CRYSTAL PALACE ELECTRICAL EXHIBITION.

No. VI.

There is always an affection for what is old by those whose taste lies in the way of archæological studies, and hence those interested in the electric light view with more or less pleasure the progress made by the oldest of the companies. It was under the auspices of the British Electric Light Company that the Gramme machine became so widely known in England; and the early installation at St. Enoch's, at Glasgow, was done by the company. The Exhibition at the Crystal Palace shows no decadence in enterprise, for the Brockie arc lamps, and the British incandescent lamps, are generally looked upon with great favour. The Brockie arc lamps are from a new design, a modification of his earlier lamps, and like them are regulated periodically. One of these lamps is shown in a projector, and this lamp is regulated in a very ingenious manner by a Griscoin motor placed just outside the office. The British incandescent lamp has not received sufficient attention. It seems to last well, to give a good light, and has a much larger bulb than either of the other incandescent lamps exhibited. At first sight the increased space, from which air has to be pumped, might be supposed to militate against such perfect vacua as we get in the Swan, Lane-Fox, Edison, or Maxim lamps; but as we have said, the vacuum seems to be admirable. The star chandelier arrangement is simple and convenient. A double series of spokes insulated from and opposite to each other form the connecting links. Between these, the lamps are placed, two springs, one on each side of the neck, one spring making contact with one spoke, the other with the other, and so with the different poles of the generator. Fig. 1 shows the lamp without a socket, while Fig. 2 shows one form of socket for connection.

The portion of the Crystal Palace which the British Electric Light Company is illuminating is that part of the nave that extends from the grand organ in the direction of the Alhambra Court. In this part of the nave it has thirteen Brockie lamps of 2000-candles power, arranged in two rows of four each and a central row of five. Passing round towards the back of the organ there are four more Brockie lamps illuminating the refreshment department. At the corner of the staircase leading into the gallery the company exhibits a model street lamp carrying a Brockie lamp, also of 2000-candles. There are six more of these lamps disposed on or about the main entrance to the palace, making a total of twenty-four.

On passing down the nave, on the left is found the Egyptian Court, which has been fitted by this company with about 120 of its improved "British" incandescent lamps, which are shown to great advantage by a variety of Venetian glass chandeliers, vases, &c., which have been lent for the occasion by Messrs. Jas. Powell and Sons. The passages at the back and sides of the Egyptian Court are illuminated by a new form of electrolier in the shape of a star, some of these being arranged to carry five and some ten lamps.

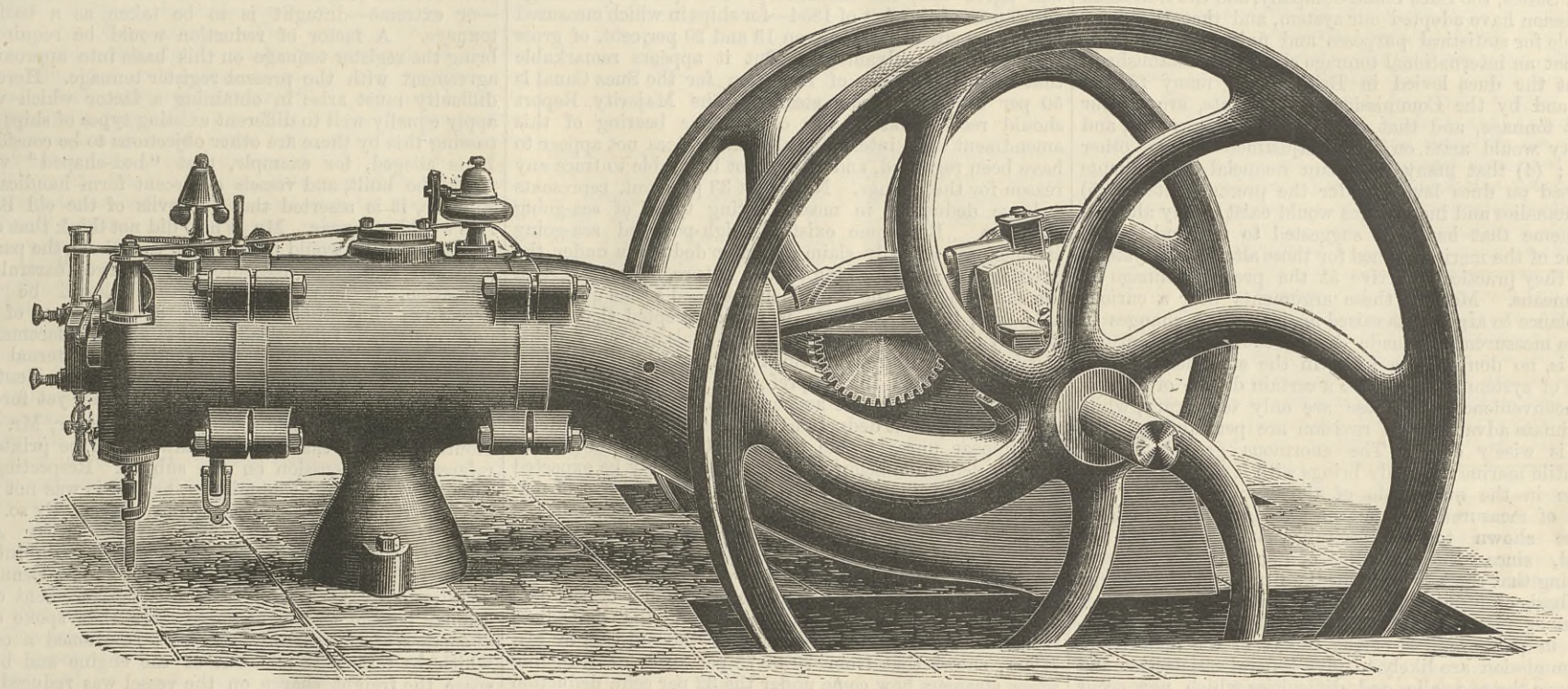
On the opposite side, in the Italian Court, a very handsome electrolier has been suspended, carrying forty-two lamps. This electrolier has been specially designed to secure extreme lightness, and is elegant without being weak. The simplicity of the design allows of the various parts being easily kept clean.

