car wheels in Europe are not quite good and safe. An Austrian engineer, Mr. Emil Stötzer, foreman of the shops of the Empress Elizabeth Railroad at Linz, calls attention to the fact that during the past winter, which in Europe was an exceptionably severe one, while the cases of tire breakages amounted to thousands, and not a few accidents were due to this cause, so far as is known there was not a single case of the breakage of a cast iron wheel, at least not one which interrupted traffic. In view of this he suggests that the prevailing prejudice against cast iron wheels should be abated, and that a great deal might be gained if at least all the freight cars that have no brakes should be provided with cast iron wheels, but thinks that experiments should be made with cast iron wheels under brakes also. He mentions the use of cast iron wheels under passenger cars in this country, but seems not to understand how general this use is, and that of the 496,718 cars reported by 'Poor's Manual' as the stock possessed by our railroads in 1879, probably 495,000 have cast iron wheels."

NOTES AND MEMORANDA.

The death-rate for Victoria for the year 1880 was lower than usual, namely 19·18 per 1000.

During the last six years the population of New Zealand has increased no less than 55 per cent. In vital statistics this colony shows in a very favourable light, the death-rate for the last eleven years being only 12·13 per 1000.

The first rough calculations of the results of the recent Indian Census make the population of Bombay 753,000, an increase of 120,000 on the population of 1872. The population of Rangoon is returned as 131,925 and of Colombo as 111,942.

We recently gave some information on the density of snow. The following from the *Scientific American* will be of interest:—A cubic yard of snow from one snowstorm will sometimes weigh 814 lb., while an equal bulk from another fall will only weigh 71 lb. This indicates that any flat surface upon which snow may be drifted to the depth of only 3ft. may be called upon to sustain a weight of snow equal to a pressure of about 814 ÷ 9 = 90·5 lb. per square foot; or it may only be loaded under like conditions to the extent of 71 ÷ 9 = 7·9 lb. per square foot. The weight of a cubic foot of the densest snow recorded by Sig. Bignami Sormani, of Milan, being 30·14 lb., while a cubic foot of water weighs 62·5 lb., it appears that, under certain conditions, the density of snow may be almost half that of water.

The phenomenon of *verglas* occurred at Urbino in Italy twice in January; and from his observations of it Professor Serpieri concludes that surfusion of the raindrops is not indispensable to its production. Surfusion, indeed, accelerates it, as do also violence of wind and intense cold; but a rain with temperature not so low as freezing falling into an air current in rapid motion, and below 32 deg. gives the phenomenon. It is pointed out, however, that the mist which usually accompanies verglas being driven against objects by the wind, and its particles being in a state of surfusion—the temperature being below freezing—probably contributes to the general result, helping to make the ice layer regular and uniform. If the verglas be such that the drop freezes wholly at once the latter has probably contained many small crystals of ice.

Minute articles suspended in fluids of various specific gravities are free to move and arrange themselves in obedience to the laws of magnetism and the collateral forces. During repeated attempts to render the "magnetic field" in some way visible, a method of investigation presented itself to J. W. Wetherell, who thus described it in the *Electrician*:—Very minute particles of steel and iron were placed in a flat-sided bottle containing lamp spirit; to the outside of this were applied the two poles of a permanent horseshoe magnet. Immediately the inductive action became visible, and the direction of the current could be well seen by placing a lighted candle behind the bottle. This is a convenient method of showing the exact extent of the "magnetic field," its form and structure. Other magnetic substances may also be tried in the same fluid, or separately, to compare the effects.

The following figures, communicated by Mr. A. Angel, to the *Analyst*, are obtained from analysis of a sample of water taken from a private well in Southampton, the water at the time being in daily use for all domestic purposes. It is very remarkable from the enormous amount of saline ammonia present, and is an example of the fearful pollution of which town wells are liable. The water was fairly presentable to the eye and was not unpalatable; the distillate from carbonate of soda smelled strongly ammoniacal, and, of course, gave a strong alkaline re-action. Parts per 100,000:—

Free NH_3.	Albumd. NH_3.	Nitrates. =N.	Cl.	P_2O_5	Solids.	Per. H.	Total hardness.
5·68 ..	0·0332 ..	1·9026 ..	2·2	*v.h.*traces	41·7 ..	.. 6·2 ..	14·5

Microscopical examination—Starch grains, paper, animal hairs.

Mr. W. Hamlet recently read a paper on the action of compounds inimical to bacterial life, to the Chemical Society. The following is his method of experiment: Flasks similar to those of Pastuer—*Etudes sur la bière*, 81—holding about ¼ litre were used. The liquids employed were Pasteur's fluid with sugar, beef tea, hay infusion, wine, brewer's wort, and extract of meat. Each flask was about half-filled and boiled for ten minutes, whereby all previously existing life was destroyed. The flask was then allowed to cool, the entering air being filtered through a plug of glass, wool or asbestos. The flask was then inoculated with a small quantity of previously cultivated hay solution or Pasteur's fluid. Hydrogen, oxygen, carbonic oxide, marsh gas, nitrogen, and sulphuretted hydrogen, were without effect on the bacteria. Chlorine and hydro-peroxide—about 7 per cent. of a 5 vol. solution—were fatal to bacteria. The action of various salts, organic acids in 5 per cent. solution was tried. Many, including potash, soda, postassic bisulphite, sodic hyposulphite, potassic chlorate, potassic permanganate, oxaltic acid, acetic acid, glycerine, laudanum, and alcohol, were without effect on the bacterial life. Others, the alums, ferrous sulphate, ferric chloride, magnesic and aluminic chlorides, bleaching powder, camphor, salicylic acid, chloroform creosote, and carbolic acid, decidedly arrested the development of bacteria.

At a meeting of the Chemical Society on the 7th inst., Mr. W. Jago read a paper on the organic matter in sea-water. On page 133 of the 6th report of the Rivers Commission it is stated that the proportion of organic elements in sea-water varies between such wide limits in different samples, as to suggest that much of the organic matter consists of living organisms, so minute and gelatinous as to pass readily through the best filters. At the suggestion of Dr. Frankland, the author has investigated this subject. The water was collected in mid-channel between Newhaven and Dieppe by the engineers of the London, Brighton, and South Coast Railway, in stoppered glass carboys. The author has used the combustion method, the albumenoid ammonia and in some cases the oxygen process of Prof. Tidy. To determine how the various methods of water analysis were affected by a change of the organic matter from organic compounds in solution to organisms in suspension, some experiments were made with hay infusion the results confirm those of Kingzett—Chem. Soc. Jour., 1880, 15—the oxygen required first rising and then diminishing. The author concludes that the organic matter of sea-water is much more capable of resisting oxidising agents than that present in ordinary fresh-waters, and that the organic matter in sea-water is probably organised and alive.

M. Muntz has for three years past been studying the phenomena that occur in the storage of grain, both by observation of the large stores of the Paris Omnibus Company and laboratory experiments. Grain placed in air, it is known, absorbs oxygen and gives out carbonic acid; and, even when air is excluded, grain still liberates carbonic acid through intracellular fermentation. The carbonic acid formed, in any case, measures the alteration and loss. Comparing the influence of renewal of air with that of confined air, M. Muntz found that in the former case the grain liberated about ten times more carbonic acid than in the latter. In contact with air the carbonic acid formed is always inferior in volume to the oxygen absorbed. There is a secondary and incomplete combustion like that in germination of oleaginous seeds. The oxygen is chiefly fixed by fatty matter. As to moisture, grain usually contains 11 to 19 per cent. of water. Very dry grain gives little carbonic acid; in consequence, it is exposed to ravages of insects, which do not then meet with asphyxiating atmosphere. The proportion of carbonic acid increases very quickly with the degree of moisture, and beyond 13 to 14 per cent. of moisture the progression is enormous. The proportion also increases very rapidly with temperature till about 50 deg. Here there is a stoppage; but on heating further the combustion acquires fresh energy. M. Muntz distinguishes two phenomena of combustion—one of physiological order, corresponding to respiration; the other purely chemical. Anæsthetics, such as sulphide of carbon, diminish, without stopping, the formation of carbonic acid.

MISCELLANEA.

The boiler of the North German passenger ship Adler exploded on Saturday morning off Harwich, scalding four men.

The New South Wales Government intend spending £6000 in completing the torpedo defences of Sydney harbour.

Victoria is losing £24,000 per annum over the present mail contract, as against a loss of £13,500 per annum over the last.

At the sixth meeting of the Liverpool Engineering Society, last week, a paper was read by Mr. W. M. Chambers on "Corrosion of Iron and Steel."

A curious paper was recently read before the American Institute by Mr. W. H. Farrington. It was on "Scientific Books," and forms an instructive running commentary on a large number of books.

The Graving Dock Company has obtained a grant from the Nova Scotia Municipality of £2000 for twenty years, and from the Canadian Dominion Government a similar amount, but the latter promised £7500 if the city would similarly increase its subsidy. If that was granted, the dock was to be proceeded with at once at a cost of £200,000.

The Vienna papers report that a few days since a young labourer, who had been engaged in cleaning the brick flues of a large boiler in Messrs. Gellerth and Fuerth's paper mill at Pilsen, had crept into the large flue and gone to sleep, where he had not been noticed when the flue was bricked up. The furnaces were lighted, and until the man was missed his horrible fate was not suspected.

For the supply of electricity to the Swan light about to be introduced into Mr. Watson's colliery at Earnock, the dynamo-electric machines are to be erected in the engine house of a Guibal fan at the colliery. From the engine house the electric cables will be led down the nearest pit shaft into the workings. The preliminary operations, of which Mr. A Jamieson has charge, attending the introduction of the light will occupy nearly a couple of months.

The Wolverhampton Corporation have made a profit upon their waterworks, during the year ending December 31st last, of £2292, upon a total income of £20,000. This profit is an increase over that of last year of £441. Since the property was purchased by the the corporation, thirteen years ago, the total profits have amounted to £10,652. Of this sum £5000 has been set apart as reserve, £1656 has been spent in extension of plant, and the balance it is proposed to apply towards the cost of contemplated extensions at the artesian wells at Cosford, rendered necessary by the increasing consumption of water and the inconvenience of relying on the river Worf for a constant supply.

There is, perhaps, no street in London in which so much cruelty to horses is to be seen as in Fleet-street. In winter time, when the smooth wood-paved hill is covered with a coating of compressed snow or ice, it rarely gets a sprinkling of sand, and yet very heavy loads, such as of heavy rolls of paper for one or two of the "largest daily circulations," have every morning to be hauled up it by straining and floundering horses undergoing a species of vivisection. Again, when the weather is dry, like the recent continuation, the hill is sprinkled with water, and soon the street is as slippery as a greased board, and horses cannot move any load, and fall in all directions as "long oats" are applied to their sides to enforce them.

It is stated that the Philadelphia capitalists who are about to reclaim the immense tracts of land in the State of Florida known as the Everglades, have completed their contract with that State, one of the main features of the scheme being the building of a ship canal across Florida. This project almost equals in importance that of reclaiming 12,000,000 acres of rich land. It would not only shorten the distance between the American ports on the Atlantic coast and all European ports to New Orleans, Mobile, and all shipping points on the Gulf of Mexico, but it would avoid the dangers to navigation which are experienced on the countless keys and coral reefs off the southern and south-western coast of Florida.

The Goldsmiths' Company, with a view to the encouragement of technical education in the design and execution of works in the precious metals, have settled a liberal programme of prizes for the current year. The total value is over £300, in amounts ranging between £50 and £10. The prizes will be awarded in December next, and objects of art, &c., should be sent in by November to the clerk, Mr. W. Prideaux, at Goldsmiths' Hall. The company have also resolved—says the *City Press*—that a travelling scholarship of £100 may be awarded to a student who has shown exceptional talent, and who shall have obtained prizes for design or modelling in three competitions, in order to enable him to study art in the precious metals on the Continent.

The allotment of space in the International Medical and Sanitary Exhibition to intending exhibitors is now being rapidly proceeded with, and at the meeting of the committee on Wednesday last (April 6th), the names of 225 exhibitors were registered and approved as follows:—Medical section, 115; sanitary section, 94; miscellaneous section, 16. In addition to the wall space and counter space taken, upwards of 1200ft. frontage of floor space will be allotted to the above exhibitors, representing an area of no less than 8000 square feet. This area will be occupied by articles which are said to be strictly within the object of the exhibition. The list of exhibitors already includes the leading manufacturers in Great Britain and Ireland in connection with the medical industries, and the industries connected with architecture and sanitary engineering, and important exhibits are said to be announced from France, Germany, Austria, Italy, Belgium, Holland, Norway, and the United States. The committee have decided, in order to meet the convenience of intending exhibitors, to extend the time for receiving applications for space, which may now be sent in up to Saturday—to-morrow—April 16th. Inquiries should be addressed to the secretary, Mr. Mark H. Judge, at the Parkes Museum of Hygiene, Gower-street, W.C.

Major Majendie's report on the circumstances attending the explosion of guupowder in a glazing house at Messrs. John Hall and Son's Gunpowder Factory at the Marsh, Faversham, on the 11th December, 1880, has been published. At the time of the explosion all manufacturing operations were suspended, the engine stopped, the boiler fires banked up, the experiment house—containing in the tub the 720 lb. of finished powder—locked up. Suddenly, at 3 a.m. on the 11th December, or twelve hours after manufacture had ceased in the building, this state of things was disturbed by a violent explosion in the glazing house, the 720 lb. of gunpowder in the glaze tub having gone off, with disastrous effects. He says:—"An explosion occurring under such circumstances must be admitted to be of a very exceptional and remarkable character. There can be no suspicion, such as would at once suggest itself in the case of what may be called chemical explosives, like gun-cotton or dynamite, that the explosion was the result of the spontaneous ignition of the material. It is a perfectly well-established chemical fact that ordinary gunpowder is not susceptible of spontaneous explosion, and the gunpowder in the glaze tub was of particularly pure, good quality. All idea of spontaneous explosion of the gunpowder may, therefore, be confidently dismissed." Major Majendie then describes experiments on the possible establishment of chemical action due to the elevated temperature of the powder, elevation of temperature of powder by process of glazing, by evolution of sulphur vapour, and on the possible ignition of wood from chemical action, but all these indicated no possible cause of explosion. Major Majendie therefore concludes—"I am forced most reluctantly, but most decidedly, to the conclusion that the explosion was wilfully brought about by some evil disposed person," and he urges that when every other possible hypothesis has been examined, and found insufficient, the fact that no motive for such a crime is apparent is not a sufficient ground for rejecting the only remaining explanation.

MEASURING ELECTRIC CURRENTS OF GREAT STRENGTH.

It has generally been the custom in measuring electric currents of great strength to measure part of the current only, and from data so obtained, to calculate the whole current. Four ways are in use for measuring such currents. The galvanometric method requires a galvanometer of small resistance and large radius, and it is necessary to bring the deflection to about 45 deg. by means of a shunt of small resistance. A large part of the current passes through the shunt, and any error in the measurement of that passing through the galvanometer multiplies the whole observation by this error. The electrometer method also has many disadvantages, such as leakage, want of constancy of charge in the electrometer, &c. The heat method necessitates measurements of temperature, and these are difficult on account of conduction, radiation, &c. With these views of the case, Professor Trowbridge, in 1878, described to the American Academy of Arts and Sciences a dynamometer he had designed to measure the whole of such currents as are obtained from dynamo or magneto electric machines. He adopted the principle of Weber's electro-dynamometer, in which the current passes down one wire of the bifilar suspension of a movable coil and up the other, and then through fixed coils surrounding the movable coil. With powerful currents it is necessary to shunt this instrument, and the errors inherent in this method are introduced. In working with dynamo-electric machines it is important that we should avoid the method of shunts; for the entire resistance of the circuit is generally of the same order of magnitude as the shunts employed. It is necessary that we measure the whole strength of the current directly at the same time that we measure the work consumed in driving the dynamo-electric machine, the velocity of the machine, and the resistance of the circuit. It is also important to eliminate local attractions. The time consumed in measuring the current strength should be small. In January, 1880, Mr. W. N. Hill described certain modifications of Trowbridge's instrument in the American "Journal of Science," and Messrs. Elliott Bros., of the Strand, were empowered to construct an instrument embodying the design of Trowbridge and the improvements of Hill, to an American order. The instrument has been constructed, and reflects great credit on Elliott Bros. for its admirable workmanship. We are by the courtesy of this firm enabled to give a detailed description of the apparatus, which we consider to show a decided advance upon previous instruments of the class used for measuring large currents.

Figs. 1 and 2 show two views of the instrument as constructed by Messrs. Elliott. When the current passes, the suspended coil is powerfully deflected, but its movement is limited by a vertical wire stop. There are two of these stops, one on each side of the pointer-rod, Fig. 5, of the suspended coil. To the pointer-rod are attached on opposite sides two silk threads, which lead over pulleys on the side bars to small scale pans, h^5, Fig. 3, as shown. Where deflection takes place weights are added as required, to bring the pointer rod back to zero. The weight employed exactly balances the magnetic force. Both Professor Trowbridge, in his paper, and Mr. Hill in his paper, give the theory of the instrument, and we quote from Mr. Hill:—"The expression for the strength of the current is very simple. The weight found is that required to balance the deflective force observed at zero, so that the earth's and local attractions are avoided, nor does the torsion of the suspension enter. Let

S = strength of current in webers.
w = weight used in milligrams.
l = length of weight, arm, or distance from point where weight acts to centre of system.
G = constant of large coils.
g = constant of small coil.
C = constant of instrument or length of magnetic arm.

"By the theory of the electro-dynamometer, the force acting to deflect is represented by the expression $\frac{2\pi n}{r} . g . S^2$, in which $\frac{2\pi n}{r}$ is the constant of the large coils or G, and g the constant of deflecting coil. This force acts with the arm C, and is balanced by the weight acting with arm l. Hence

$$S^2 = \frac{l\,w}{C\,G\,g}.$$

The coils being large, G and g are readily ascertained by measurement; l is a known distance; C is the constant of the instrument, and must be specially determined; C, l, G and g being known, it is evident that from weight found the current may be obtained with little calculation, or a table may be made so as to obtain the values desired by inspection." Mr. Hill constructed tables to use with his instrument, but it is clear that tables constructed for one instrument will not answer when employed on calculation with another instrument, so the best plan for the possessor of an instrument of this kind would be to calculate his constants and make out a table for future reference. The deflections of the instrument are powerful, and thus the weights are large enough to give sufficient sensitiveness. Mr. Hill points out that a set of weights could be made which would represent weber currents, making calculation unnecessary. With his instrument he worked with currents as small as 10 webers, but found it insufficiently sensitive for such small forces. It worked satisfactorily with currents above 20 webers. "It is evident, however, that this form of dynamometer is particularly suitable for larger currents. We have $S : S^1 :: \sqrt{w} : \sqrt{w^1}$. That is, as the currents increase, the corresponding weights increase more rapidly, and greater accuracy and minuteness are attained."

In the complete instrument there is a glass cover, of which the working—back—end is removable, and it also contains a hole, through which a water tube passes to the top plate. The wrought iron parts of the instrument are thickly plated with nickel, as are the pieces T, R, S, Figs. 3, 4, 5, 6, the framings P and Q, and the cross bar C. The important parts of the instrument will be seen by considering the detailed drawings. A shows the large coil, which consists of six turns of a copper band. The diameter of the coil is 12in. from centre to centre. Each turn of the coil is 1·5in. wide and ·083in. thick. Great difficulty was encountered during the construction in getting the convolutions of this coil in the exact position required. The turns are kept in position by insulated screw bolts, as shown; a similar insulated screw bolt being used to fasten the coil to the plate. B shows the small coil at right angles to the large coil. This also has six turns, of wire, the diameter from centre to centre being 2·5in. The width and thickness of each turn is the same as in the large coil. Just above this coil is a brass ring to keep the coil down. A brass stud b^2, Fig 6, bears a lever b^5, also of brass, in which are notches 1in. apart. The stud is upon a piece of ebonite, which serves various purposes, *e.g.*, the insulation of the coils at this part, and holders to the rods d^3 e^6. At the ends of the lever b^5 are thin brass or steel needles, whose movements are read off on the ivory scale, whilst the lever is prevented from making too great oscillations by b^8. C is a brass cross-piece insulated at both ends, carrying plunger as shown, dipping into the upper mercury cup D. The water pipes are affixed at c^6 c^6. A steel spring d^1, Fig. 4, is suspended as shown. E, Fig. 6, is a lower mercury cup, with passages for water through e^1 e^1. M is an ebonite plate 1in. thick, fixed to N, a brass plate ·5in. thick. G G are brass brackets insulated from the coil. H H are brass pulleys sliding along the lever with grooves for silk threads carrying scale pans. The framing P P is of brass, as is the bridge Q, and the bed-plate R which carries two movable pulleys, the position of the pulleys being altered by sliding the brass brackets in the ebonite plate; s^1 s^1 show guide pulleys, and s^2 s^2 the brackets. The top piece T carries pulley t^1 for silk thread affixed to ring d^4, Fig. 6; the height of the pulley can be regulated by the screw above it. Three levelling screws of the usual kind are used.