The company's office is lighted by "British" incandescent lamps. On the table outside the office is shown a Hodson rotary engine and Gramme machine of the M type, which is driven as a motor; also a case showing the process of manufacture of the "British" incandescent lamps, and a highly-finished Brockie lamp. Outside the office are two "British" incandescent lamps of about 500-candle power each. These lamps are worked in series off the same circuit as those in the Egyptian Court, and take a current of about eight ampères. These two lamps are, we believe, by far the largest incandescent lamps yet exhibited.

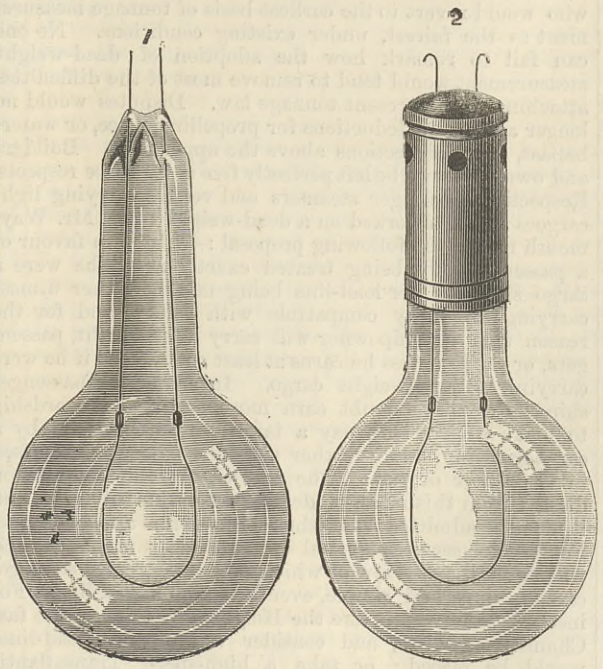
The machinery will be found in the basement, and consists of two 16-horse power portable engines by Marshall, Sons, and Co., of Gainsborough, also an 8-horse power compound engine by the same makers, which have already been described in The Engineer. This last engine is used me ely as a standby, and also to supply steam to a 12-horse power Hodson rotary engine, which is employed in driving a "D" Gramme machine. The line of shafting, 56ft. in length, extends for the whole length of the engine-room; this is arranged in two halves which are connected by a coupling in the centre. Each of these halves is driven by one of the 16-horse engines, and it is so arranged that in the event of one engine breaking down the shaft can be driven by the remaining one. The Gramme machines are as follows:—Six of the "H" type, two of the "E" type, six of the "A" type, and six of the "B" type. Three of the H machines are used in driving the twenty-four Brockie arc lamps above-mentioned, eight being in series on each machine.

The incandescent lighting is divided into three circuits. One circuit, which is supplied by two "B" Gramme machines coupled for quantity, leads to the Egyptian Court table, and the office lamps; in all 111 lamps, exclusive of the two large lamps of 500-candles each mentioned above, which are also driven in this circuit. Another circuit with 102 lights in the Egyptian and Italian Courts has the current supplied by two similar machines. The third circuit is supplied by an "H" machine, which supplies twelve star electroliers in the passages; of these, four contain ten lamps each, and eight contain five lamps each, in all eighty lamps. These lamps are coupled in double multiple series—that is to say, there are two circuits leading from the machine, each of which contains four parallels of ten lamps each. The external resistance of this circuit is 16 ohms, and the current required is 22 ampères.

We have referred already to the gas engines exhibited by Messrs. Crossley Brothers for driving dynamos at the Crystal Palace. They will be found at the north side of the Palace, not far from Messrs. Galloway's fixed engine, and nearly at the back of the entertainment theatre lit up by Edison. At the Crystal Palace there are eight Crossley engines, viz., one 16-horse power nominal gas engine, indicating 40-horse power; three 12-horse power nominal gas engines, of 25-horse power each, indicating 75-horse power; one 8-horse power nominal gas engine, indicating about 15-horse power; one 3½-horse power nominal gas engine, indicating 5·8-horse power; one 2-horse power nominal gas engine, indicating 3·9-horse power; one ½-horse power nominal gas engine, indicating 2-horse power. The total indicated horse-power is 141·7 The brake or effective horse-power of these engines when in good order is stated to be about five-sixths of the indicated power. The 16-horse power engine is an entirely novel design, so far as the framing is concerned. We illustrate it above. The form is at once rigid, and most economical of material, while nothing can be easier to fix, nor depend less on the skill of the erector. This engine has also a new form of governor, in which, by changing the position of a link against the end of which a cam presses, the gas supply is varied by changing the period of admission. The air supply is, nevertheless, unaffected. This is a desideratum in Crossley engines. The principle of this new movement, which is simplicity itself, and yet is equal to varying the cut-off in steam engines, is also applicable to steam engines. If applied to them a separate small steam valve is put outside the slide casing, and on it the governor may operate in a manner analogous to that in which it operates on the gas valve. It is a form of governor arrangement which has the important advantage of offering no appreciable resistance to the governor itself, the work of moving the valve being done independently by the shaft of the engine. Everything about this engine is thoroughly substantial, durable, accessible, and for the most part even elegant in form. A small ½-horse power nominal engine, which drives a number of Swan lamps, with a Siemens dynamo affixed to it on a suitable stand, forms a complete little electric plant, adapted for use in private houses, and is, we think, a very good little apparatus, and entirely novel, too, as a small installation.



MESSRS. CROSSLEY BROS. 16-H.P. GAS ENGINE.



THE INSTITUTION OF NAVAL ARCHITECTS.

The proceedings of this Institution recommenced on Thursday morning, the 30th ult., with a paper by Mr. W. H. White, Chief Constructor of the Royal Navy, on

The Revision of the Tonnage Law.

The author embraced the occasion of the meetings of the Institution as an opportunity for the necessary discussion of the various proposals for the revision of the tonnage law made in connection with the work of the Royal Commission of 1881. The first question was—Having regard to the present conditions of trade and shipping, should internal capacity be retained as the basis for tonnage measurements? The majority of the Commissioners have answered this question in the affirmative, and given reasons for their opinion. Dead-weight was undoubtedly regarded as the fair basis for assessment of tonnage dues up to about half a century ago; and tonnage laws—like the B.O.M. rule—depending upon external measurements, were intended by those who first framed them to approximately measure dead-weight capability. In framing the tonnage law now in force two fundamental conditions were accepted: First, that the taxable tonnage of a ship should be represented by her freight-earning power; second, that the space available for remunerative service—the conveyance of passengers or cargo—should be taken as the measure of freight-earning power. A reference to Moorsom's excellent book on "The Laws of Tonnage," or to his other publications, will show that the above is a fair statement of the intentions of the framers of the Act of 1854. Leaving out of account for the present the difficulties which arise in determining what shall or shall not be included in the taxable space, and not entering into the vexed question whether tonnage dues should be assessed on earning power, it may be well to inquire whether the changes in the construction and propulsion of ships made since 1854 have not necessitated some modification of the opinion that internal capacity is the fairest measure of the possible earnings of most ships. There are undoubtedly many vessels in which what was thought to hold good generally in 1854 still holds good; as, for example, passenger steamers and vessels engaged in carrying light merchandise. On the other hand, in the great majority of ships at the present time, the limit of freight-earning is to be found in their dead-weight capability. Another reason for abandoning the present basis of measurement has been found in its supposed tendency to foster the construction of specially unsafe types of ships. Here there is a great conflict of opinion, not merely amongst the witnesses, but between the majority of the Commission and certain dissentient members. The controversy as to the "well-deck type" of ship, for example, can scarcely be said to have been brought to a satisfactory conclusion. Other circumstances besides the tonnage law appear to have encouraged the construction of well-deck