The water enters first at one of the upper openings, cools the hollow chamber, passes out at the opposite opening, is carried down to one of the lower openings, cools the lower mercury cup, and passes out at the other opening. The electric current passes through binding screw to the lower mercury cup, thence by the copper rod to the outward coil, thence through coil to the brass stud and other copper rod to upper mercury cup, thence to the large coils.

We believe this instrument has been constructed for the United States Torpedo Department. It may not be out of place here to suggest that it is desirable to have similar instruments for use on this side the Atlantic. The increased demand for electric light apparatus will lead to increased demand for information from the workers in pure science, and England is wonderfully degenerate if some of her children cannot supply to the various physical laboratories instruments that must prove of great value to those engaged in making measurements of large electric currents.

SPECIFICATION FOR GOODS ENGINES, LANCASHIRE AND YORKSHIRE RAILWAY.

In our impression for April 1st we published a Working Drawing of one of fifty goods engines ordered last year for the Lancashire and Yorkshire Railway. We now proceed to give the specification, prepared by Mr. Barton Wright, to which these engines have been built. The tender is somewhat peculiar in construction, and we shall publish a drawing of it and end views of the engine. The specification runs as follows:—

The engines must be made to the dimensions given in the following specification, and exactly to the drawings supplied by the company's locomotive superintendent; any alteration or proposed deviation from the drawings furnished must be first submitted to the locomotive superintendent, and his sanction obtained in writing before it is carried out. The materials to be of the make specified in each case, and where no instructions are given, the workmanship and materials must be the very best of their respective kinds. No advantage whatever is to be taken of any omission of details or discrepancies that may occur in the drawings or specification, as the contractor may obtain full information about any part of the work that is not sufficiently explained. The engines must be finished in every respect in the most complete manner, and to the entire satisfaction of the company's locomotive superintendent, who shall be at liberty to inspect, either personally or by deputy, the work during its progress, and to reject any defective or unsuitable materials or workmanship. The contractor is to pay all royalties, and to be liable for all claims in respect of patent rights for any article or part supplied under this contract, or required for its due performance. It must be clearly understood that the prices named in the tender are to include everything required to be done by the conditions of contract and specification, or by any drawings therein referred to, and also all such work as is manifestly necessary to the proper completion of the contract, though special mention thereof may have been omitted in the specification or drawings. The contractor shall pay all costs attendant on any tests which the company's locomotive superintendent or his deputy shall require to be made. In case of any dispute arising, either during the progress of the work or at its termination, the decision of the company's locomotive superintendent is to be taken as final, and binding in every respect. The engines are to be delivered by the builders free of charge to the Lancashire and Yorkshire Railway Company, at Miles Platting, Manchester, fit and ready for work in every respect; and prior to payment each engine will be required to run 3000 miles consecutively, without showing any defects in material or workmanship, and the builders will be held responsible for all such defects that may appear—accidents being excepted, until they have run that distance.

Drawings and Photographs.—The contractor is to furnish with the fifth engine two complete sets of detail and general drawings of the engines, exactly as made, on tracing cloth of double elephant size; also twelve large mounted photographs, showing the engines exactly as finished. The cost of these drawings and photographs is to be included in the amount of the tender.

Quality of Materials.—Iron: In all cases where "Best Yorkshire Iron" is specified, it must be wrought iron of the manufacture of either Lowmoor, Bowling, Farnley Best Iron, Monkbridge, S. T. Cooper and Co., or Taylor and Co., and will be subject to being tested. The brand of the manufacturer must be placed wherever possible so as to be seen when finished. Brass: Where "brass" is specified it must be of good tough metal. Gun-metal: Gun metal must be composed of copper 5 parts, tin 1 part. White metal: White metal must be composed of tin 16 parts, antimony 2 parts, copper 1½ parts. Other materials to be obtained of the manufacture specified under the respective heads, unless the consent of the company's locomotive superintendent be obtained to an alteration.

Boiler.—Boiler dome, smoke-box tube plate, and fire-box shell, with all angle irons, rivets, and stays, to be made of Lowmoor iron in sixteen engines; of Bowling iron in sixteen engines; and the remainder of one of the other firms before specified. Barrel to be telescopic as shown, and to be made of three plates. Transverse joints to be single rivetted; longitudinal seams to be butt-jointed with inside and outside joint strips, and these seams to be placed on each side of centre line of boiler at the top. Seam joining barrel to fire-box shell to be zigzag rivetted. The joint of the middle and dome plate to be welded, and the thickness of this part to be kept full the strength of the plate. A strengthening ring ½in. thick to be rivetted to the inside of the middle barrel, as per detail drawing. Hole for dome to be 19in. only.

Smoke-box Tube Plate.—Smoke-box tube plate to be secured to boiler barrel by a continuous weldless ring of mild Siemens-Martin angle steel, well annealed, manufactured by Messrs. John Spencer and Sons, of Newcastle-upon-Tyne, or Vicars and Sons, Sheffield. To be faced, bored, and turned to section shown on drawings, and shrunk on to the barrel and double rivetted. Two per cent. of these rings to be tested before leaving the steel works by the company's inspector.

Dome.—Dome to be in one plate, welded at the seams and flanged top and bottom, and to be fitted with a wrought iron cover. Flanges of dome and cover must be faced, so that a perfectly steam-tight joint can be made.

Fire-box Shell.—The side and top to be made in one plate. The front or throat-plate of fire-box shell to be flanged forward and double rivetted to boiler. The back plate to be flanged to 6in. radius outside, and single rivetted to sides and top; the upper part to be stayed by a heavy T-girder of best Yorkshire iron, double rivetted to the inside of the plate as per detail drawing. A similar stay to be fixed to inside of smoke-box tube-plate, no gussets or longitudinal stays being used. Palm stays to copper box, and other stays where shown on drawing. All iron used in any part of barrel or fire-box shell must be best Yorkshire.

Manhole.—A wrought iron manhole, flanged top and bottom, to be double rivetted to the centre of fire-box top; to be fitted with a wrought iron cover-plate 1⅜in. thick, on which will be mounted the safety valves. Cover-plate and top flange of manhole to be accurately faced, so that a perfectly steam-tight joint can be made.

Fire-hole Ring.—Fire-hole ring of best Yorkshire iron 2⅜in. by 2½in.

Foundation Ring.—Foundation ring to be 4½in. deep by 2½in. thick struck to 5½in. radius outside at the corners, at which parts the side and end plates are continued the full depth to allow of double rivetting.

Wash-out Door and Mud Plugs.—A heavy cast iron seat and wash-out door to be rivetted to underside of boiler barrel, 16in. in front of fire-box shell. Hole 5in. diameter, and lid to be made with coned joint as per detail drawing. Thirteen brass taper mud-plugs to be placed for purposes of washing out, viz., three on fire-box front, and three on fire-box back, above bottom ring. Two on fire-box back above copper-box roof, one on each side of fire-box shell, and three on smoke-box tube-plate as shown on drawings.

Workmanship.—All rivets must completely fill the holes, which must be slightly countersunk under the rivet heads, and so punched that when the plates are in a proper position for rivetting, the smaller diameters of the holes meet at the centre of the joint. All holes in the plates or angle-irons, &c., must be perfectly fair with each other, and no drifting will be allowed on any consideration whatever. Should any of the holes not come perfectly fair with each other they must be carefully rimered until they become so; care must be taken that after rimering, the rivets completely fill the holes. All the plates to be brought well together before any rivets are put in. Outside edges of holes to be slightly countersunk, and all burs carefully filed off. Holes in the angle iron must be marked off from the plates and drilled, not punched. Pitch of rivets and lap of plates to be made to detailed drawing. Edges of all the plates to be planed, turned, or shaped to an angle of 1 in 8 before being put together, so as to have a full edge for caulking, which must be done with a broad-faced fuller, so as not to injure the plates.

Testing.—The boiler before being lagged is to be tested by the contractor in the presence of the company's locomotive superintendent or his deputy, to a pressure of 200 lb. per square inch with water, and afterwards to 150 lb. with steam, and it must be perfectly tight under these pressures. To receive a coat of boiled oil while hot. All fitting and studs must be fixed complete before the boilers are tested with water or steam pressure.

Dimensions.

	ft.	in.
Centre of boiler from rails	6	8
Length of barrel between plates	10	3
Diameter of barrel outside at fire-box end	4	4
Thickness of plates	0	½
Thickness of smoke-box tube plate	0	⅜
Length of fire-box shell outside	6	0
Breadth outside at bottom	4	1
Depth from c. line at front	4	11
,, ,, ,, back	3	3
Thickness of throat plate	0	⅝
,, sides, back, and roof	0	½
Distance apart of copper stays	0	4
Diameter	0	⅞

Number of threads per inch, 11.

Inside Fire-box.—Copper fire-box and stays to be of the very best quality, and obtained from Messrs. Pascoe Grenfell and Co.; Vivian and Co.; Bibby, Son, and Co.; or other approved maker. To bear the test of being doubled cold without showing any signs of cracking. Three brass plugs, with fusible centres, to be inserted in crown of fire-box. The copper stays to be screwed tightly into the fire-box and shell plates, the thread being turned off the portion of the stay between the plates. Great care to be taken in cutting off the ends not to injure the threads. Heads of the stays to be larger on inside of box. Crown and sides of fire-box to be in one plate, and the tube plate to be widened out, forming a pocket on side plates, to allow a wide spacing of tubes. To be rivetted together with 1⅛in. best Yorkshire iron rivets—see drawings. The roof to be stayed with eight girder stays of "best Yorkshire iron," as shown on drawing. Fire bars of cast iron, as shown on drawing.

Dimensions.

	ft.	in.
Length of copper fire-box outside (top)	5	2⅜
Breadth ,, ,, ,,	3	9
,, ,, ,, ,, (bottom)	3	7
Depth at front end	5	7¾
,, back ,,	3	11¼
Thickness of sides and top	0	0½
,, back	0	0⅝
,, tube plate	0	1
,, ,, below tubes tapering down to	0	0⅝

Tubes.—To be lap-welded iron tubes, with 6in. of solid copper brazed on to the fire-box end, the part passing through the copper tube plate being rolled down to a smaller diameter; manufactured and brazed by the Imperial Tube Company, Smethwick, near Birmingham. To be expanded by a Dudgeon's tube expander, beaded over, as shown on drawings, by a Selkirk's or Brisse's tube beader, and fixed with ferrules at fire-box end only. At smoke-box end to stand through plate ½in., and be rolled out by a Dudgeon's tube expander.

Dimensions.

	ft.	in.
Number of tubes—194 spaced in vertical rows.		
Length ,,	10	10¼
Diameter outside	0	1⅞
,, at fire-box end for a length of 1½in. only	0	1⅝ full
Thickness 13 B.W.G.		

Ferrules.—Ferrules to be made from weldless steel tubing to be obtained from the "Weldless Steel Tube Co.," Birmingham.

Fire Door and Deflector.—A casting to be fixed both inside and outside round fire-hole ring, the two to be firmly bolted together. A wrought iron plate to be hinged on the bottom to outside frame and a cast iron deflector hinged to top of inside casting and worked from the outside by a lever, as shown on drawings.

Brick Arch.—Fire-box to be fitted with a brick arch, supported by two iron bars 2½in. by 1in. thick, to be fastened with studs on side of fire-box.

Smoke-box.—The smoke-box front to be made in one plate; all the plates to be specially clean and smooth and well ground over. All rivets countersunk and filed off flush. To be fitted with a spark arrester. The door to be circular and to fit into a recess, bedding on edge of an angle iron ring 2½in. by 2½in. by ½in. thick. The cross-bar to be made to lift out. Double handle and gripping screw to be provided, as shown. The tube plate to be flanged forward to smoke-box, and the front plate to extend onwards across ends of leading sand boxes.

Dimensions.

	ft.	in.
Radius of smoke-box outside	2	5⅜
Thickness of plates	0	0⅜
,, door	0	0⅜
,, liner plate	0	0¼
Size of angle iron	0	2½
Diameter of rivets	0	0⅝
Pitch of rivets	0	3

Chimney.—The chimney to be of best Staffordshire iron, $\frac{5}{16}$in. thick, butt jointed with rivets countersunk on outside. To have a cast iron top neatly finished. Height from rail to top of chimney to be 13ft.

Ash-pan.—Fitted with one movable door worked from the foot-plate, and arranged to contain water supplied by a tap on injector suction pipe worked from foot-plate. Sides and door of ash-pan to be made of ¼in. plate, and bottom of ⅜in. plate.

Safety Valves.—Two 3in. Ramsbottom's, placed on seating on centre of fire-box shell. Adjusted to blow off at 140 lb. per square inch.

Regulator.—To be of cast iron; the upper portion being removable and attached to the lower by a flange joint. The main valve to be of brass, and to have an easing slide of brass working on the back, making it equilibrium. The internal steam pipe to be of copper, and the end in regulator to have a copper cone.

Steam Pipe.—The smoke-box steam pipe to be also of copper, and the connection at the top to the T pipe, and at the bottom to the cylinders, to be also made of coned copper: ends brazed on and held in place with wrought iron loose gland flanges and two bolts with brass close-ended nuts as shown.

Dimensions.

	in.
Diameter inside of internal steam pipe	4¼
,, ,, smoke-box steam pipe	4
Thickness of each	7 w.g.

Best brazed pipes.

Exhaust Pipe.—Of cast iron, with loose top bored to 4⅞in. diameter, and made with separate branch at base to each cylinder; fixed by four studs only, with brass cover-ended nuts.

Cylinders.—To be of the best close-grained, tough, cold-blast cast iron, as hard as can be worked, and perfectly free from honeycomb or other defects. They must be accurately bored and bell-mouthed as shown on drawings. All joints and surfaces to be planed or turned, and scraped to a true surface, so that perfectly steam-tight joints can be obtained. Centre line of ports to be raised 1⅛in. to give greater area for exhaust, as per drawings. Top of cylinder castings to be protected by fireclay and bricks, and bottom covered with ¼in. plate.

Dimensions.

	ft.	in.
Inside diameter of cylinders	1	5½
Stroke of piston	2	2
Steam port, 15in. by 1¼in.		
Exhaust port, 15in. by 3in.		
Centre to centre of cylinders	2	4
,, ,, valve spindles	0	3¾

Glands.—The piston rod glands must be in halves, notched one into the other, and made removable while rod is in place. The leading end of valve spindle glands to be solid, and the two cast in one piece.

Lubricators.—One of Dewrance's patent piston lubricators to be fixed on smoke-box side, delivering into steam pipe, and two of Dewrance's patent window lubricators, viz., one connected to boss on centre of each cylinder, as per drawing.

Pistons.—To be of good, tough cast iron, made from cylinder metal, and to be sound and free from all defects. Fitted with two cast iron rings sprung into their places.

Piston Rods and Crossheads.—Solid with crosshead, and made of the very best mild crucible cast steel, well annealed, manufactured by Messrs. Vickers, or J. Spencer and Sons, of Newcastle-upon-Tyne. Ends steeply coned, and secured by brass nut and cotter, as shown on drawing. At the crosshead end the gudgeon must be of wrought iron, case hardened, and be forced into place by screw or hydraulic pressure.

Dimensions.

	in.
Width of pistons	4
Diameter of rod	2⅜
,, gudgeon	3
,, gudgeon ends	1⅝

Slide Blocks.—To be of good sound cast iron—chilled—perfectly free from all defects. Surface of slide blocks 14in. by 2⅜in.

Slide Bars.—Of the very best mild crucible cast steel, manufactured by Vickers and Co., or J. Spencer, of Newcastle-upon-Tyne. Section of slide bars 2¾in. by 2in.

Slide Valves.—Slide valves to be of best gun-metal, of form shown on drawings.

Dimensions.

	in.
Lap outside of valve	1
Lead in full gear	3/32

Slide Valve Spindles.—Slide valve spindles to be made of best Yorkshire iron, as per drawings.

Valve Motion and Reversing Gear.—All motion work of "Best Yorkshire Iron," and all working surfaces to be well case-hardened, and finished in the best manner. Expansion links to be lifted from the top, the weigh shaft being placed below, and worked by a screw reversing gear, fixed on left-hand trailing splasher, and made to drawings. Reversing screw and nut to be of steel; all motion pins to be of "Best Yorkshire Iron," well case-hardened and accurately fitted.

Valve Spindle Connecting Rods and Guides.—The valve spindle connecting rods to be circular on wearing surfaces, and the guides to be of gun-metal, lined with white metal.

Excentrics.—Excentric tumblers to be cast, the two halves in one. Excentric straps or "Best Iron" with white metal liners. Ends of excentric rods to be furnished with butt-ends for adjustment, as shown on drawings.

Dimensions.

	ft.	in.
Diameter of excentrics	1	4
Breadth of ,,	0	2⅝
Throw of ,,	0	6¼
Radius of expansion links	4	8
Thickness of ,,	0	2¼
Centre to centre of pins of expansion links	1	5
Diameter of pins	0	1½
Diameter of reversing shaft at centre	0	3½
,, ,, ,, bearings	0	3
Diameter of valve spindle connecting rod guide	0	3¼
Length of valve spindle connecting rod guide	1	0

Connecting Rods.—To be of Best Yorkshire Iron, forged without weld. Brasses of gun-metal lined with white metal at the large end, and brasses of gun-metal, adjusted by wedge and screw at the small end, as shown on drawings. Both ends to be supplied with buttons in oil cups.

Dimensions.

	ft.	in.
Length of connecting rod centre to centre	6	2
Diameter of large end bearing	0	7⅛
Width ,, ,,	0	3⅛
Diameter of small end bearing	0	3
Width ,, ,,	0	3 bare.
Section of rod at large end	0	4½ by 1⅝
,, ,, small end	0	3¼ by 1⅜
Thickness of swelled part at large end	0	2¾
,, ,, small end	0	3 bare.

Coupling Rods and Crank Pins.—Coupling rods of Best York shire Iron, forged without weld, and centre coupling case-hardened. Crank pins of Best mild crucible cast steel, manufactured by Vickers and Sons, or John Spencer and Sons, Newcastle-upon-Tyne. Bushes of solid brass, lined with white metal, as shown on drawings, and forced into rods by hydraulic pressure. Oil cups to be supplied with buttons.

Dimensions.

	ft.	in.	
Diameter of leading and trailing crank pins	0	3⅛	
Width ,, ,, ,,	0	4⅜	
Diameter of driving crank pin	0	4	
Width ,, ,,	0	4⅜	
Diameter of pin in wheel-boss	0	4½	(taper 1 in 100)
Length ,,	0	6¾	(finished)
Diameter of joint pin ,,	0	2½	
Centre of leading to centre of driving crank pin	7	3	
,, driving ,, trailing ,,	7	9	

Axles.—Straight axles for the first twelve engines to be of the Best mild crucible cast steel, manufactured by Vickers and Sons only, and those for the remaining engines of the best Bessemer steel, manufactured by Cammell and Co.; Brown, Bayley, and Dixon; or the Bolton Iron and Steel Co.; all turned accurately to gauges. Two per cent. of the axles to be tested by the company's inspector before leaving the steel works.

(To be continued.)

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

(From our own Correspondent.)

The ironmasters' quarterly meeting in Wolverhampton to-day—Wednesday—was not remarkable for the extent of the business transacted; but it was remarkable for the divergence of views on the part of the leading Staffordshire firms as to the course which should be pursued touching prices. Last week I advised you that the Earl of Dudley and Messrs. Barrows and Sons had dropped prices 10s. per ton, bringing the bars of the former firm to £7 12s. 6d., and those of the latter to £7 per ton. These reductions followed a similar drop by Messrs. Philip Williams and Sons and by Messrs. Millington; and they were accompanied by a like declaration from Messrs. E. S. Wright and Sons, and some other high-class firms. But first the new British Iron Company, of Corngreaves, near Dudley, and then Messrs. John Bradley and Company, of Stourbridge Ironworks, announced by circular to their customers that they had not made any alteration in their prices, which would remain the same as last quarter. Messrs. Barrows intimate that some of the firms who have reduced their prices are "only now doing openly what they have done throughout the past quarter, otherwise the average net selling price recently declared would have been higher." In their personal intercourse to-day with their customers, these two firms held to their prices quoted three months ago. They were, therefore, ahead of the market by 10s.

Buyers generally declined to operate to-day, reserving their transactions till to-morrow in Birmingham. But there did not appear to be many orders held, whether by merchants or by consumers.

The market was, however, steadied on the basis of £7 for bars by the action of the Lilleshall Company and the Madeley Wood Company. Each of these reduced their quotations for pig iron 5s. per ton. The reduction brought Shropshire cold blast down to £4, and hot blast to £3. The quotations of £4 5s. and £3 5s. had prevailed for six months, the Shropshire prices having gradually dropped to that figure by the Michaelmas quarterly meetings last year, when those figures were fixed in the usual course.

By the declaration of £7 as the crucial quotation for marked bars, it is pointed out that prices have touched the lowest point that they have reached for nearly thirteen years past. The last time prices were fixed at this figure was in April, 1868, when the price was reduced from £7 10s., at which it was fixed in January, 1867. The subsequent variations have been as here:—November, 1869, £8; September, 1871, £8 10s.; and the next month £9. There had now begun those striking advances which have made the year 1872 remarkable in the history of the iron trade of Great Britain. Throughout that twelvemonth there were no fewer than eight distinct changes in the ruling quotations upon the Wolverhampton and Birmingham Exchanges. January opened with a rise of £2, making bars £11. In February £1 more was put on; in April 10s., in May 10s. more, in June £1, in July £2, bringing the quotation for marked Staffordshire bars to £16. The upward movement had now spent itself. The £2 which was put on in July was taken off in September, and a further £2 in November. Thus the year which had opened at £11 closed at £12. But the excitement reappeared with 1873. In January £13 was declared to be the price for the bars in question; in February it was £14; in March it had once again shot up to the fatal maximum of £16; and in July it had dropped to £14. In 1874, February saw bars down to £12, and in July £11 had to be taken. Throughout the nine months of 1875, beginning with April, £10 ruled. The next year commenced with £9, and that figure ruled till September of the year following, when £8 10s. was proclaimed. That price had a reign of twelve months, for in September, 1878, £7 10s. was declared. It was not till November, 1879, that any reaction began. In that month the price advanced to £8, and next month to £9. By May last year £8 had reappeared, and in October, after Messrs. P. Williams and Sons, and Messrs. Millington, had been selling for some weeks at £7 10s., that price was declared by the rest of the leading houses. And at £7 10s. prices have remained till, with this month, they have been brought back to the quotation of April, 1868. As many as twenty-six changes are here indicated. Thus the average life of alterations in the thirteen years has been six months. Most other kinds have fluctuated with bars.

Sheets mostly of the sort used by the galvanisers attained a striking position in 1873, when singles of the quality which were to-day to be had easily at £7 5s. were quoted at as high as £22. To-day galvanising sheets were more in demand than they were last week, for on Tuesday the Australian mail brought better orders than for two or three months past for corrugated sheets galvanised. Agents' reports showed that there had been active sales throughout the month in Melbourne, It was notified that fully 2000 tons of "Sun" and of "three-crowns" had been sold, and that 350 cases of "stock" brand in stock, and to arrive, had been taken up at full prices. These were £20 10s. for 26 w.g. ordinary brands, and £21 10s. to £22 for best brands.

On 'Change in Birmingham this afternoon some Staffordshire all-mine pig makers quoted 2s. 6d. more than the Shropshire houses, namely, £3 2s. 6d. But the market refused to believe in makers' ability to maintain this course, and their sales at such a price were consequently very small. The firmness of hematites was remarkable. Tredegar sorts were 67s. 6d.; Barrow, 70s.; and Carnforth forge were quoted 72s. 6d.; best sheet makers announced that their prices would remain unaltered. Tin-plates were 1s. 3d. per box, firmer, making Staffordshire cokes 18s.

Excepting for corrugated roofing sheets, the Australian mail of this week has not been of conspicuous value. There were again but few orders for drawn fencing wire, which had sold at £12, £12 10s., and £13 for Nos. 6, 7, and 8 respectively. Bar and rod iron had realised from £8 10s. to £11. Hoop iron was offering at from £10 10s. to £11.

The week's West Indian mail was quite of average worth, the demand again appearing best for galvanised roofing sheets. The Brazilian mail this week has proved of most value to the edge-tool firms.

Government orders, always acceptable in times of dull trade generally, are especially so now, and some firms in South Staffordshire are trying to have that district included in the area from which tenders are sought for supplies to what is technically known as the Government "tool shed." Hitherto tenders have been asked only from the Sheffield district.

An Admiralty contract for heavy wrought iron hinges has this week been distributed between Wolverhampton and Tipton and Lancashire.

Messrs. John Rigby and Sons, axle and spring and coach ironwork manufacturers, of Britannia and New Britannia Works, Wednesbury, have at the Melbourne Exhibition gained a first award for their exhibit of axles, springs, and general coach ironmongery.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—There is no indication whatever of any improvement in the iron trade of this district, and this week the quarterly meetings, together with the Easter holidays, have tended to still further restrict what little business might otherwise have been offering. Scarcely a single inquiry of any importance has been reported in the market, and, beyond the general statement that iron all round is easier, it is only possible to arrive at an approximate estimate of values, as there have been really no transactions to afford any reliable basis for quotations. A few very small parcels are bought here and there to cover hand-to-mouth requirements, and these represent the bulk of the business at present being done. For long deferred deliveries, such as over the last six months of the year, at the very lowest prices which can be named, there are some buyers in the market, but makers naturally are not anxious to commit themselves to long forward engagements at prices which, under no circumstances, can leave them any margin for profit.

Lancashire makers of pig iron still quote 45s. for No. 4 forge, and 46s. for No. 3 foundry, less 2½ per cent., delivered equal to Manchester; but as these quotations, as I pointed out last week, are open to offers, they are purely nominal, and an early reduction of the list rates is more than probable.

Outside brands of pig iron are very irregular in price, makers who are not in pressing want of orders quoting several shillings per ton above what needy sellers are willing to take, and in the present state of the market no fixed prices can be given.

There is very little new business stirring amongst finished iron makers, and prices are this week decidedly easier. Although the reductions which have been announced during the last few days in marked brands have already been fully discounted in the common irons, they are taken advantage of by buyers as a lever to secure further concessions. Common bars delivered into the Manchester district are now being offered at £5 12s. 6d. to £5 15s. per ton, common hoops at £6 5s. to £6 7s. 6d., common plates at about £7, and common sheets at £7 5s. to £7 10s. per ton.

The coal trade generally continues dull, and although the recent cold weather has kept a tolerably good demand for the better class of round coal, there is an easier tone in all descriptions of round coal, common classes for manufacturing purposes being a drug in the market and very low in price. Burgy also is abundant, but good slack is in fair demand and firm in price. Short time is being worked at many of the collieries, especially those only raising inferior coals, and for quantities colliery proprietor, as a rule, are willing to make concessions upon late rates. Best coals are still quoted at from 9s. to 9s. 6d. per ton at the pit, but seconds can be bought at from 7s. to 7s. 6d., and common round coals at from 5s. 3d. to 5s. 6d. per ton. Burgy ranges from 4s. 3d. to 4s. 6d. for common sorts, up to 5s. for the best, and slack from 3s. 3d. and 3s. 6d. for common, up to 4s. 6d. for the better qualities at the pit mouth.

Cotton machinists in this district are in most cases only very moderately supplied with work, but there are some fair inquiries from the Continent and from America, which, if they develope into actual orders, will tend to improve matters considerably. At present, however, there is no prospect of any large orders being given out on home accounts. Whilst referring to this particular branch of trade, I may mention that ring-spinning, of which so much was said about eighteen months or two years ago, is at present dropping out of favour, so far as Lancashire is concerned. In America, where finer cotton is used, ring-spinning continues much in vogue, but it has not been found so adaptable here, and there are very few orders being given out by Lancashire manufacturers for ring-spinning machinery.

Barrow.—The aspect of affairs in the hematite pig iron trade varies very little from my report of last week. The producers here are receiving a very fair amount of orders, not only from America, from which place the largest amount of inquiries are being made, but from home and continental consumers. From the best authorities I am assured a little disappointment is felt at the continued low prices. In one or two cases makers are not over anxious to book long contracts at the present rates, though less disposition is shown to hold out for higher prices than was the case a short time since. The output at the furnaces is not in any way diminished, and, although very large deliveries are being made both at home and abroad, stocks are accumulating. This, I expect, is one reason why producers are less inclined to stand out till higher rates are likely to be realised. With the shipping season fairly open, stocks of iron will largely decrease, as much of that which is now being stocked is ordered for delivery; but owing to the very severe winter, ports are scarcely open yet. Iron is changing hands at from 64s. to 65s., but some little business has been done at much lower figures than these. In the steel trade the activity which has characterised this branch of industry for some time still continues. The inquiries which are being made point to an increased briskness in this department. Iron shipbuilders are still actively employed. Iron ore is at from 13s. to 14s. 6d. per ton, and in good demand. Shipping fairly employed.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

In the coal trade I hear complaints made on all hands. The demand from the London and other markets for house coal has considerably moderated, and there are prospects of an early reduction in price as the weather gets more summer-like. A very limited tonnage is being sent to Hull and Grimsby. Locomotive and gas coal continue to be fairly supplied on account of existing contracts. The coke trade is active, though the demand for manufacturing fuel is only languid. In the Erewash Valley affairs are pretty much the same.

The iron trade in the whole South Yorkshire district is very quiet in almost all branches. At the Elsecar Works two blast furnaces have been damped down, and the men engaged at other two have received a month's notice. In the Erewash Valley the output of pig iron is reported to be very heavy, but scarcely anything is doing in the finished iron trade. The imports of ironstone from Northamptonshire are well kept up.

I hear that the Admiralty contract for files has been given out. It has fallen this year to Messrs. Sanderson Brothers and Co., Limited, and Messrs. Howell and Co., Brook Steel Works, Brook-lane. The quantity is 8000 dozens.

Messrs. Charles Cammell and Co., Limited, are at present engaged on composite armour-plates, of the "Wilson" type, for the French Government's new war-ship, the Indomtable, which is now being constructed at Cherbourg. The plates are 14in. thick.

At several of our district collieries and works the electric light is being brought into use. It has been used at the Nunnery Colliery for some time for screening coal, and now Messrs. Wilson, Cammell, and Co., Limited, Dronfield Steel Works, have it in operation on their premises.

Addressing 150 colliery officials at Sheffield, on Saturday evening, Professor Arnold Lupton, M.I.C.E., said the Mines Regulation Act of 1872 had well stood the test of time. It had caused no extra expense in the working of collieries, because all the rules in force under this Act which caused any appreciable expense were already in force at the best-managed collieries in Yorkshire and elsewhere before the Act was passed. The cost of coal mining was greater now than formerly, because the pits were deeper and a greater weight of superincumbent strata caused greater expense in maintaining the underground roads. The deep pits, too, had more firedamp now as a rule. He anticipated that great good would result from the Employers' Liability Act, which would tend to promote the safety, and, indirectly, the economy of mines. Many colliery explosions, he said, were due to the fine coal dust which would explode, particularly if there was a small percentage of inflammable gas in the air; the amount of gas, of course, might be too small to cause a serious explosion unless aided by the dust. Professor Lupton estimates the tonnage of coal annually raised in the world at 320,000,000 tons.

At one large establishment this week I was told that steel rails were making £6 5s. per ton at the works; but this, I have reason to know, is a price considerably above the average at which orders are at present being executed.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

The iron market has lacked animation this week, and the prospects of the trade are not nearly so cheering as it was expected they would become by the middle of April. Accounts as to the state of trade in America, Canada, and on the Continent, agree in representing the inquiry as very slow. Freights for pig iron from the Clyde are exceedingly moderate, and there is every inducement to attract purchasers, but so far the demand continues unsatisfactory. It is estimated that since Christmas stocks in the public stores and in makers' yards together have accumulated by about 117,000 tons, while the shipments exhibit a falling off to the large extent of about 90,000 tons as compared with the same period of 1880. It is noticeable, however, that they are just about the same as in 1879, and considerably larger than in the first three months of the preceding year. These years were slack ones in the trade, and it was anticipated that by this time the volume of the trade would be much greater. There is still some probability that a favourable change may manifest itself in the course of the next few weeks. The same number of furnaces continues in blast, viz., 121, as against 114 last year, and the weekly addition to the stocks in Messrs. Connal and Co.'s stores is between 3000 and 4000 tons. In the course of the past week nearly 6000 tons of iron ore from Spain were landed at Glasgow Harbour.

The warrant market has been backward during the week. Business was done on Friday morning at from 48s. 6d. to 48s. 6½d. cash and 48s. 6d. one month, the afternoon quotations being 48s. 5½d. to 48s. 4d. cash and 48s. 6½d. to 48s. 5d. one month. On Monday the market was flat at 48s. 3d. cash and 48s. one month to 47s. 11d. cash. Business was done on Tuesday from 47s. 10d. to 47s. 8d. cash, and 47s. 9d. one month. To-day—Wednesday—the market was very flat, with business at 47s. 8d. fourteen days, to 47s. 3d. cash, and 47s. 6d. one month.

Makers' prices do not show much alteration. G.m.b. f.o.b. at Glasgow, No. 1 is quoted at 59s. 6d. per ton; No. 3, 47s. 6d.; Gartsherrie, 58s. and 50s. 6d.; Coltness, 58s. 6d. and 50s. 6d.; Langloan, 58s. 6d. and 50s.; Summerlee, 57s. 6d. and 50s.; Calder, 58s. and 50s.; Carnbroe, 55s. and 49s. 6d.; Clyde, Monkland, Quarter, and Govan, each 49s. 6d. and 47s. 6d.; Glengarnock at Ardrossan, 55s. and 50s. 6d.; Eglinton and Dalmellington, 49s. 6d. and 47s. 6d. each; Shotts, at Leith, 59s. and 51s. 6d.; Carron, at Grangemouth, 52s. 6d.—specially selected, 56s.—and 51s. 6d.; Kinneil, at Bo'ness, 50s. and 48s. 6d.

There is a fair amount of employment at the malleable works, there being still a brisk demand for all sorts of iron used in shipbuilding. The past week's shipments of iron manufactures from the Clyde embraced £10,810 worth of sewing machines, of which £3635 were despatched to Alicante, £3600 to Santander, £2815 to Mediterranean ports, and £760 to Antwerp; £21,800 worth of railway wagons, sleepers, chairs, &c., to Calcutta; £3537 pipes to Alicante, and £1322 to the Mediterranean; £4000 other articles, of which £1200 went to the Mediterranean, £970 to Trinidad, £750 to Rangoon, and £555 to New York.

The committee of shareholders of the Monkland Iron and Coal Company, Limited, appointed at the last meeting to confer with the directors as to the financial position of the company, have prepared a report, in which they attribute its straitened circumstances chiefly to the miners' strike of last year. Present pressing obligations amount to about £25,000. Floating stocks require to be greatly reduced. The debenture account of the company is in a very unsatisfactory state, as out of a total issue to the public of £84,414, £52,000 stands at call, while £14,586 is held by the directors in security of a cash credit obtained from the Union Bank on their personal obligations. The committee considers that this is a position in which the company cannot be with safety allowed to remain. It has besides borrowed £9000 on security of its rolling stock, which it is desired should be paid off. The works as a going concern have been valued at £317,964, and the stores at £80,000. The committee are satisfied that with sufficient capital the concern can be worked at a profit, even in times of low prices, and they therefore propose to improve its financial position by floating a new company, to be called the Monkland Debenture Company, Limited, with a capital of £200,000 in 40,000 shares of £5 each. The directors concur in this proposal, and they and the members of the committe have taken upwards of 4000 shares.

There is a fair trade doing in coals with the West of Scotland, and the shipments from Glasgow in the course of the past week have been considerably above the average. Competition for both inland and foreign orders is very keen, and prices are about the same as those of last week. The gas coal contracts are now coming forward. In the eastern mining counties the trade does not improve as was to have been expected after the opening of the continental navigation. Shipments are on a very small scale, and prices so low that a reduction of miners' wages is anticipated unless a change for the better should ensue.

Messrs. Robert Napier and Sons have agreed to give their joiners an advance of 7½ per cent.; but it is doubtful whether the example will be followed by the other shipbuilders.

The coppersmiths of Greenock have solicited an increase of ½d. per hour, their present rate of pay being 7d.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

The statment made in my letter last week that an acre a day of coal is being cut and sent away from the Ocean Collieries alone, has caused a wide-spread sensation, and has been reproduced in the chief daily newspapers of South Wales, accompanied by a strong request that coalowners should unite in not giving the coal riches of Wales away for a song. I am sorry, however, to add that I believe there is nothing can prevent, such is the condition of things, small collieries, needy circumstances, little capital, and the old result. Buyers by operating on the needy ones get the market down.

The March totals of iron, coal, coke, and fuel exports are just issued, and show a very gratifying advance.

Great complaints reach me of the state of trade at some of the house coal collieries in Monmouthshire. Two collieries have been stopped, and a turn or two turns a week have been the most at others. It is fortunate for the house coal colliers of the places stopped that Harris Deep Navigation is being steadily opened out, and requires more hands.

The Briton Ferry Coal and Pottery Company has been launched, with a capital of £10,000 in £10 shares. One of the objects of this company is to take over the Tor-y-Mynydd Colliery, Baglan.

There was a statement current in the locality last week that the manufacture of steel would shortly be commenced at Cyfarthfa. This, I think, is rather premature. Mr. Crawshay is now busily engaged in developing the valuable coal seams of the Castle pit. This can be worked nearer to the boundary of Merthyr Vale than can be done by Messrs. Nixon, Taylor and Cory, on account of the water, and the coal from the deep is of the purest character of the four-feet. By this I mean that the coal has just that quality ranging between the anthracite and bituminous, which makes it especially valuable. Plymouth has a certain acreage unworked of the same character.

Tin-plate is exhibiting a slightly improved state as regards quantity, and prices are beginning to look up.

An improved American demand within the last few days has made steel rails firmer.

The appointment of workmen's representatives on the sliding scale has been deferred for a month.

The annual meeting of the Miners' Permanent Fund Committee has been held, and the report of Mr. Campbell, secretary, was held as encouraging considering the circumstances. The fund is now beginning to make headway, and there are few pits without having some of the men enrolled. The growth is evidently to be of the slow and sure character.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

5th April, 1881.

1471. Compressing, &c., G. Gilders, Stratford-by-Bow.
1472. Steering Gear, G. W. Robertson, Glasgow.
1473. Pipes, &c., G. B. Jerram, Walthamstow.
1474. Telegraphic Conductors, J. C. Mewburn.—(*J. Bourdin and General S. Ivanowitch de Maltzoff, Paris.*)
1475. Window Blinds, W. H. Dandy, Great Driffield.
1476. Designs, &c., R. H. Brandon.—(*I. S. Hyatt, U.S.*)
1477. Imitation Ivory, R. Brandon.—(*I. S. Hyatt, U.S.*)
1478. Washing Fabrics, W. Mather, Manchester.
1479. Wire Healds, H. B. Barlow, Manchester.
1480. Moulds, R. H. Brandon.—(*I. S. Hyatt, U.S.*)
1481. Raising Objects, G. Behrns & G. Unruh, Lübeck.
1482. Subaqueous Boring, T. English, Dartford.
1483. Cocks, &c., J. Ingleby.—(*R. Meyer, Breslau.*)
1484. Expanding Fire-screen, C. Haarburger, London.
1485. Preventing Escape of Steam, &c., G. Tall and J. Daddy, Kingston-upon-Hull.
1486. Chairs, C. H. Chadburn, Liverpool.
1487. Colouring Matters, E. G. Thomas, Brentford.
1488. Machine Guns, T. Nordenfelt, London.
1489. Flour, &c., A. Crabtree and J. Jackson, Bolton.
1490. Fibrous Materials, W. R. Lake.—(*Messrs. Corral, Tejado and Corbera, Madrid.*)
1491. Dyeing, C. Smith, S. Milne, & J. Binns, Bradford.
1492. Looms, H. A. Foster, Queensbury.
1493. Boot Fastenings, I. A. Wells, Syston.

6th April, 1881.

1494. Steam Valves, &c., J. Gresham, Salford.
1495. Sheep Shears, J. Reaney, Sheffield.
1496. Marine Engines, T. Mudd, Hartlepool.
1497. Varnishing, &c., W. and S. Rawcliffe, Liverpool.
1498. Cabinets, &c., R. Kerr, Paisley.
1499. Tobacco, J. Hopkinson, Manchester, and F. Wills, Bristol.
1500. Tramway Rails, E. Frére, Antwerp.
1501. Skates, R. H. Bishop and H. F. Hailes, London.
1502. Warps, &c., G. C. Taylor, Huddersfield.
1503. Cupola Furnaces, H. A. Dufrene, London.
1504. Splitting Wood, J. Hardinge, London.
1505. Parasols, &c., W. P. Lane, London.
1506. Pencils, W. R. Lake.—(*B. A. Fiske, Illinois, U.S.*)
1507. Cooking Apparatus, J. Hall, London.
1508. Raising Ladies Dresses, J. Heurman, London.
1509. Water Heaters, H. Schofield, Stannington.
1510. Heels and Soles, F. Hocking, London.
1511. Receptacles, &c., J. Heaps, Manchester.
1512. Spectacles, W. R. Lake.—(*R. A. Carter, U.S.*)
1513. Vessels, &c., J. Taylor, London.
1514. Steering Apparatus, F. W. Willcox, Sunderland.
1515. Wrappers, &c., C. H. Dibb, Hull.

7th April, 1881.

1516. Spindles, &c., R. H. B. Thompson, Hollinwood.
1517. Supporting Apparatus, E. Edwards, London.
1518. Gas Valves, G. Waller, Southwark.
1519. Cravats, J. Hinks, T. Hooper, and F. Baker, Birmingham.
1520. Decorating, R. Applegarth.—(*E. Lheureux, Paris.*)
1521. Shuttles, J. Lomax & R. Dawson, Over Darwen.
1522. Soles, W. Lake.—(*D. C. Knowlton, Boston, U.S.*)
1523. Valve Gear, J. McFarlane and T. T. Lumsden, Edinburgh.
1524. Pickers, M. Holt, Todmorden.
1525. Fastenings, W. R. Lake.—(*T. L. Jacobs, U.S.*)
1526. Electric Lamps, J. D. F. Andrews, London.
1527. Concentration, &c., J. Imray.—(*J. Buffet, Paris.*)
1528. Uniting Pipes, W. T. Sugg, London.
1529. Lines, A. Lawson.—(*J. Coulson, St. Petersburgh.*)
1530. Cement, J. C. J. Smith, Northfleet.
1531. Fire-arms, P. T. Godsal, 52nd Regiment Light Infantry.
1532. Edge Tools, W. Morgans, Bristol, and M. G. Morgans, Mells, Somerset.
1533. Brakes, W. R. Lake.—(*E. Schrabetz, Vienna.*)
1534. Money Tills, F. Hawkins, near Stratford.
1535. Shoes for Horses, J. P. Rothwell, of Lytham.

8th April, 1881.

1536. Electric Lighting, J. Dupont-Auberville, Paris.—(*V. Delaye, Paris.*)
1537. Locks, H. J. Haddan.—(*G. Hathaway and B. Taylor, U.S.*)
1538. Paper, H. Haddan.—(*J. Hutinet & P. Lamy, Paris.*)
1539. Brakes, &c., W. L. Jackson, Manchester.
1540. Railway Points, H. Whitehead, Bucknall, and T. Dodd, Winsford.
1541. Gas Engines, L. Bénier, Rue dela Fidélité, Paris.
1542. Roving, &c., B. Hunt.—(*J. Pollitt, U.S.*)
1543. Electric Lamps, St. G. L. Fox, London.
1544. Drying Machine, J. Walter.—(*Messrs. F. C. da Cunha and Company, Rio Janeiro.*)
1545. Moistening Air, J. Mewburn.—(*A. J. Desmarest, P. Cosnard, E. and P. Sée, Lille, France.*)
1546. Menstrual Apparatus, E. Grœbert, Peckham.
1547. Butter, E. Brewer.—(*L. Q. Brin, Paris.*)
1548. Sewing Machines, J. W. Ramsden, Leeds.
1549. Woven Fabrics, J. Worrall, Ordsall, Salford.

9th April, 1881.

1550. Magnetic Needles, J. S. Gisborne, Manchester.
1551. Speed Indicators, W. Stroudley, Brighton.
1552. Scraping Ships' Bottoms, J. Westberg, Finland.
1553. Saw Bench, J. Grills, Saint Dominic.
1554. Printing Presses, A. Godfrey, London.
1555. Bituminous Substances, J. G. Tongue.—(*H. Randhahn, Waldau, Prussia.*)
1556. Brakes, W. H. Wise, West Hartlepool.
1557. Winding Apparatus, J. L. Lee, Wakefield.
1558. Couplings, &c., J. O. O'Brien, Liverpool.
1559. Supports, &c., A. Pumphrey, Birmingham.
1560. Distributing Apparatus, W. Wells, Earlswood.
1561. Road Gutters, W. & J. Lawley, West Bromwich.
1562. Soap, H. H. Lake.—(*B. Taffé and Darmstaedter, Charlottenburg, Germany.*)

11th April, 1881.

1563. Velocipedes, J. C. Garrood, Fakenham.
1564. Treating Sewage, R. Wild, Littleborough, and H. Ledger, Leek.
1565. Pipes, J. Trieb.—(*S. Notton, St. Claude, France.*)
1566. Clips, H. J. Allison.—(*J. Celier, Nevers, France.*)
1567. Regulating, &c., T. B. Lightfoot, Dartford.
1568. Beverages, G. W. Kincaid, London.
1569. Shifting Boards, M. Dring and J. Pattison, West Hartlepool.
1570. Sanitary Appliances, R. Pease and T. Lupton, Bradford.
1571. Carding Engines, W. H. Oates, W. Jameson, and B. Leonard, Blackburn.
1572. Combs, &c., W. Brierley.—(*J. Courtis, Vienna.*)
1573. Slipping Contrivance, B. J. Grimes, London.
1574. Medicinal Compound, E. Harris, London.
1575. Brakes, G. W. von Nawrocki.—(*G. H. Lippmann, Zwickau, Saxony.*)
1576. Slide Bolt, W. Gedge.—(*J. Francois, Lyons.*)
1577. Electric Telegraphs, J. Hopkinson and A. Muirhead, London.
1578. Feeding Wool, J. & A. Leadbeater, Morley.
1579. Churns, W. H. and T. Atkinson, Halifax.
1580. Wetting Envelopes, F. H. F. Engel. — (*B. Amsberg, Hamburg.*)
1581. Thrashing Machines, R. Crud, Cloyne.
1582. Swifts, &c., W. Graham, Monk Bretton.

Inventions Protected for Six Months on deposit of Complete Specifications.

1460. Rakes, &c., G. E. Vaughan, Chancery-lane, London.—A communication from the Johnson Harvester Company, Brockport, U.S.—*2nd April*, 1881.
1464. Preserving Apparatus, H. A. Bonneville, Cannon-street, London.—Com. from A. Robert, Rue St. Honore, Paris.—*4th April*, 1881.
1469. Mining Machines, H. H. Doubleday, Washington, U.S.—Com. from F. M. Lechner, Waynesbury, U.S.—*4th April*, 1881.
1476. Designs, &c., R. H. Brandon, Rue Laffitte, Paris.—Com. from I. S. Hyatt, U.S.—*5th April*, 1881.
1477. Imitation Ivory, R. H. Brandon, Rue Laffitte, Paris.- Com. from I. S. Hyatt, U.S.—*5th April*, 1881.
1480. Moulds, &c., R. H. Brandon, Rue Laffitte, Paris.—Com. from I. S. Hyatt, U.S.—*5th April*, 1881.
1506. Pencils, W. R. Lake, Southampton-buildings, London.—A communication from B. A. Fiske, Naperville, Illinois, U.S.—*6th April*, 1881.
1512. Spectacles, &c., W. R. Lake, Southampton-buildings, London.—A communication from R. A. Carter, New York, U.S.—*6th April*, 1881.
1537. Locks and Staples, H. J. Haddan, Strand, Westminster.—A communication from G. M. Hathaway and B. S. Taylor, Jersey, U.S.—*8th April*, 1881.

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

1368. Tank for Smelting Glass, T. Kilner, Thornhill, Lees, near Dewsbury.—*6th April*, 1878.
1389. Looms, J. Ainsworth, Preston.—*8th April*, 1878.
1581. Bedsteads, T. Allen, Bristol, and J. Martin, Islington, London.—*18th April*, 1878.
1352. Coiled Tubes for Ordnance, E. Palliser, Charleville-road, London.—*5th April*, 1878.
1375. Signalling, T. T. Powell, Harrogate.—*6th April*, 1878.
1376. Metallic Pipes or Tubes, E. Quadling, Cannon-street, London.—*6th April*, 1878.
1457. Corn and Seed Drills, &c., J. J. Smyth, Peasenhall.—*11th April*, 1878.
1606. Effecting the Movement of Rudders, &c., H. Wadsworth, Geneseo.—*20th April*, 1878.
1736. Wagons, T. R. Hutton, Barrow-in-Furness.—*30th April*, 1878.
1406. Distilling Alcoholic Spirits, D. Walker, Liverpool.—*9th April*, 1878.
1473. Watches, W. R. Lake, Southampton-buildings, London.—*12th April*, 1878.
1388. Furnaces, G. Sinclair, Ecith.—*8th April*, 1878.
1393. Converting Reel Blades into Rake Blades, &c., W. M. Cranston, London.—*8th April*, 1878.
1532. Gloves, T. Foster, Streatham.—*17th April*, 1878.
1556. Opening the Supply of Gas to Burners, &c., H. Green, Preston.—*17th April*, 1878.
1423. Glazing or Fixing Glass, &c., T. W. Helliwell, Brighouse.—*10th April*, 1878.
1432. Couplings, &c., N. Macbeth, Bolton.—*10th April*, 1878.
1422. Shearing Metals, J. McLachlan, Sheffield.—*10th April*, 1878.
1449. Looms, W. H. Hacking, Bury.—*11th April*, 1878.
1504. Determining Organic Matters Contained in Solutions, J. A. Wanklyn and W. J. Cooper, Westminster.—*15th April*, 1878.
1582. Adjustable Spanners, &c., J. E. Rogers, Smethwick.—*18th April*, 1878.
1806. Forming and Fixing Studs, &c., F. D. H. Dowler and F. Dowler, jun., Aston.—*6th May*, 1878.

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

1205. Breech-loading Fire-arms, J. Needham, Piccadilly, London.—*7th April*, 1874.
1238. Pressing Bricks, J. Gill, Hunslet, near Leeds.—*9th April*, 1874.
1291. Leather-dressing Machines, W. Morgan-Brown, Southampton-buildings, London.—*15th April*, 1874.
1484. Softening, &c., Steel Wire, S. Fox, Deepcar, near Sheffield.—*28th April*, 1874.
1485. Manufacture of Wire, S. Fox, Deepcar, near Sheffield.—*28th April*, 1874.
1268. Stop Motion Winding Doubling Frames, T. Unsworth, Manchester.—*13th April*, 1874.

Notices of Intention to Proceed with Applications.

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

5016. Waxed Threads, J. C. Mewburn, London.—A com. from E. Guillemaud.—*2nd December*, 1880.
5032. Colour Printing, W. G. White and R. A. A. White, London.—*3rd December*, 1880.
5034. Steamships, J. S. White, East Cowes, Isle of Wight.—*3rd December*, 1880.
5040. Gas Regulators, H. Devine, Manchester.—*3rd December*, 1880.
5045. Iron Wire, H. E. Newton, London.—A com. from E. Minary.—*3rd December*, 1880.
5054. Dividing the Card-covered Surfaces of the Drums of Carding Machines, P. Pingard, France.—*4th December*, 1880.
5055. Syphons, J. Delord, Nimes, France.—*4th December*, 1880.
5064. Regulating Flow of Gas, T. Thorp, Whitefield, and R. Tasker, Prestwich.—*4th December*, 1880.
5070. Looms, D. Sykes, P. Pontefract, and J. A. Greenwood, Digley Mills.—*6th December*, 1880.
5076. Tooth-gearing, H. J. Haddan, Strand.—A com. from Delcey-Petit.—*6th December*, 1880.
5085. Sorting, &c., Seed, H. H. Lake, London.—A com. from W. A. Stone.—*6th December*, 1880.
5118. Working Hobby-horses, &c., A. Waddington, Bradford.—*8th December*, 1880.
5135. Retaining the Bottoms of Trousers, &c., A. M. Clark, London.—A com. from F. de Sandoval.—*8th December*, 1880.
5161. Bottles, E. Breffit, Castleford.—*10th December*, 1880.
5241. Brushes, J. Worrall and J. Lawrence, Ordsall, and J. Lea, Eccles.—*14th December*, 1880.
5242. Weighing, &c., Machines, W. H. Baxter, Brixton-hill, Surrey.—*14th December*, 1880.
5244. Stoppering Bottles, &c., H. Smith, Holland-street, Surrey.—*14th December*, 1880.
5294. Wheels for Transmitting Motion to Velocipede Gearing, &c., J. Radges, Warwick.—*17th December*, 1880.
5304. Sewing Machines, W. L. Bigelow, London.—A com. from J. Bigelow.—*17th December*, 1880.
5370. Disengaging Hood, &c., J. Brown, Water-street, Liverpool.—*22nd December*, 1880.
5384. Machine Guns, W. Gardner, Southampton-buildings, London.—*22nd December*, 1880.
5472. Glazing, C. F. Elliott, Liverpool.—*29th December*, 1880.
153. Electric Lamps, A. Muirhead and J. Hopkinson, Westminster.—*12th January*, 1881.
290. Smelting Zinc, J. Binon and A. Grandfils, Membach, near Dublin.—*22nd January*, 1881.
292. Brushes, J. Worrall and J. Lawrence, Ordsall, Salford, and J. Lea, Eccles.—*22nd January*, 1881.
434. Railway Wheels, W. H. Kitson, Leeds.—*1st February*, 1881.
853. Lighting Railway Carriages, J. F. Shallis and T. C. J. Thomas, London..—*28th February*, 1881.
868. Vegetable Products, &c., H. Guiliani, London.—*1st March*, 1881.
1080. Floating Bridges, B. P. Stockman, Poet's-corner, Westminster.—*12th March*, 1881.
1083. Perforating Paper, H. H. Lake, London.—A com. from the Automatic Music Paper Company.—*12th March*, 1881.
1095. White-lead, H. J. B. Condy, Battersea, Surrey.—*14th March*, 1881.
1153. Stamping Letters, &c., H. Codd, King William-street, London.—*16th March*, 1881.
1211. Button-hole Sewing Machines, H. Mills, Birmingham.—A com. from D. Mills.—*19th March*, 1881.
1239. Flyers for Spinning, &c., D. Frazer, Newry.—*21st March*, 1881.
1275. Hoppers, &c., J. Redgate, Nottingham.—*23rd March* 1881.

Last day for filing opposition, 4th May, 1881.

5071. Light-preserving Composition, N. Chevalier, Porchester-terrace, London.—*6th December*, 1880.
5074. Miners' Safety Lamps, E. Robathan, Risca.—*6th December*, 1880.
5084. Rock-drilling Machine, J. McCulloch, Camborne.—*6th December*, 1880.
5095. Quilt or Bed-covering, W. Mitchell, Waterfoot.—*7th December*, 1880.
5099. Meters, W. Stead, Northallerton.—*7th December*, 1880.
5114. Support, &c., for Rails of Railways, H. A. Houllier, Rouen, France.—*8th December*, 1880.
5116. Water-meters, R. Schloesser, Manchester.—A communication from Messrs. Dreyer, Rosenkranz, and Droop, Hanover.—*8th December*, 1880.
5119. Skates, H. Bezer, St. John-street, Smithfield, London.—*8th December*, 1880.
5123. Baths, H. Jones, Adam-street, Strand, London.—*8th December*, 1880.
5130. Gas Motor Engines, J. Livesey, Westminster.—Com. from F. H. W. Livesey.—*8th December*, 1880.
5134. Producing Light and Heat, F. Wilkins, Southampton-buildings, London.—*8th December*, 1880.
5142. Bobbins, W. and J. Dixon, Steeton.—*9th December*, 1880.
5144. Non-intoxicating Compounds, T. H. Larmuth, Kennett-road, London.—*9th December*, 1880.
5150. Preparing Moulds for Casting, H. Gibbons, Hungerford.—*9th December*, 1880.
5166. Stands for Bottles, &c., J. E. Bingham, Sheffield.—*10th December*, 1880.
5171. Railway Vehicles, W. R. Lake, London.—Com. from J. W. Chisholm.—*10th December*, 1880.
5176. Turntable, J. P. Clarke, Abbey-hill, Bury St. Edmunds.—*10th December*, 1880.
5195. Smoke-consuming Grates, &c., H. S. Snell, London.—*11th December*, 1880.
5197. Dies for Shaping Metals, &c., J. T. Andrews, Handsworth.—*11th December*, 1880.
5201. Trough Water-closets, B. C. Cross, Dewsbury.—*11th December*, 1880.
5202. Stuffing-boxes, C. E. Hœger, Kolback, Sweden.—*13th December*, 1880.
5203. Wood and other Pulp, C. E. Hœger, High & Holborn, London.—*13th December*, 1880.
5211. Preparing, &c., Silk, J. C. Mewburn, London.—Com. from M. J. L. Aubenas.—*7th December*, 1880.
5245. Rectification of Alcohol, S. Pitt, Sutton.—A communication from Compagnie Industrielle des Procedés Roaul Pictet.—*14th December*, 1880.
5282. Preparing Vanilline, &c., G. de Laire, Rue St. Charles, Paris.—*16th December*, 1880.

Patents Sealed.

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

4122. Chambers in Ships, &c., S. H. Linn, Southampton-buildings, London.—*11th October*, 1880.
4124. Ventilating Sewers, &c., T. H. Mitchell, Waldegrave Park, London.—*11th October*, 1880.
4125. Covers for Cellar Openings, J. Mathewson and G. Tidey, London.—*11th October*, 1880.
4134. Signalling Apparatus, E. Guend, France.—*12th October*, 1880.
4140. Packing for Steam, Hydraulic, &c., Purposes, J. Briggs, Sunderland.—*12th October*, 1880.
4142. Pickers for Looms, H. Almond, Blackburn, and J. Holding, Manchester—*12th October*, 1880.
4144. Scutching Machines, A. J. Boult, High Holborn, London.—*12th October*, 1880.
4146. Pistons, A. J. Boult, High Holborn, London.—*12th October*, 1880.
4148. Supporting Spectacles, J. Betjemann, Pentonville-road, London.—*12th October*, 1880.
4149. Lamps, G. W. von Nawrocki, Leipziger-strasse, Berlin.—*12th October*, 1880.
4153. Regulating the Position of Doors, &c., R. W. Gossage, Creek-road, Deptford.—*13th October*, 1880.
4161. Printing Presses, W. R. Lake, Southampton-buildings, London.—*13th October*, 1880.
4164. Glazing Vertical, &c., Surfaces, W. H. Thompson and D. Thompson, Leeds.—*13th October*, 1880.
4165. Crushing, &c. Diamondiferous Conglomerates, W. Hartnell, Leeds—*13th October*, 1880.
4182. Furnaces, &c., J. Neil, Glasgow.—*14th October*, 1880.
4228. Treating Vulcanised Fibre, J. C. Leigh, Moorside-street, Droylesden.—*16th October*, 1880.
4254. Distributing Artificial Light, W. A. S. Benson, Kensington.—*19th October*, 1880.
4302. Locks for Fire-arms, M. Kaufmann, Wellington-street, Strand, London.—*21st October*, 1880.
4313. Sewing Machines, J. Warwick, Manchester.—*22nd October*, 1880.
4401. Wheels, A. C. Uljée and J. Cleminson, Westminster-chambers, Westminster.—*28th October*, 1880.
4407. Boilers, J. Humphrys, Barrow-in-Furness.—*28th October*, 1880.
4516. Transmitting Heat to Steam Boilers, W. L. Wise, Westminster.—*4th November*, 1880.
4586. Governing the Supply of Injection Water to

Jet Condensers, J. Griffiths, Water-street, Liverpool.—9th *November*, 1880.
4597. Silk Dressing Machinery, A. Greenwood, Leeds.—9th *November*, 1880.
4615. Cooling Brewer's Worts, H. H. W. Jaeckel-Handwerck, Grimma, near Leipzig.—10th *November*, 1880.
5138. Steam Engines, J. McCallum, Greenock.—9th *December*, 1880.
5184. Sweat Bands, H. A. Bonneville, Cannon-street, London.—11th *December*, 1880.
5285. Tricycles, J. Steele, Birmingham.—16th *December*, 1880.
5386. Meteorology, F. H. F. Engel, Hamburg.—22nd *December*, 1880.
5486. Cubes, &c., of Sugar, G. Jager, jun., Liverpool.—30th *December*, 1880.
35. Bicycles, &c., W. Woolley, Birmingham.—4th *January*, 1881.
100. Mill Gearing, N. Macbeth, Bolton.—8th *January*, 1881.
140. Alimentary Substaces, T. F. Wilkins, Lavender-road, Clapham Junction.—12th *January*, 1881.
181. Husking Rice, J. H. C. Martin, Church hill, Walthamstow.—14th *January*, 1881.
303. Machine Guns, W. Tranter, Birmingham.—22nd *January*, 1881.
376. Earthenware, S. C. Homersham, Buckingham-street, Adelphi, London.—27th *January*, 1881.
388. Rollers, W. R. Schürmann, Dusseldorf.—28th *January*, 1881.
676. Uniting Gun Barrels, R. H. Brandon, Rue Laffitte, Paris.—16th *February*, 1881.

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

4166. Dyeing, &c., Fabrics, M. Sella and F. Cerrutj, Henniker-road, Stratford.—13th *October*, 1880.
4171. Drawing Frames, W. A. Barlow, St. Paul's-churchyard, London.—13th *October*, 1880.
4190. Stoppering Bottles, S. Wilkes, Selly Oak, near Birmingham.—15th *October*, 1880.
4192. Lamps, &c., G. P. Harding, Jermyn-street, Piccadilly, London.—15th *October*, 1880.
4196. Heating Apparatus, W. Love, Glasgow.—15th *October*, 1880.
4198. Looms for Weaving, J. Hollingworth, Dobcross, and A. B. Crossley, Halifax.—15th *October*, 1880.
4202. Finishing Cashmere, &c., J., J. W. and J. Reffitt, Leeds.—15th *October*, 1880.
4209. Cutting Tobacco, S. P. Wilding, Rood-lane, Fenchurch-street, London.—15th *October*, 1880.
4210. Safety Fastener, H. A. Silver and W. Fletcher, Sun-court, Cornhill, London.—15th *October*, 1880.
4212. Cooking Apparatus, S. J. V. Day, Glasgow.—16th *October*, 1880.
4216. Turning over Leaves, &c., W. Rigg, Swaine-street, Bradford.—16th *October*, 1880.
4217. Cloth Oils, J. Swallow, Leeds.—16th *October*, 1880.
4219. Pianofortes, H. R. Schreiber, Neumeyer Hall, Hart-street, London.—16th *October*, 1880.
4222. Treating Coffee, E. G. Brewer, Chancery-lane, London.—16th *October*, 1880.
4224. Looms for Weaving, W. Thompson, Larkfield, Rawdon, near Leeds.—16th *October*, 1880.
4225. Umbrella Runners, &c., A. C. Wright and R. R. Newton, Birmingham.—16th *October*, 1880.
4237. Swing Looking Glasses, J. Whitfield and H. W. Atkins, Birmingham.—18th *October*, 1880.
4263. Envelopes, E. Hely, Dublin.—19th *October*, 1880.
4280. Securing Ships' Cables, T. Archer, jun., Dunston Engine Works, Dunston.—20th *October*, 1880.
4308. Incubators, A. M. Clark, Chancery-lane, London.—22nd *October*, 1880.
4330. Washing, &c., Machinery, T. Bradford, High Holborn, London.—23rd *October*, 1880.
4346. Glass, C. N. Blumberg, Cannon-street, London.—25th *October*, 1880.
4381. Cement, &c., W. Forsyth, Worcester.—27th *October*, 1880.
4383. Abdominal Belts, P. W. G. Nunn, Maplestead, Bournemouth.—27th *October*, 1880.
4416. Doubling, &c., Yarns, E. Whalley, Manchester, and J. H. Stott, Rochdale.—29th *October*, 1880.
4420. Weaving Reversible Fabrics, A. and C. H. Rothwell, Bury.—29th *October*, 1880.
4447. Velocipedes, T. F. Best, Birmingham.—30th *October*, 1880.
4449. Railway Buffer Stops, A. A. Langley, Kent-terrace, Clarence-gate, London.—30th *October*, 1880.
4498. Sewing Machines, R. Steel, C. H. Binns, A. Steinmetz, jun., C. A. Spring and W. A. Nichols, Philadelphia, U.S.—3rd *November*, 1880.
4628. Type Printing Telegraphs, F. H. W. Higgins, Farleigh-road, London.—10th *November*, 1880.
4823. Plaisters, A. H. Mason, Liverpool.—22nd *November*, 1880.
4901. Dyeing Woollen Yarns, J. H. Rogers, Stroud.—25th *November*, 1880.
4943. Explosive Compound, W. R. Lake, Southampton-buildings, London.—27th *November*, 1880.
5041. Spinning, &c., B. A. Dobson and R. C. Tonge, Bolton.—3rd *December*, 1880.
5296. Boiling Apparatus, C. D. Abel, Southampton-buildings, London.—17th *December*, 1880.
5350. Salt, &c., J. H. W. Biggs, Liverpool.—21st *December*, 1880.
5372. Salt, &c., J. H. W. Biggs, Liverpool.—22nd *December*, 1880.
5393. Cartridge Belt Fabrics, J. H. Johnson, Lincoln's-inn-fields, London.—23rd *December*, 1880.
241. Railways, &c., T. G. Hardie, Leeds, and T. Kendall, Shipley, near Leeds.—20th *January*, 1881.
380. Closing, &c., Doors, W. Leggott, Bradford.—28th *January*, 1881.
532. Gas Motor Engines, J. Fielding, Atlas Works, Gloucester.—8th *February*, 1881.
563. Filter-presses, H. E. Newton, Chancery-lane, London.—9th *February*, 1881.
567. Welding Tubes, A. and J. Stewart, and J. Wotherspoon, Coatbridge.—10th *February*, 1881.
613. Moulds, &c., J. Duncan, Mincing-lane, London, and B. E. R. Newlands, Clyde Wharf, Victoria Docks.—12th *February*, 1881.
653. Stoves, W. A. G. Schönheyder, Flora-terrace, Albion-road, London.—15th *February*, 1881.

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

324,* 4d.; 2755, 4d.; 2927, 6d.; 2981, 6d.; 3082, 4d.; 3169, 6d.; 3233, 4d.; 3234, 2d.; 3235, 2d.; 3242, 6d.; 3261, 8d.; 3270, 6d.; 3274, 2d.; 3285, 6d.; 3343, 6d.; 3351, 6d.; 3360, 8d.; 3374, 6d.; 3382, 6d.; 3387, 8d.; 3395, 6d.; 3402, 6d.; 3409, 8d.; 3422, 8d.; 3449, 6d.; 3451, 6d.; 3452, 6d.; 3464, 6d.; 3467, 6d.; 3473, 10d.; 3478, 6d.; 3479, 6d.; 3480, 6d.; 3491, 6d.; 3492, 6d.; 3504, 6d.; 3506, 6d.; 3507, 6d.; 3514, 6d.; 3515, 6d.; 3532, 8d.; 3533, 8d.; 3539, 8d.; 3541, 6d.; 3542, 6d.; 3544, 6d.; 3551, 6d.; 3555, 10d.; 3560, 4d.; 3563, 6d.; 3567, 6d.; 3570, 6d.; 3575, 6d.; 3576, 6d.; 3578, 6d.; 3588, 6d.; 3595, 6d.; 3597, 4d.; 3598, 6d.; 3602, 6d.; 3603, 6d.; 3604, 2d.; 3605, 6d.; 3607, 6d.; 3609, 2d.; 3611, 6d.; 3614, 2d.; 3615, 2d.; 3616, 4d.; 3617, 4d.; 3618, 2d.; 3620, 6d.; 3622, 6d.; 3624, 2d.; 3626, 6d.; 3630, 6d.; 3631, 2d.; 3633, 2d.; 3641, 6d.; 3642, 2d.; 3643, 2d.; 3644, 2d.; 3645, 2d.; 3650, 4d.; 3651, 2d.; 3654, 2d.; 3655, 2d.; 3656, 4d.; 3657, 2d.; 3661, 2d.; 3662, 2d.; 3663, 6d.; 3664, 4d.; 3668, 2d.; 3669, 2d.; 3670, 4d.; 3671, 2d.; 3673, 6d.; 3674, 2d.; 3675, 2d.; 3678, 2d.; 3680, 4d.; 3681, 2d.; 3687, 2d.; 3689, 4d.; 3693, 1s.; 3694, 2d.; 3696, 2d.; 3709, 6d.; 3710, 2d.; 3711, 2d.; 3714, 2d.; 3717, 2d.; 3719, 2d.; 3726, 2d.; 3728, 2d.; 3729, 2d.; 3731, 2d.; 3741, 6d.; 3745, 4d.; 3866, 6d.; 3873, 8d.; 3957, 6d.; 4492, 4d.; 4561, 6d.; 5447, 6d.; 36, 6d.; 39, 4d.; 75, 6d.; 119, 4d.

*** 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.*

2755. Excentric for Actuating Valves of Steam Engines, *E. Edwards.—Dated 6th July*, 1880.—(*A communication from S. Lopes.*)—(*Not proceeded with.*) 4*d.*

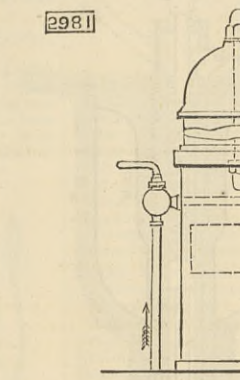
This relates to the form of the excentric, which is made up of four segments of a circle, and is placed in a rectangular frame, to which the valve rod is connected.

2927. Steaming Woven Fabrics, *F. W. Ashton.—Dated 15th July*, 1880. 6*d.*

The steaming chamber is of a circular or oval section of about 30ft. in height, and has at top a small opening, wide enough to admit the fabric. Level with opening, and extending to the opposite side of the chamber, are placed two bars formed of steam pipe, and joined together to form a frame, above which are other pipes, so as to form guides for rollers, which carry the fabric. Steam is circulated through these pipes to prevent condensation, the steam to act upon the fabric being admitted at the bottom of the chamber. The rolls of fabric are placed in a frame, and the ends all joined together and secured to a short blanket, one end of which is fastened to the pipes at the farther side of the chamber. The fabric passes through measuring rollers, so as to enable the quantity passed into the steam chamber to be ascertained.

2981. Apparatus for the Supply of Aerated Water, *D. J. Fleetwood.—Dated 20th July*, 1880. 6*d.*

This consists in applying to any ordinary machine used in the production of aerated water an apparatus for the purpose of regulating the pressure in the act of drawing, so as to allow of the aerated water being drawn off for use into the vessels without the necessity of bottling in the ordinary manner, and consists in attaching to the end of a delivery pipe leading from



the aerated water chamber of the machine a strong glass or other receiving chamber, which may be shut off from communication with the delivery pipe by means of a stop-cock or valve; in connection with this receiving chamber is another or extra chamber, which can also be shut off from the receiving chamber by a stop-cock or valve. A tap is attached to the receiving chamber to draw off the aerated water.

3082. Hair-clipping Apparatus, *W. R. Lake.—Dated 26th July*, 1880.—(*A communication from Les fils de Peugeot Frères.*)—(*Not proceeded with.*) 4*d.*

This relates to the construction of apparatus similar to that employed for clipping cattle for the purpose of cutting human hair, and consists principally in prolonging the comb of the lower plate at an angle that may be varied as desired.

3169. Brake Apparatus for Railway Vehicles, *H. H. Lake.—Dated 2nd August*, 1880.—(*A communication from V. Kramer.*) 6*d.*

This relates to continuous brakes for railway vehicles, that is to say, brakes worked by means of compressed air, and the improvements consist essentially in the use of a special construction of piston and a special arrangement of apparatus connected therewith. Fig. 1 represents an elevation of a locomotive with the apparatus applied; Fig. 2 is a longitudinal central section of the improved differential piston. The apparatus consists of two casings A and B of unequal size, connected by a middle piece C communicating with the atmosphere by a small hole or

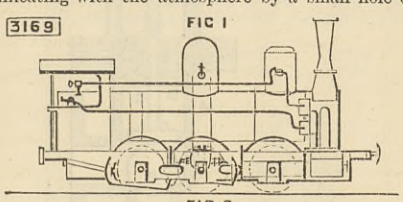
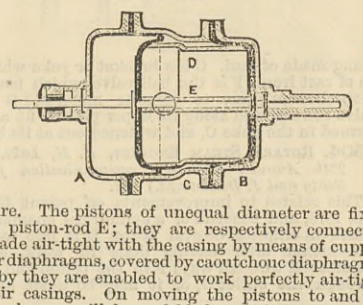


FIG. 2



aperture. The pistons of unequal diameter are fixed to the piston-rod E; they are respectively connected and made air-tight with the casing by means of cupped leather diaphragms, covered by caoutchouc diaphragms, whereby they are enabled to work perfectly air-tight in their casings. On moving the pistons to and fro one diaphragm will be unfolded and distended while the other is folded; they are thereby alternately made to bear against the sides of the casings A and B and against the surface of the pistons D respectively, and in so doing they form a circular fold which presents but a small annular area to the air pressure, so that the diaphragm, being subjected to a slight strain only, can withstand a very considerable air pressure.

3233. Flutes, *C. A. Drake.—Dated 7th August*, 1880. 4*d.*

This relates to a mode of improving the tone of the lower E natural, D sharp, D natural, and C sharp notes, by opening one or more additional holes to those now in use at the side or below the hole producing the note required.

3234. Compensating Apparatus for Working Railway Signals, *C. R. Sharpe.—Dated 7th August*, 1880.—(*Void.*) 2*d.*

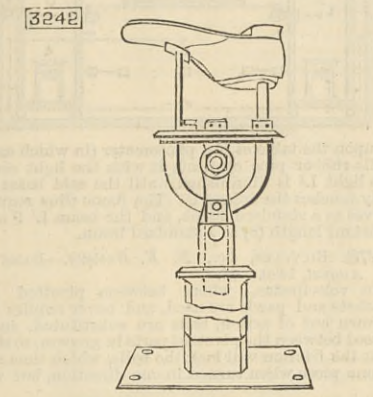
The wires or chains are connected to the pulley or lever on the signal post in the usual manner, but the opposite end is passed round one or more pulleys in the neighbourhood of the operating levers, the end being attached to a weight sufficient to maintain it at a constant tension.

3235. Interlocking Apparatus for Railway Points, &c., *C. R. Sharpe.—Dated 7th August*, 1880.—(*Void.*) 2*d.*

The interlocking frame has two sets of rocking shafts respectively arranged vertically and horizontally, each of the former having a crank at its upper end, while on the opposite side of the frame a similar crank is carried on a stud, the two cranks being connected by a horizontal bar moving across the top of the frame. Each horizontal bar has a projection on it against which the lever bears so as to carry the bar with it, and at the same time move the cranks until they carry the horizontal bars out of contact with the levers, when the lever can be drawn or pushed over to the opposite side of the framing. The vertical shafts have other cranks and connecting links coupling them at the requisite places with other cranks of the horizontal shafts, which are used to interlock by the projections on them entering recesses in the vertical shafts.

3242. Manufacture of Boots and Shoes, *E. Jefferys.—Dated 9th August*, 1880. 6*d.*

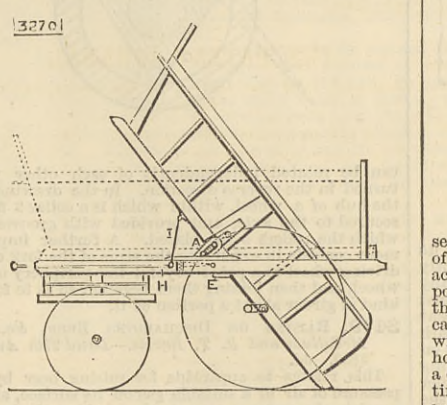
This relates to the method of constructing and arranging movable supports or standards in which boots or shoes are held whilst being made, in such manner that the position of the boot or shoe can be



readily and quickly altered as desired, so that every part of it is brought successively into the most convenient position to be operated upon by the workman.

3270. Tip Vans or Wagons, *E. Hora.—Dated 10th August*, 1880. 6*d.*

This relates to improved means for tipping the van, and consists in fixing upon the upper surface of each of the side pieces of the under or main frame a slotted piece A, in the slot of which works a pin C fixed on each side of the tipping body. Across the under frame a bar E is fixed, against which the tipping body strikes when first tipped up, thus causing



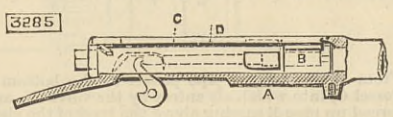
the pins to slide up the slots in the slotted pieces A. The axle of the hind wheels is cranked towards the front of the vehicle, so that the van tips between the wheels. The tail-board is fixed on the under frame. Between the sides of the main frame is fitted a sliding rod H connected by a link I to the under side of the tipping body, and serving to facilitate the tipping of the van. A modification is shown.

3274. Sheet Metal Plates, *W. Elmore.—Dated 10th August*, 1880.—(*Void.*) 2*d.*

This relates to the manufacture of tin, zinc, and other plates by the electro-deposition of tin, zinc, or other metal upon sheets of iron or steel, and consists in producing a uniformly bright surface upon them by means of polishing or scratching brushes mounted on a revolving spindle.

3285. Breech-loading Fire-arms, *C. T. H. Bennett and S. Le N. Neave.—Dated 11th August*, 1880. 6*d.*

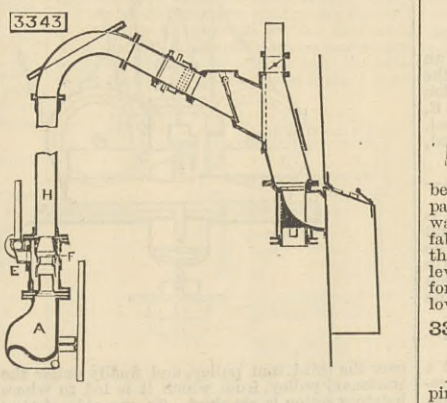
At the breech end of the barrel there is a trough-like shoe A, in which the plug or stopper B for closing the breech is able to slide. C is the cover to the trough A. When the cover is in its place the trough is closed at



the top, and also in rear. D is the locking bolt; the front end of this bolt enters a recess in the back end of the plug or stopper, and its hinder end passes through a circular hole in the back end of the cover C, and has on its end a handle. The breech is opened by turning the bolt D one quarter round by means of the handle at its end, and then drawing it, together with the cover and breech plug, to the rear. During the drawing back of the bolt, a hook-like spring extractor on the top of the breech plug draws back the cartridge case which remained in the barrel from the last time of firing and causes it to be thrown out.

3343. Jet Apparatus for Ejecting Solids and Semi-liquid Materials, *G. D. Robertson.—Dated 17th August*, 1880. 6*d.*

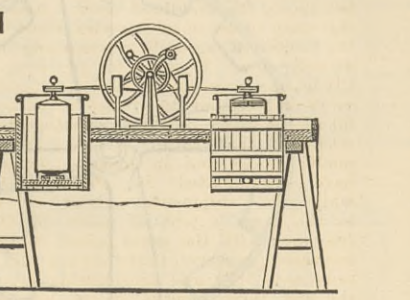
The invention is designed to utilise the force of impact of a direct or spiral intermittent or continuous steam jet, as combined in an ejecting apparatus, if necessary with a stream of cold expanded air or water producing condensation of the steam. The material to be ejected is placed in the mouthpiece A, the



bottom of which is supported by spring hinges, so that when it is struck by the shovel the material is thrown upwards, and being acted upon by the steam entering the double nozzles E and F, enters the tube H. Where this tube bends a secondary steam, water, or cold expanded air jet is caused to act on the material and change its direction of travel.

3351. Apparatus for Manufacturing Ices, Ice Creams, &c., *C. France.—Dated 18th August*, 1880. 6*d.*

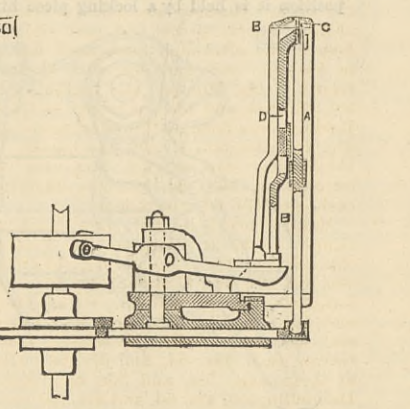
The revolving freezers are made of glass, earthenware, or porcelain, porous or otherwise. When four ice tubs are used, they are arranged two at each end of a table, and upon the table two fly-wheels are mounted upon horizontal axles in bearings with



handles for driving. At the bottom of each ice tub there is fitted a central wooden boss or bearing in which the centre pins of the freezers work. Above the ice tubs there are fitted metallic frames with holes acting as bearings to the upper ends of the freezers.

3360. Sewing Machines, *H. Greenwood.—Dated 19th August*, 1880. 8*d.*

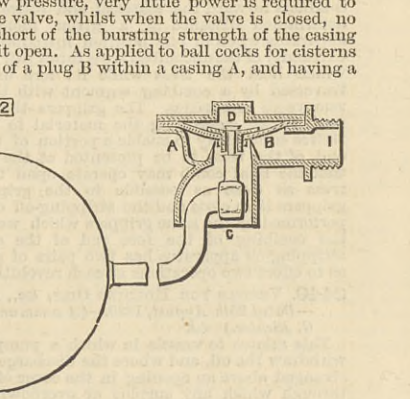
This relates to the adaptation of a pricker feed to sewing machines having the shuttle for carrying the locking thread above the work. In the drawing A is the hollow part closed with a cap, on which the work is placed, and through which plays a hooked needle. B is the pricker feed and C the looper, the former being larger in diameter than the needle, and also



serving to pierce the work preparatory to the descent of the needle. This pricker is carried by a lever D, so actuated that the point is enabled to retire to such a position as to be out of the way of the looper when throwing in the thread. The looper is so actuated by cams that its eyelet, through which the thread passes, will describe any required path, either around the hook or across its path, and then remain stationary in a direct line with the centre of the hook during the time occupied by the thread in passing up through the material under operation.

3382. Valves or Cocks, *J. Willoughby.—Dated 20th August*, 1880. 6*d.*

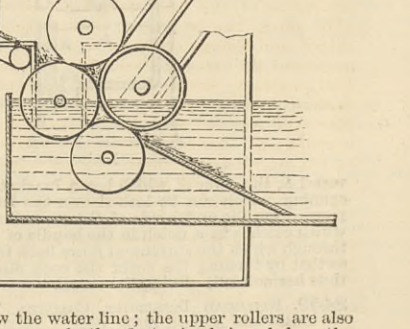
This consists in so constructing valves for regulating the supply of liquids, that whether the liquid is at a high or low pressure, very little power is required to operate the valve, whilst when the valve is closed, no pressure short of the bursting strength of the casing will force it open. As applied to ball cocks for cisterns it consists of a plug B within a casing A, and having a



passage through it in which works a small valve or plug D attached to the ball lever. When the plug D is opened, the water above the plug B—which has entered through perforations in B1—escapes. A projection on the plug D now lifts the main plug B from its seating and allows the passage of the liquid from the inlet I to the outlet C.

3387. Washing Fibres and Fabrics, *J., C., L., and M. Jefferson.—Dated 20th August*, 1880. 8*d.*

Three rollers are by preference used, the lower one



being below the water line; the upper rollers are also partially immersed, the first nip being below the water line, thereby securing a nip of the fibres or fabrics whilst hot and saturated with water or suds; the other or second nip is dry or above the water level, completing the squeezing. The wash of the forks passes or floats the fibres direct to the nip of the lower rollers.

3395. Cleaning and Polishing Boots, &c., *T. G. S. M'Carthy and A. Shakespear.—Dated 20th August*, 1880. 6*d.*

A bell-shaped brush is mounted so as to revolve on a pin at the base of the frame, being driven by a pulley actuated through a crank or treadle, so as to clean the boot placed within the brush.

3402. Screw Propellers, *J. Taylor.—Dated 21st August*, 1880. 6*d.*

The improvements are particularly applicable where screw propellers are applied in twin form, and consists in surrounding the blades of the propeller with a ring

of metal C, preferably a flat ring placed horizontally. Between the blades on the inner surface of the ring additional vanes or fins E are formed, and on

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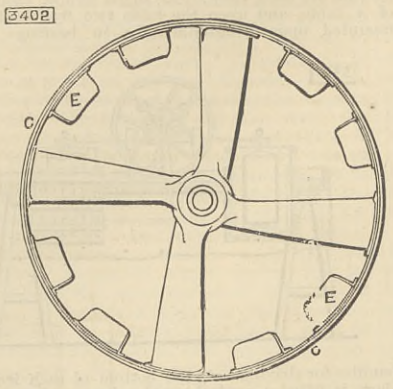

the outside of the ring other vanes or fins may be pitched evenly round the periphery if desired.

3409. Breech-loading Cannon, &c., *P. Jensen.*—*Dated 23rd August*, 1880.—(*A communication from C. C. Engström.*) 8*d*.

The breech-loading mechanism is applied to a gun with two upper and two lower lugs or ears at the rear end, and is constructed as follows :—The breech block is hinged to the two aforesaid lower lugs on the gun, and has a face for forming joint with the rear end of the gun; it has a safety spring and bolt passing through it. When the block is in the raised or closed position it is held by a locking piece hinged to the

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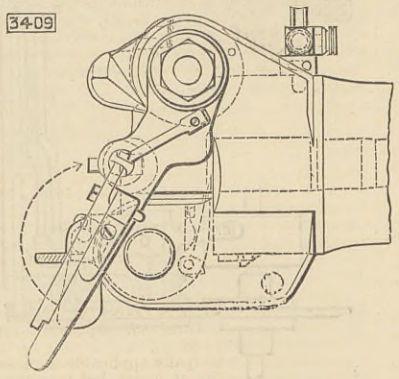

upper lugs on the gun, and having two lugs on its right side; the hinge bolt is mounted very slightly excentrically in the locking piece for giving a gradually increasing pressure to the breech block face against the gun. There is a key or lever mounted on the right end of the locking piece hinge bolt, and formed with two lugs corresponding with the aforesaid two lugs on the locking piece, one lug for the purpose of holding the locking piece in the locked position, and the other lug for releasing it therefrom and raising it out of the way.

3422. Combing Fibrous Materials, *J. H. Johnson.*—*Dated 24th August*, 1880.—(*A communication from H. Truxler.*) 8*d*.

This relates, First, to the feeding apparatus which conducts forward the material and retires from it a determined distance at a given moment. This apparatus when in one position introduces the fore extremity of the uncombed tress into a pair of grippers, which hold the tress while its fore extremity is traversed by a combing segment with teeth, which remove all impurities. The grippers then open, the feed holder containing the material to be combed retires sufficiently to enable a portion of the combed end of the tress to be presented at the exterior, so that the final comb may operate upon the combed tress as close as possible to the grippers. The grippers then close and the stripping-off operation is performed by the same grippers which were used in the combing of the fore end of the sliver. The stripping-off apparatus has two pairs of grippers, so as to effect two operations at each revolution.

3449. Vessels for Holding Oils, &c., *E. Edwards.*—*Dated 25th August*, 1880.—(*A communication from G. Richter.*) 6*d*.

This relates to vessels in which a pump is used to withdraw the oil, and where the discharge aperture is arranged above an opening in the cover of the vessel, through which any surplus or overflowing oil runs back into the latter, and it consists of the pump X delivering into the discharge G, the top of which is bent over so as to terminate above the centre of the

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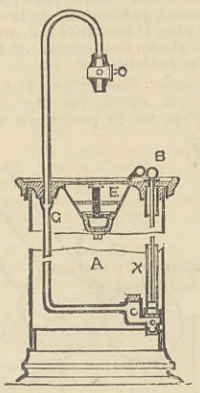

vessel A, the cover of which has a bracket B, with an opening, which can be locked over the handle of the pump. On the under side of the cover is a projection which catches in a notch in the handle of the cock E, through which the surplus oil flows back to the vessel, so that by turning the cover the cock also is turned, thus hermetically closing the vessel.

3452. Railroad Passenger Coaches, *T. Clarke.*—*Dated 26th August*, 1880. 6*d*.

This relates to the construction of a car which is adapted for use during the day as a drawing-room and during the night as a sleeping car, and consists in the general construction and combination of parts so as to obtain great simplicity and durability, the utilisation of all available space, superior ventilation, and the perfect comfort, privacy, and safety of the traveller.

3464. Centigrade Photometer, *D. Coglievina.*—*Dated 26th August*, 1880. 6*d*.

This instrument is based on the principle that a light source may be taken as a standard of measurement, if its extreme beam attains a given invariable length (*a*) and also on the principle that a sphere is illuminated equally by two light sources L^1 L^2 placed on opposite sides of it, if the image of this sphere on a mirror placed vertically under the latter does not show a border line or limit between the sides illuminated by the two different sources, but appears as a uniformly illuminated circle. Therefore, if L^1 is a source of light applied in the chamber A and required to be measured, a beam of the light is conducted first by the convex lens L, and then by the rectangular glass prisms placed inside the photometer box or camera obscura, so far that its length, until its contact with the sphere F enclosed in a chamber, amounts to (*a*) = 8 metre. By means of a regulating cock, which may be placed directly under the light source

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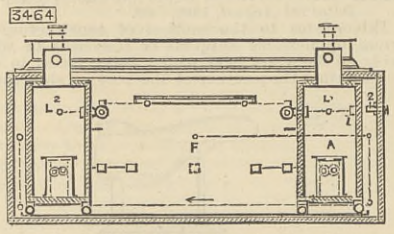

or upon the table of the photometer (in which case an india-rubber pipe connects it with the light source), the light L^1 is diminished until the said beam L^1 F only touches the sphere F. The flame thus regulated serves as a standard flame, and the beam L^1 F of the constant length (*a*) as a standard beam.

3478. Bicycles, &c., *N. K. Husberg.*—*Dated 27th August*, 1880. 6*d*.

In velocipedes, where between pivotted parts ratchets and pawls are used, and never require to be thrown out of action, balls are substituted, and are placed between the pivotted parts in grooves, so shaped that the friction will lock the balls, which thus rotate as one piece when turned in one direction, but which

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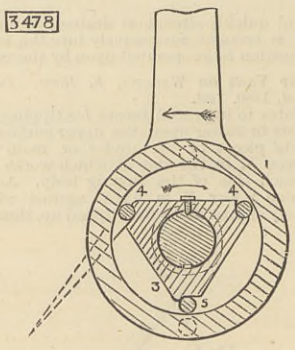
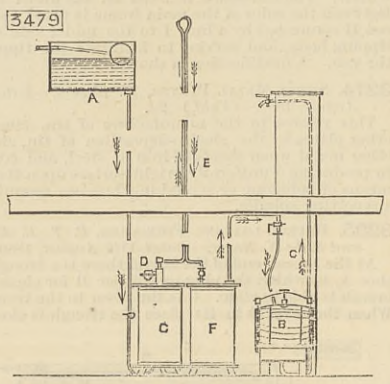


can be rotated independently of each other when turned in the reverse direction. In the drawing 1 is the hub of a wheel, within which is a collar 3 firmly secured to the axle, and provided with grooves 4 in which the rollers 5 are placed. A further improvement consists in extending the arms of the fork of the driving wheel to a point beyond the periphery of the wheel, and then joining them together so as to form a kind of girder about a portion of it.

3479. Raising or Discharging Beer, &c., *G. McCallum and R. T. Harris.*—*Dated 27th August*, 1880. 6*d*.

This relates to apparatus for raising beer by the pressure of air or a suitable gas on its surface, and it consists of a water cistern A placed above the level of the place where the beer is to be delivered, and serving to compress the air to be supplied to the beer barrel B.

3479

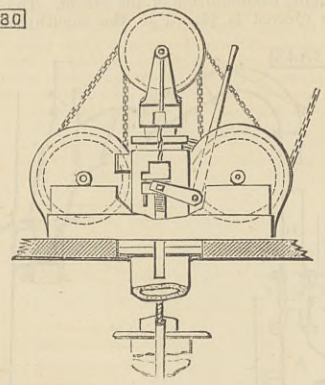


From the cistern a pipe passes to the bottom of a vessel C, into which air enters by the valve D, and is forced up pipe E passing above the level of the cistern, and then descending to the air receiver F, from which the air passes by a pipe to the interior of the beer barrel, and forces the beer up the pipe G to the place where it is to be delivered.

3480. Hydraulic Hoisting Apparatus, *A. B. Brown.*—*Dated 27th August*, 1880. 6*d*.

The cylinder is made by preference of steel, and is bolted up to the underside of a casting comprising the head of the cylinder and a plate carrying the stationary pulleys, of which pulleys there are two on one side and one on the other. The plate is formed with a raised rim to retain any leakage water, and carries the valve details by which the passage of the water to and from the cylinder is controlled. The ram is fitted with a head carrying three pulleys, and the rope or chain, the end of which is fixed to the side of the cylinder head, first passes over one of the ram pulleys, next round one of the two stationary pulleys on one side, then over the second ram pulley to the stationary pulley on the other side, whence it passes

3480



over the third ram pulley, and finally under the last stationary pulley, from which it is led to where the hoisting action is required. To one side of the ram-head there is fixed a rod of square section, which passes down a pipe parallel to the cylinder and is of a length corresponding to that of the ram. The rod is twisted and passes through a short tube which fits it, and which is retained between guides, and the twist of the rod causes the tube to rotate as the rod rises or descends. The tube is screw-threaded externally, and has on it a nut with studs which engage with a forked lever on a rocking shaft, and the rocking shaft has on one end of it a lever or crank carrying the fulcrum of a hand lever by which the valve is worked. The usual catch-plate is arranged in connection with the hand lever, and is provided with an adjustable stop for limiting the movement of the lever to any particular length of hoist less than the maximum for which the apparatus is made.

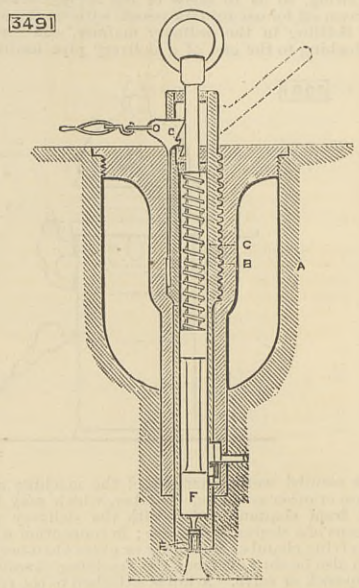
3467. Boots, Shoes, &c., *C. Morlet.*—*Dated 26th August*, 1880. 6*d*.

A metal plate is fitted to the under side of the heel and serves as a pivot for a split metallic ring, which can be turned so as to prevent the heel wearing down on one side. In the part of the sole most subject to wear a circular groove is formed, and within it a split ring is placed.

3491. Firing Apparatus for Guns, *W. Palliser.*—*Dated 28th August*, 1880. 6*d*.

This relates to firing apparatus for guns, particularly applicable for breech-loading ordnance, so arranged as to enable the gun to be lubricated after each round by a steam jet, which at the same time serves to blow the smoke out of the gun before the breech is opened, to apply a detonating priming charge close to the powder charge in the gun, and to avoid back flash of the disharge through the vent, and the blowing out of the firing tube. In the breech plug A is fixed a lining tube B forming the vent, and receiving the firing tube C, which is secured in the vent by a screw thread formed at the external mouth of the vent, the male thread being in relief on the tube C, and both being cut away in two or more segments, so that the tube can be inserted and secured by turning it partly round. The inner end of the firing tube receives a small

3491

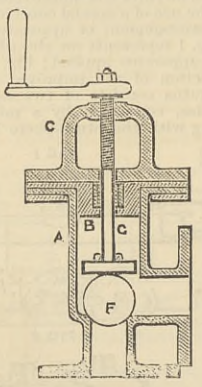


cartridge E, having a percussion cap and anvil, the case projecting beyond the mouth of the firing tube, so as to act as a gas check, covering the joint at the end of the tube. Within the firing tube is a sliding hammer rod F which fires the cartridge, being actuated by a spring, and pulled back by a ring when it is held by a spring latch trigger G. When the firing tube is withdrawn a current of steam is passed through the gun from a suitable hose.

3492. Stop Valves for Corrosive Fluids, *A. H. Cochrane.*—*Dated 28th August*, 1880. 6*d*.

The drawing represents a vertical section of a stop valve, suitable for arresting the flow of sulphuric acid. A is the shell of the valve-box, and B its cover; both

3492

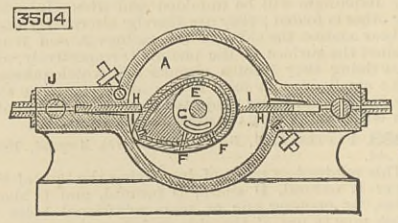


being made of lead. C is a bracket or yoke which may be of cast iron; F is the ball-valve, which may be of caoutchouc, glass, or ceramic material; G is the valve rod screwed along its upper part to fit a thread formed in the yoke C, and widened out at its base.

3504. Rotary Steam Engines, *H. H. Lake.*—*Dated 28th August*, 1880.—(*A communication from E. Genty and J. Deschamps.*) 6*d*.

This relates to improvements on patent No. 2613, A.D. 1878, and consists of a cylindrical chamber A in which an elliptical or oval piston B is free to rotate. The steam, after having done its work, enters a chamber E through ways F in the piston and escapes through the outlet G, or it may be made to escape

3504



through openings H provided with valves, which, by by means of cams, are closed when the piston is passing, but are opened as soon as the slide valve is closed. The slide valves I are pushed into the interior of the cylinder by steam entering at J, and are pushed back by the piston B.

3506. Incubators, *C. H. Dunn and H. T. Cartwright.*—*Dated 30th August*, 1880. 6*d*.

The drawing is a longitudinal section of an incubator with the improvements applied. A is the incubator properly so called, and which is of the ordinary construction. The improved heating apparatus combined therewith consists of a vertical tubular boiler B heated by means of a suitable lamp C. The boiler is constructed of two flues D which open into a heat box E, from which the heat and products of combustion pass up through the tubes F into the upper part G of the boiler and out by the chimney H. From the boiler above the heat box E pass the horizontal tubes, the upper one having a semi-cylindrical core K, while the lower heating tube has a cylindrical core L, the spaces M and N respectively forming the water spaces. These horizontal tubes pass through the incubator cistern O and open into the vertical tube P which passes through the top of the

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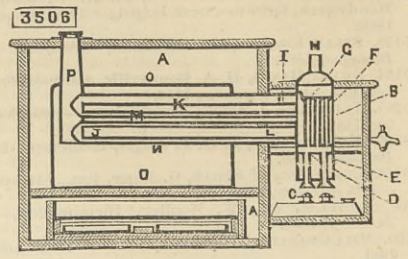

apparatus, such tube P serving for supplying the water to the heating apparatus.

3507. Bobbin and Shuttle Tongue for Shuttles, *T. Pearson and J. Taylor.*—*Dated 30th August*, 1880. 6*d*.

This consists in forming an internal annular cavity in the base of the bobbin, and on the shuttle tongue is fixed a pin, which, when the bobbin is placed thereon, enters the cavity through a slot, when the bobbin is

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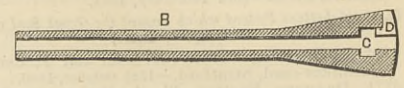

turned partly round and the pin retains the bobbin securely in its place. In the drawing B is the hole in the bobbin through which the shuttle tongue passes, C the cavity in the base, and D the slot through which the pin near the base of the shuttle tongue passes.

3514. Cylinders and Valves of Steam Engines, &c., *W. Payton and A. Wilson.*—*Dated 30th August*, 1880. 6*d*.

This invention relates to the passages and valves by means of which steam is admitted to and passed out of the interior of steam engine cylinders, and it has for its object the construction of such parts in such a manner as will allow of the valves having a much shorter travel than is usual with ordinary valves, and reduce considerably their friction when in motion. E is the cylinder, a part of which is formed into the valve chest A containing the valve face B, and the said valve chest A has connected to it by screwed studs and nuts the cover C which is placed parallel with the valve face B, and has formed upon or attached

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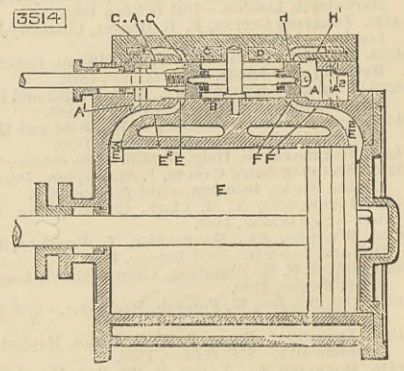
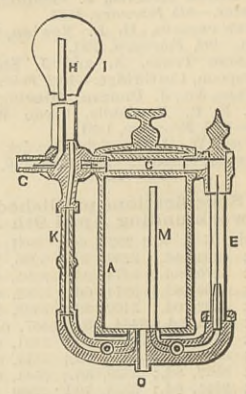


to its inner surface a valve face D exactly similar and opposite to the valve face B. The said valve face B is provided with a port at E^1, which is connected by means of the passage E^2 with the interior end E^3 of the cylinder E, and another port is formed in it at F, which is connected by means of the passage F^1 with the interior end F^2 of the said cylinder. The valve face D of the cover C is also provided with ports at G and H exactly opposite and similar to those at E^1 and F in the valve face B, and the said ports G and H are connected with the passages E^2 and F^1 leading to the interior ends of the cylinder E by means of the passages G^1 and H^1 formed in the cover C, and the passages A^1 and A^2 formed in the valve chest A, the said passages E^2 and F^1 having their capacities sufficiently enlarged between their points of junction with the passages A^1 and A^2, and the interior ends of the cylinder E, to allow of their receiving the additional steam supplied to them by the said passages A^1 and A^2.

3515. Lubricating Apparatus for Steam Engines, *W. R. Lake.*—*Dated 30th August*, 1880.—(*A communication from G. H. Flower.*) 6*d*.

This relates to lubricating apparatus in which the lubricant is supplied by the aid of steam, and consists in conveying the lubricant to the steam chest through the same pipe that supplies the steam, which (becoming condensed) imparts by hydrostatic pressure the onward movement to the lubricant. A is the oil reservoir closed at top by a stopper and opening at the bottom into an exhaust tube O. A steam pipe C

3515



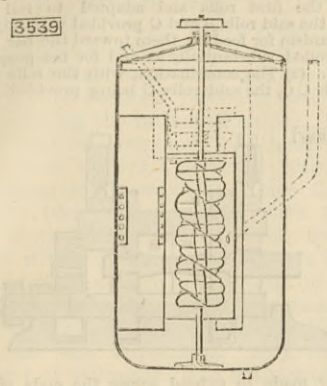
passes from the steam chest through the upper part of the reservoir and opens into the transparent tube E. A steam inlet tube H leads from the steam pipe on the side of the reservoir nearest the steam chest up into a condenser I. The condenser is closed at top, and in the bottom is an opening for the passage of tube H and another to receive the end of the water tube K, the other end of which opens into the bottom of the oil reservoir. The oil outlet M consists of a tube passing into the oil reservoir, and its bottom end passing through the bottom of the tube E.

3532. Cigarettes, *G. F. Redfern.*—*Dated 31st August* 1880.—(*A communication from E. Side.*) 8*d*.

This relates to the construction of a machine for manufacturing cigarettes, and consists of a hopper vibrating across the machine by means of levers, a pitman, and a crank stud, and having an opening fitted with an adjustable gate to regulate its size. A knife cuts off the desired quantity of tobacco, which falls into a trough, and is formed into a roll. The trough conveys it to a sheet of paper, upon which it deposits it, when rollers and an endless band cause the paper to be wound round the tobacco, the paper having previously been cut to the desired size, and pasted along one edge. The finished cigarette is delivered into a trough, and cut into four by knives.

3539. TREATING LIQUIDS OR MATTERS DISSOLVED OR SUSPENDED IN LIQUIDS, &c., *J. Storer.—Dated 1st September*, 1880. 8*d*.

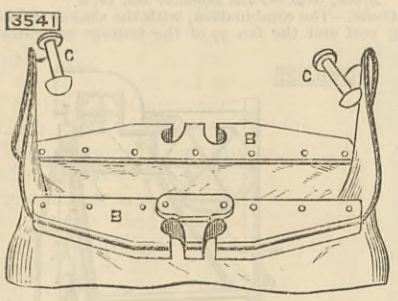
The liquid, which may have matters dissolved or suspended in it, is subjected to the action of one or more rotating propellers or pulverisers driven at a considerable velocity, the apparatus being in most of the applications arranged so that gases or vapours are brought by the propeller or propellers into a minutely



subdivided condition, and forcibly and systemically mixed and agitated with the liquids, whereby the processes are rendered more efficacious and expeditious than as hitherto practised. The drawing shows one modification of the apparatus.

3541. FASTENING SACKS OR BAGS, *D. A. B. Murray, jun.—Dated 1st September*, 1880. 6*d*.

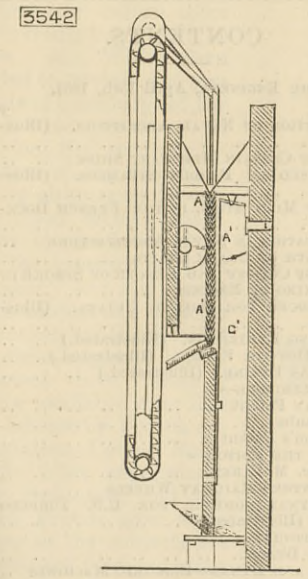
This relates to means for fastening sacks filled with flour, grain, or other substance, and consists in fitting to the mouth of the sack two light bars B, secured one on either side in any suitable manner. In the bars two-deep notches are formed in the upper edge nearly in the centre of their length. Midway between



the ends of the bars two bolts C, formed with heads on each end, are attached to the mouth of the bag by cords or wires. To close the sack the two bars are drawn close together, and the other sides of the mouth of the bag are drawn tightly inwards by the bolts C between the bars B, and the bolts forced into the notches in the bars.

3542. MACHINE FOR DRYING GRAIN, *W. Davidson.—Dated 1st September*, 1880. 6*d*.

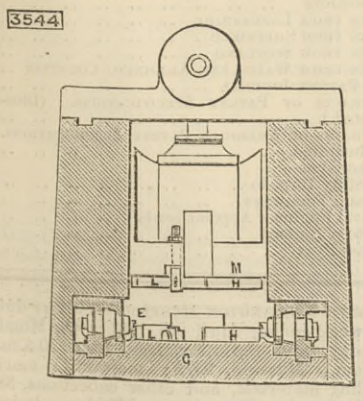
The grain is caused to descend through a framing A A^1, formed by a series of super-imposed angled vanes, hoppers, or ducts, in one, two, or more regular streams, while heated air or the hot products of



combustion of a furnace underneath at one side pass, or are drawn freely through, the hoppers and the grain, and with or without an automatic arrangement of ventilating or tempering the heat of the flue C1.

3544. HORSESHOE NAILS, *W. W. Clark and J. Priestley.—Dated 1st September*, 1880. 6*d*.

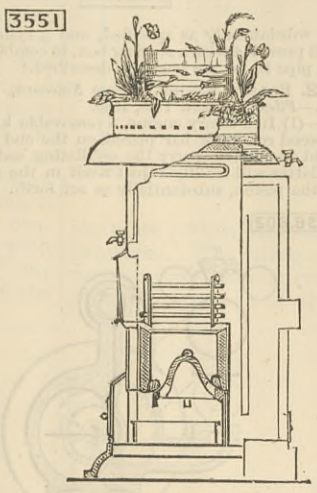
This relates to that class of machinery in which the nails are produced from heated metal rods by means of a series of blows given in rapid succession by a number of hammers arranged in a circle, and to which an up-and-down motion is given by the elastic force of steam acting in a suitable cylinder, and consists in dispensing with the nicking apparatus and heading



machine usually employed, and performing the operation by pushing the heated rod into the machine, when a cutter stock advances and cuts off the required length. A blank is then pushed sideways over an opening, down which it is forced by a punch connected with the hammer into grippers E, the head and blade being forged in one operation by a number of forging dies H placed on the anvil G and on the bottom of the hammer M; and also a number of flattening and shaping dies L. These dies are made in segments.

3551. HEATING APPARATUS, *L. W. Leeds.—Dated 1st September*, 1880. 6*d*.

This consists mainly of improvements on patent No. 1646, of 1879. According to the present invention, a dome-shaped grate is employed, said grate being solid in its upwardly projecting portion, for the purpose of preventing the air circulating through the centre, and to compel the air to pass up at the sides against the fire-bricks, and so towards the illuminating window or windows. This grate is supported on



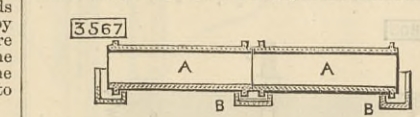
permanent lugs attached to the sides of the fire-box, while projecting into the fire chamber are permanent wedge-shaped pieces of metal, which, in combination with the movable grate, act as crushers for the cinders. Said grate, when moved backwards and forwards in a horizontal plane (by means of a grate shaker), leaves alternately enlarged openings on either side of the permanent crushers, thus permitting the crushed cinders to fall into the ash-box.

3560. MOISTENING OR LUBRICATING THE INTERIOR OF RIFLE BARRELS, *R. H. Finlay.—Dated 2nd September*, 1880. 4*d*.

A hollow stopper is shaped so as to fit into the chamber or breech cavity, and to it is attached a flexible tube with a mouthpiece. After a discharge the stopper is inserted in the breech, and by blowing down the tube the barrel is lubricated.

3567. JOINTS OF EARTHENWARE PIPES, *H. Doulton.—Dated 2nd September*, 1880. 6*d*.

The ends of the pipes are ground, and whilst they are butted together a ring of cement is formed round them. For this purpose the pipes A are formed with



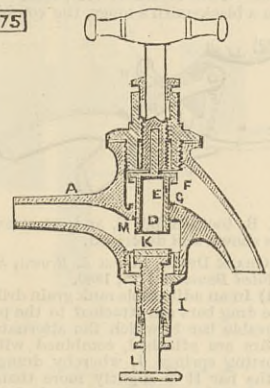
collars round their ends and are supported in chairs B, the cement being placed round the ends of the pipes between the collars.

3570. EXHIBITING GOODS, &c., *F. M. B. Bertram.—Dated 2nd September*, 1880. 6*d*.

The articles to be exhibited are held by means of clips secured to cross-bars adjustable on a wire frame, so as to raise the articles to any required height.

3575. TAPS OR COCKS, *T. Singleton.—Dated 3rd September*, 1880. 6*d*.

The drawing is a sectional view of a high-pressure tap or cock having a plug or valve in connection with a hollow perforated cylinder, and also a case or shell containing a plug or valve and washer worked by a screw for cutting off the supply of water or other fluid when required. The tap is shown open, the water entering at the bottom of the hollow cylinder D, and passing out through the perforations E. The



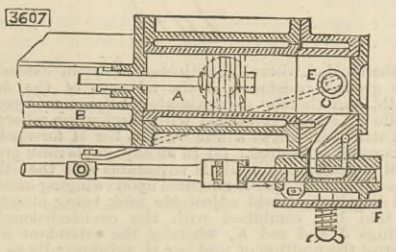
washer F is far above the seating G. To the lower part of the body A is screwed the case or shell I, in which there is a washer K connected to a plug or valve worked by the screw L, the seating of the valve and washer being marked M, and it will be seen that the flow of water can be entirely cut-off when required.

3604. WHEELS FOR BICYCLES, *T. Humber, T. R. Marriott, and F. Cooper.—Dated 4th September*, 1880. (*Not proceeded with.*) 2*d*.

The cellular line of the wheel is made of three plates of metal, two forming the shell of the rim, and the third serving to support the two outside plates. The edges of one of the outer plates are bent over the other while the inner plate is so confined between the two as to act as a strut and stay. The spokes pass through holes in the inner plate and the bottom outer plate, and are secured to the plate farthest from the axle.

3607. GAS ENGINES, *H. W. T. Jenner.—Dated 4th September*, 1880. 6*d*.

This relates principally to improvements of the arrangement for igniting the explosive charge. A is the cylinder, the front end of which acts as a pump to draw in and mix the gas and air on the in-stroke of the piston, and compress and force it into a receiver



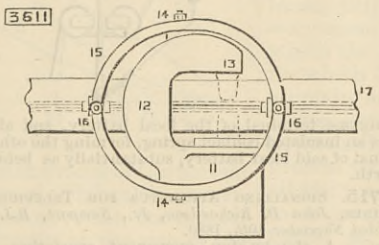
B on the out-stroke. The rear end of the cylinder serves to further compress the charge and also to ignite the same, for which purpose it is provided with an ignition chamber E and a slide F to admit the charge from the receiver B. In the chamber E is a valve G for the escape of the products of combustion.

3609. CEILINGS, ROOFS, AND CORNICES, &c., *C. Brothers.—Dated 4th September*, 1880.—(*Not proceeded with.*) 2*d*.

This consists in decorating ceilings and roofs by inserting glass panels ornamented with painted designs.

3611. PORTABLE HYDRAULIC RIVETTING MACHINES, *A. C. Kirk.—Dated 6th September*, 1880. 6*d*.

The drawing shows one modification in which the rivetting machine, 11, 12, 13, is carried on bearings 14, placed so that it is balanced, or nearly balanced, on them, in a frame or carriage 15 fitted with two rollers 16 (or it might be with slides instead of rollers), of



which one is in front and the other behind. It is by these rollers 16 or the slides that the machine rests on or bears against, and is moved and guided along the work 17 being rivetted, whilst it can be turned about its bearings 14 between the cheeks or sides of the frame or carriage 15 so as to act on each rivet at the proper distance from the edge.

3614. DRIVING BOATS, &c., *F. H. F. Engel.—Dated 6th September*, 1880.—(*A communication from G. Reuter.*) (*Not proceeded with.*) 2*d*.

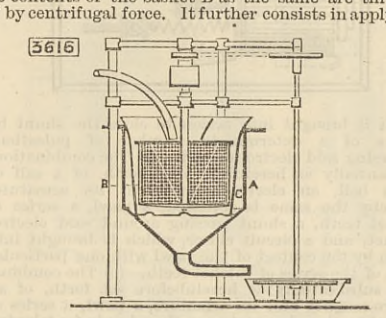
This relates to apparatus for driving twin boats, the two boats being joined together by a frame in the centre, where a paddle wheel is mounted and caused to revolve by treadles worked by the person propelling the boat.

3615. MOVING RAILWAY VEHICLES BY MANUAL POWER, *W. Schmid.—Dated 6th September*, 1880.—(*Not proceeded with.*) 2*d*.

This consists of an apparatus to be secured to the buffer beam of carriages, and consists of a frame which runs upon two rollers on the rail, its top end being connected to the buffer beam, so that a portion of the weight of the carriage rests upon the wheels of the frame, and produces the requisite adhesion on the rail. The wheels are caused to revolve by means of a crank handle near the top of the machine, the motion being transferred to the wheels by means of bevel gearing and a chain.

3616. AMALGAMATORS FOR SEPARATION OF METALS FROM OTHER SUBSTANCES, *P. B. Wilson.—Dated 6th September*, 1880. 4*d*.

This consists in the interposition between the revolvable basket B and the outer casing A of the machine of a mercury-coated plate C adapted to receive the contents of the basket B as the same are thrown off by centrifugal force. It further consists in applying



to the said basket an inner or supplemental basket having preferably a perforated bottom, whereby in the operation of the machine a more minute division of the particles of material projected against the said amalgamated plate is effected and the yield of gold is increased.

3617. CLEANING OR DRESSING AND SORTING GRAIN, &c., *W. R. Lake.—Dated 6th September*, 1880.—(*A communication from C. A. F. Gramke.*)—(*Not proceeded with.*) 4*d*.

A wooden casing contains in the upper part a vertical cylinder of perforated sheet iron within which revolves a brush. The grain enters the cylinder at top, and being acted upon by the brush is cleaned, and falls on to a reciprocating screen, passing in its passage through a current of air, whereby it is freed from dust. The grain passes through the sieve and falls into an inclined collecting box, from which it passes to a sorting cylinder.

3618. LINOLEUM, &c., *W. R. Lake.—Dated 6th September*, 1880.—(*A communication from E. A. D. Guichard.*)—(*Not proceeded with.*) 2*d*.

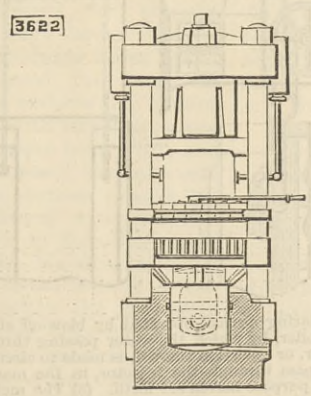
One part of this invention relates to employing sand or dust of silicious, metallic, or other substance, either coloured or in their natural state, to ornament linoleum; and also to imparting a roughness to linoleum so as to prevent the feet slipping.

3624. GAS, *W. R. Lake.—Dated 6th September*, 1880.—(*A communication from E. Genty.*)—(*Not proceeded with.*) 2*d*.

This relates to the production of illuminating gas by passing air through a mass of mineral oil, such as petroleum or other carburetted liquid.

3622. COMPRESSING BLACKLEAD, &c., *W. C. James.—Dated 6th September*, 1880. 6*d*.

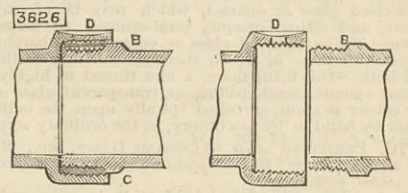
The machine is formed with a horizontal bed or table, through which a number of vertical holes are formed, each of a diameter equal to the diameter of the blocks which are to be moulded. Below this table is a horizontal plate or platten supported by the ram of a hydraulic press below it. Projecting upwards from the top of this plate are numerous projections or plungers which enter and fit into the bottom ends of the holes formed through the table. Above the table



is another similar plate or platten with a number of plungers descending from it, which, when the platten is lowered, enter and close the top of the holes in the table. By preference each of these plungers is mounted in the plate or platten, so that it can be revolved, and has upon it a toothed wheel, by which this revolving motion can be imparted to it; the several toothed wheels are made to gear together, so that when one is revolved the others revolve with it. Motion can be given to one of the wheels to revolve it by a rack actuated by a small hydraulic cylinder, or by other mechanical appliance.

3626. PIPES AND PIPE JOINTS, *F. Jackson.—Dated 7th September*, 1880. 6*d*.

The pipe is formed with a circular band B near the spigot end, while the socket head C is formed with an opening D. A fillet of cement, prepared gas tar, or a washer of felt is placed within the socket, and the spigot of the next end is then inserted until the band



B butts against the end of the socket, when a fillet of strong cement is used to close all openings between the band and the socket. The annular space between the socket and spigot is filled in with liquid cement through the opening D in the socket.

3631. FILLING OR FACING COMPOSITIONS, *F. C. Clarke and R. MacAusland.—Dated 7th September*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to compositions principally used for filling in cracks in wood, metal, or other bodies, and consists in grinding shale to a powder and mixing it with such matters as boiled oil, raw linseed oil, turpentine, terebine, gold size, and varnish.

3633. POCKET SLATE TABLET, *T. O. Jones.—Dated 7th September*, 1880.—(*Not proceeded with.*) 2*d*.

This consists of a slate fitted with a cover, so that it may be carried in the pocket without fear of effacing the notes.

3642. STANDS FOR BOTTLES, &c., *F. T. Marrian and T. W. Bocock.—Dated 8th September*, 1880.—(*Not proceeded with.*) 2*d*.

The sides of the frame are hinged and fitted with a handle projecting over the stoppers of the bottles, the hinges of the sides being provided with a lock to prevent the sides being turned back except when the lock is unfastened.

3643. CHAINS FOR USE IN LOOMS, &c., *J. Holding and E. K. Dutton.—Dated 8th September*, 1880.—(*Not proceeded with.*) 2*d*.

The chain is principally applicable as a substitute for the picking bands of looms, but may also be used for other purposes. It consists in forming links by coiling wire on a mandril and cutting up the coil into short lengths, each having more than one coil or turn. These links are connected together by threading in the same manner as when putting keys on a split ring.

3644. CEMENTS, *J. C. Bloomfield.—Dated 8th September*, 1880. 2*d*.

This relates to improvements on patent No. 738, A.D. 1880, and consists, First, in producing a pink cement by substituting for the ground silica employed ground burnt red brick clay; and, Secondly, in producing a yellow cement by substituting for the ground silica ground burnt shale.

3645. EGG BEATER, *F. A. Grebert.—Dated 8th September*, 1830.—(*Not proceeded with.*) 2*d*.

The eggs to be beaten are placed in a glass vessel fitted with a cover, through which passes the stem of a three-disc beater, the discs of which are perforated. By moving the beater up and down, the eggs are thoroughly beaten.

3651. MAKING CIGARETTES, *C. E. Cherry.—Dated 8th September*, 1880.—(*Not proceeded with.*) 2*d*.

The tobacco and cigarette paper are placed within the loop of a coil of paper, one end of which is secured to a roller, and the other to a plate, over which the roller is mounted. The roller is made to revolve by means of a handle, and in so doing rolls the paper round the tobacco.

3654. FLUSHING APPARATUS FOR DRAINS, &c., *B. R. Phillipson—Dated 8th September*, 1880.—(*Not proceeded with.*) 2*d*.

A valve is attached to a lever having a float, and closes the discharge pipe. This lever travels in a slotted standard, to which a latch is pivotted, and is furnished with a slot traversing on a pin. The latch carries an arm connected to a chain attached to a float, which itself is connected to a chain near the top of the tank containing the whole. A second latch in a reversed position is pivotted on the other side of the slot in the standard, and the lever attached to it carries a float.

3655. DESTROYING FIRE-DAMP IN MINES, *A. M. Clark.—Dated 8th September*, 1880.—(*A communication from R. Blacklidge, A. J. Battles, and G. Wilcox.*)—(*Not proceeded with.*) 2*d*.

This consists in employing a large number of separate flash torches or rockets to fire the gas accumulated, such torches being distributed over the mine in various places, and lighted simultaneously or in quick succession, so that the gas will be lighted at a new point before the flame from the first point lighted has reached the second point.

3657. TURNING LATHES, *J. Garvie.—Dated 9th September*, 1880.—(*Not proceeded with.*) 2*d*

This relates to a lathe for turning regular and irregular work, and for chasing or cutting screws. When used for turning taper circular, or irregular work, a pattern is mounted on a bracket at the back of the lathe, and is caused to swivel when required on a centre, and is capable of adjustment and of being fixed in any desired position. Along the pattern slides a block to which one end of a connecting rod is connected, the opposite end being attached to the slide rest, on the top of which is a T-slot to receive the tool holder.

3661. PROPULSION OF SHIPS OR VESSELS, &c., *T. P Walker.—Dated 9th September*, 1880.—(*Not proceeded with.*) 2*d*.

A number of paddles project from the side of the ship, and are reciprocated by a steam or other motor.

3662. SEWING MACHINES, *E. Ward.—Dated 9th September*, 1880.—(*Not proceeded with.*) 2*d*.

This relates, First, to so arranging the handle and platform or work-plate that they may be turned down within the area of the base plate when not in use; Secondly, to means for facilitating the threading of the machine; and Thirdly, to means for facilitating the threading of the shuttle and regulating the tension of the shuttle thread.

3668. LOOMS, *R. Hindle and G. Greenwood.—Dated 9th September*, 1880.—(*Not proceeded with.*) 2*d*.

This relates to mechanism for regulating the "letting off" the warp from the beam, for adjusting and determining the degree of tension in the warp during the letting off, and for facilitating "letting back" or slacking the warp when requisite.

3669. LIDS FOR JARS, BOTTLES, &c., *A. V. Langstedt.—Dated 9th September*, 1880.—(*Not proceeded with.*) 2*d*.

A hinged frame on the under-side of the stopper is formed with a ring in which a slab of glass may be introduced, and the upper part of the stopper is fitted with a spring catch to secure it over the mouth of the jar.

3671. WRITING INSTRUMENTS, *J. Nadal.—Dated 10th September*, 1880.—(*Not proceeded with.*) 2*d*.

The pen has a tubular holder to receive the ink, and its lower end is conical and is pierced for the passage of a rod which forms the writing point. The upper end of the rod controls a valve for admitting air inside the holder.

3674. Stockings, *H. Röhner and L. Pagel.—Dated 10th September*, 1880.—(*Not proceeded with.*) 2*d.*

This relates to preventing the tightness and consequent rapid wear at the knees of stockings. Extra stitches are gradually taken in on each side of the stocking a little above the knee and nearer the front than the rear. They are then taken off again below the knee in the same gradual manner.

3675. Ornamenting Articles of Glass, *W. H. Stuart.—Dated 10th September*, 1880.—(*Not proceeded with.*) 2*d.*

The glass of which the article is to be made is gathered from the pot of an ordinary glass-blower's tube, and formed into a hollow bulb; it is then, while in a heated and plastic state, rolled upon a slab of iron or other surface upon which has been sprinkled some pulverised glass or enamel, which may be of any colour, and either opaque, semi-opaque, or transparent; the particles of glass or enamel are thereby caused to adhere or attach themselves firmly to the said bulb. This being done, a fine thread of highly-heated opaque, semi-opaque, or transparent glass of any colour is spun, or coiled spirally upon the bulb, either by hand or by machinery, in the ordinary way.

3678. Purifying and Cleansing Gases, &c., *W. Foulis.—Dated 10th September*, 1880.—(*Not proceeded with.*) 2*d.*

The brushwood twigs are held at their upper ends in or between bars or frames, by which they are suspended in successive horizontal rows or layers across the scrubber. The bars or frames are so arranged that the water or other liquid used in the scrubber flows on to the top of the twigs, thereby insuring that it will trickle or flow down over the twigs lengthwise.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

238,689. Telephonic Apparatus, *Henry Howson, Philadelphia, Pa., assignor to John L. Kite, same place.—Filed January 18th*, 1881.

Claim.—In telephonic apparatus, the combination of a transmitter, a switch, a receiver, and a support for the same, with mechanism whereby the receiver may

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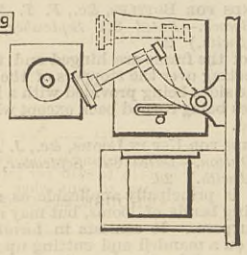
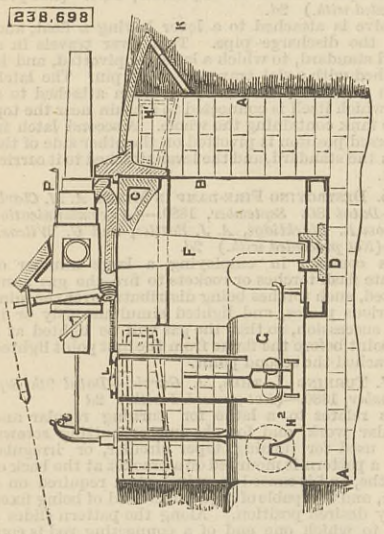


be held to he tear without the aid of the hands, and whereby the switch is automatically operated on adjusting and releasing the receiver, all substantially as described.

238,698. Mounting and Operating Ordnance, *Alfred Krupp, Essen, Germany.—Filed October 2nd*, 1880.—*Patented in France May 15th*, 1880.

Brief.—The gun is mounted on a vertical shaft provided with bearings at top and bottom, and having at its upper end trunnion bearings and a shield for the protection of the gunners. The gun is elevated and depressed by means of a screw carried by a yoke supported on the deck or platform. *Claim.*—(1) A gun battery consisting of a ship or structure in which a cylinder B is united to the outer sides or shell A by means of stays or struts H^1, the said cylinder containing a neck bearing C for a vertical shaft F, which latter rests in a pivot bearing on the bottom of the cylinder B, and carries the gun trunnion bearings, substantially as set forth. (2) A gun battery consisting of a ship or structure in which a ring B^1 is united to the outer sides or shell A by means of struts or ties H^1 and H^2, the said ring B^1 containing the neck bearing for a vertical pivotted shaft F, which carries the gun trunnion bearings, substantially as set forth. (3) The protected revolving gun carriage proper, or the part containing the trunnion bearing, consisting

238,698



of the bottom and sides M, secured to the shaft F, in combination with the slanting shield N on a breech-loading gun, the back end of which, behind the trunnions, is provided with means for elevating it, substantially as set forth. (4) The brake or appliance for fixing and holding in position, laterally, a pivot-mounted gun, consisting in the vertical sliding wedge bolt, in combination with the horizontal sliding bolt for pressing a disc against the neck bearing, substantially as set forth. (5) The elevating appliance, consisting of a screw Q^1, which is connected to a lug Q^3, on the back end of the gun, so that the said back end hangs therein, and which screw works through a boss in a carriage Q, and has a hand wheel Q^4, which forms the nut for the screw, and serves to raise and lower the gun to any required position, in which it is retained after being fired off, substantially as set forth.

238,706. Pavement, *John Murphy, Columbus, Ohio.—Filed January 26th*, 1881.

Claim.—The improved pavement, formed of the broken stone and grout foundation B, the layer C, of

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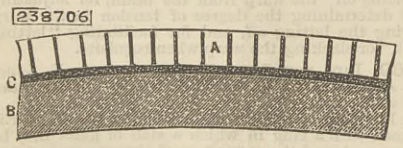
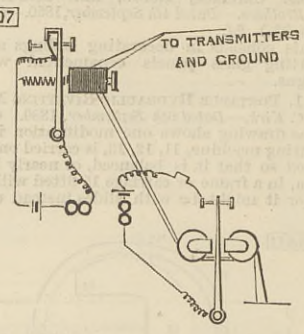


slag and lime, the stone blocks A, and the interstitial filling of grout, all as shown and described.

238,707. Multiplex Telegraph, *Henry C. Nicholson, Kenton, Ky.—Filed January 10th*, 1881.

Brief.—A device for riding over the kick in quadruplex telegraphs. When the neutral relay is demagnetised by a change of polarity its armature falls back, but not far enough to break the circuit of the local until the proper transmitter puts a weaker current to line regardless of polarity. *Claim.*—A neutral relay subject to reversals of the flow of the line current, the armature lever of which has a hook,

238,707

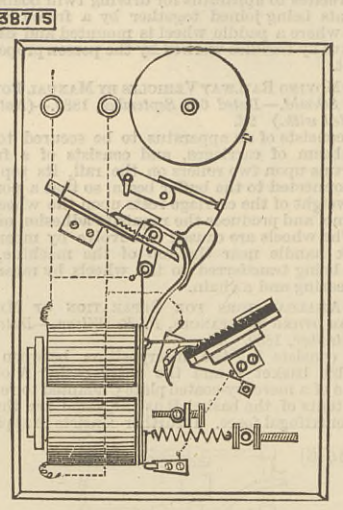


forming one terminal of the local battery, and also carries an insulated contact spring, forming the other terminal of said local battery, substantially as before set forth.

238,715. Signalling Apparatus for Telephone Lines, *John D. Richardson, Jr., Newport, R.I.—Filed November 10th*, 1880.

Brief.—A step-by-step movement consisting of sliding ratchets actuated by the bell armature. One ratchet controls a shunt circuit, which includes the station circuit closer and the armature, and the other ratchet controls a device for preventing the bell hammer from striking the bell except when required. *Claim.*—(1) The combination, substantially as hereinbefore set forth, of an electro-magnet and armature, a shunt circuit passing around said electro-magnet, a spring contact in said shunt circuit adapted to be opened and closed by the vibration of the armature, and an independent circuit closer in said shunt circuit,

238,715

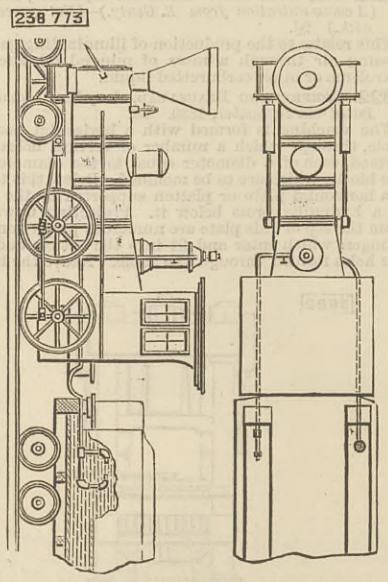


which is brought into action to close the shunt by means of a determinate number of pulsations traversing said electro-magnet. (2) The combination, substantially as hereinbefore set forth, of a call or alarm bell, an electro-magnet and its armature, whereby the same is actuated, a pawl, a series of ratchet teeth, a shunt passing around said electro-magnet, and a circuit closer, which is brought into action by the contact of the pawl with one particular tooth of the series of ratchet teeth. (3) The combination, substantially as hereinbefore set forth, of an electro-magnet and its armature, a pawl, a series of ratchet teeth, a dog or stop pawl, and a pin for tripping said dog at a determinate point in the movement of the ratchet. (4) The combination, substantially as hereinbefore set forth, of an electro-magnet and its armature, a pawl, a series of ratchet teeth, a dog or stop pawl, and a spring for holding said dog out of the path of the teeth after having been tripped by said pin. (5) The combination, substantially as hereinbefore set forth, of a series of ratchet teeth, a dog, a spring for holding said dog out of the path of the ratchet teeth, and a pin moving with the ratchet teeth, which acts to trip the spring and engage the dog with the said teeth, when the mechanism is restored to its normal or zero position. (6) The combination, substantially as hereinbefore set forth, of an electro-magnet and its armature, a bel hammer attached to said armature, and a bell with a stop lever, a lifter, a series of ratchet teeth, and a pawl actuated by the said armature.

238,773. Combined Heater and Muffler, *Gilmore C. Fink, St. Petersburg, Pa.—Filed November 12th*, 1880.

Claim.—(1) The combination of an injector located within the tender, and a blow-off chamber, with the safety valve, said chamber and injector being connected by a suitable pipe, whereby the blow-off steam is condensed, and the noise usually occasioned thereby is avoided, in the manner described. (2) The combination with an injector located within the tender, of the

238,773

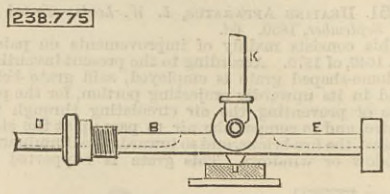


water-circulating device, operated by blow-off steam from the boiler, by which the water passing through said injector, or a portion thereof, is made to circulate and again pass through the injector, in the manner and for the purpose herein set forth. (3) The method herein descriped of retaining the hot water in one portion of the tender by means of a steam injector and a circulating device, all arranged and operating together, for the purpose set forth.

238,775. Expansion Joint, *William Forman, Bradford, Pa.—Filed January 22nd*, 1881.

Claim.—An expansion joint consisting of the case A, having the closed portion E, passage F, leading to the

238,775



pipe K, substantially as specified, and a cylindrical portion B provided with a stuffing box, in combination with the pipe D, for the purposes described.

238,802. Rotary Engine, *Alonzo Noteman, Toledo, Ohio.—Filed September 11th*, 1880.

Claim.—(1) In a rotary engine, a removable knuckle or interposed retaining bar placed on the end of the blade, and adapted to carry the oscillating saddle, so that the latter will readily adjust itself in the revolutions of the piston, substantially as set forth. (2) In

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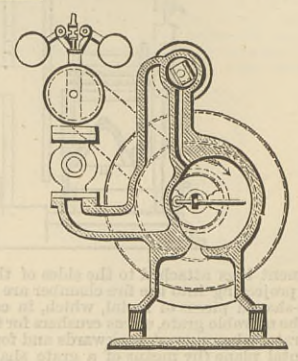
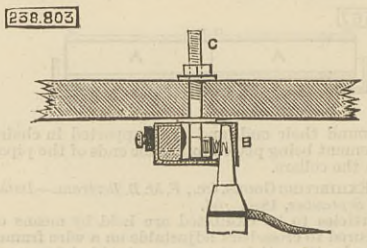


a rotary engine, a blade having its ends provided with dovetail tenons, a removable knuckle having a dovetail mortise, which slides over the tenon on the blade, and the removable saddle, which slides on to and has an oscillating movement thereon, substantially as set forth.

238,803. Switch for Telephone Exchanges, *Augustus H. Palmer, Utica, N.Y.—Filed June 28th*, 1880.

Brief.—A modified form of spring jack, the moving parts being enclosed in a circular case. The plug has the conducting cord entering the handle laterally and secured with a nut and washers. *Claim.*—(1) The combination of the perforated case B and pin with the pivotted dog G and male and female screws, arranged in the manner and for the purpose set forth.

238,803

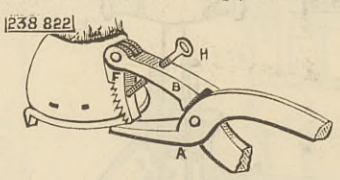


(2) The jack or dog G, provided with the arms or lugs and arm and contact points, in combination with a plug or plugs, whereby the ground is cut off and an electric circuit established, as set forth. (3) The pin or plug constructed as described, in combination with washers, nut, and wire, whereby the wire is admitted through the side of the plug handle, and a simple and reliable connection made.

238,822. Horseshoe Nail Clincher, *Fredrik Wierwille, Columbus, Ill., assignor to Reuben H. Roland, same place.—Filed September 11th*, 1880.

Claim.—In a blacksmith's tongs, the combination of

238,822



the jaws A B, toothed bit F, and set-screw H, substantially as shown and described.

238,845. Grain Drill, *Hiram L. Brown, Shortsville, N.Y.—Filed December 11th*, 1880.

Claim.—(1) In an adjustable rank grain drill wherein a part of the drag bars are attached to the permanent frame, a movable bar to which the alternate remaining drag bars are attached, combined with one or more supporting springs J, whereby draught resistance upon the bar H is slightly more than counterbalanced, so that the bar and its attached teeth may be moved backward with but slight application of power. (2) In an adjustable rank grain drill wherein one set of the drag bars are attached to the permanent frame of the machine, and another and alternating set are attached to a movable bar H, one or more springs

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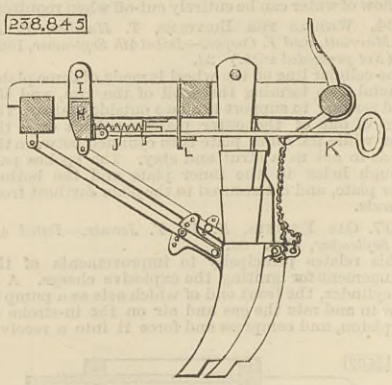
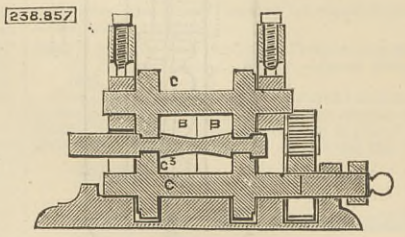


J, the tension whereof is adjusted to be in excess of the ground resistance to the advance of the drill teeth, and thereby approximately balance said teeth while in action, combined with mechanism whereby the attendant can at will move said bar H forward or backward, as desired. (3) In an adjustable rank grain drill wherein one rank is adjustable and the other non-adjustable, a bar H mounted upon swinging arms I, the drag bars of said adjustable rank being attached to said bar, combined with the counterbalancing springs J and rod K, whereby the attendant may control the position of said bar H, substantially as set forth. (4) In an adjustable rank grain drill wherein one rank is adjustable and the other not, the swinging bar H, to which the adjustable rank is attached, combined with the springs J, rod K, and locking stop L, as set forth.

238,857. Roll for Rolling Car-axles, *Thos. S. Cook, Cleveland, Ohio.—Filed May 31st*, 1879.

Claim.—(1) The mechanism for rolling railway car axles, consisting of two rolls B geared to run in the same direction, their surfaces conforming to the central portion of the car axle, and in connection therewith two rolls C, located opposite the space between the first rolls and adapted to roll the journals, the said rolls B and C provided with adjusting mechanism for feeding them toward the bar that is being rolled, substantially as and for the purposes described. (2) The combination, with the rolls B B, of the rolls C C, the said rolls C being provided with

238,857

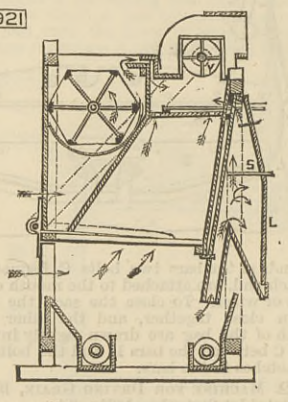


collars C^3, made to extend across the ends of the rollers C, and bearing upon the axle to hold the same in position, substantially as and for the purposes described. (3) Apparatus for changing the surface of a bar of metal into another form, in which its external surface shall be concentric with the axis of the bar, but shall vary in diameter, said apparatus consisting of two parallel rolls adapted to be brought against the bar, between which rolls the bar may be inserted longitudinally of the axes, and a second set of rolls located opposite the space between the first, and adapted likewise to be brought against the bar by being collared in beyond the outer surface of the first set, substantially as and for the purposes described.

238,921. Middlings Purifier, *John A. Kister, Mill Brook, Ohio.—Filed December 8th*, 1879.

Claim.—The combination, with the shaker and bolting reel and the fan *y*, of the tailings separator L,

238,921



having the inner wall inclined so that its upper part overhangs the pocket *f*, and the perforated diaphragm S, all constructed and arranged as shown and described, for the purpose specified.

CONTENTS.

The Engineer, April 15th, 1881.

South Kensington Museum.—Visitors during the week ending April 9th, 1881:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 9579; mercantile marine, building materials, and other collections, 3897. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 2409; mercantile marine, building materials, and other collections, 338. Total, 16,223. Average of corresponding week in former years, 15,965. Total from the opening of the Museum, 19,817,191.