ships, and if the extent to which they should be loaded were duly considered, there is no *à priori* reason why this type should not be safe at sea. Admitting that Mr. Waymouth is correct in saying that "the aim of the ordinary shipowner is to have a vessel which will carry as many 20 cwt. tons upon as few 100 cubic feet tons—on which he pays his tonnage dues—as he possibly can," it is obvious that "the 20 cwt. tons" in a given ship depends upon the load line. If Lloyd's fixed such a line for well-decked ships as they do for awning-decked ships, the former class would probably be less deeply loaded than it now is, and be proportionately safer. The majority of the late Commission consider that sufficient grounds for resisting any change in the principle of measurement by internal capacity can be found in the following summary of facts:—(1) That the 39,000 ships of all descriptions and size, constituting the British Mercantile Marine, are now admeasured under a system based on internal cubical capacity, with deductions for crew and propelling space, and that the mercantile and shipping community are familiar therewith and base their transactions thereon; (2) that all the chief maritime countries of Europe, the United States, the Suez Canal Company, and the Danubian Commission have adopted our system, and that it is very desirable for statistical purposes and uniformity of taxation that an international tonnage should be established; (3) that the dues levied in British and many foreign ports, and by the Commissioners of Lights, are on our present tonnage, and that great confusion, expense, and difficulty would arise on their adjustment to any other system; (4) that many important financial engagements are based on dues levied under the present system; (5) that anomalies and inequalities would exist in any alternative scheme that has been suggested to us; and, lastly, that one of the merits claimed for those alternative systems is that they practically arrive at the present tonnage by other means. Most of these arguments bear a curious resemblance to arguments raised against other changes in tonnage measurements made during the present century. There is, no doubt, some force in the statement that a change of system must involve a certain degree of novelty and inconvenience, but these are only temporary, while the ultimate advantages of revision are permanent, if the work is wisely done. The enormous growth of the mercantile marine naturally brings with it a corresponding increase in the magnitude of the task of revising the system of measurement; but on this ground, if revision can be shown to be desirable, it should not be delayed, since the growth of shipping continues. Assuming that there is no immediate prospect of a change in the basis of measurement, it seems desirable to consider whether or not the amendments in the existing law suggested in paragraph 44 of the report of the majority of the Commission are likely to give general satisfaction and to remove the anomalies and difficulties which now occur in the application of the Act of 1854. After giving these amendments, Mr. White referred to their separate paragraphs as follows:—There can be no doubt that many of these amendments would prove advantageous if adopted. It may be noted that the advances made in scientific knowledge on the part of persons engaged in shipbuilding during the last thirty years appear to render it unnecessary to rigidly prescribe the mode of taking the measurements and making the calculation for the volume of capacity. Suggestions in three of the paragraphs are obviously made with reference to the Suez Canal regulations; another has grown out of recent occurrences, which need not be dwelt upon, and it is so reasonable that it must find general acceptance. No one is likely to find fault with the small favour granted to sailing ships; but it is singular that while a limitation in allowance is fixed for sail rooms, no similar limitation in deduction appears in the preceding paragraph relating to crew space, &c. The three most important paragraphs are those relating to depth of hold, for measurement, closed or covered-in spaces, and deductions for machinery and coals. These are also the amendments which seem most open to doubt; they deal with matters on which warm controversies have already arisen, and deal with them in a manner which will give satisfaction to few. Take, for example, the paragraph which is really an approval of the view taken by the Board of Trade of the disputed question of the measurement of ships built on the cellular system, with double bottoms fitted to hold water ballast. For the purposes of tonnage measurement, and for that alone, it is recommended that a hypothetical boundary shall be constructed from the bilges to the middle line of ships built on the cellular system. This hypothetical boundary in most cases would be a little below the inner skin of the cellular bottom, so that the nominal tonnage would be estimated to a boundary line involving certain spaces where cargo never could be stowed, because they are in the double bottom. This appears to be a departure from the fundamental principle of the Act of 1854. One obvious reflection, on reading the paragraph by which the Majority Commission justified this is, how should vessels be measured if built on the cellular system, but not fitted with water ballast? Cases of this kind may be very exceptional, but they are not beyond the range of possibility. Again, it appears somewhat singular that, just at the time when the transverse system of building with frames and floor-plates is being to a great extent displaced, a proposal should be made to take the old system as a standard, and to put a penalty upon departure from it. There is no recognition of the claims for a reduction of some kind in the register tonnage of ships, such as the awning-deck class, in which it appears that the whole of the available space can never be utilised. The Majority Report deals at length with this matter, and sums up the reasons for the recommendation in the following passage:—"We are of opinion that the exemption of any closed-in space from measurement into tonnage, as an inducement to owners to increase the safety of ships, is unsound in principle; and, if adopted, would have to be followed by new restrictions, upon which fresh complaints would be founded." Mr. White could not concur in this conclusion, but remarked that it would seem no difficult matter to deal with such spaces by an extension of the Act of 1876 relating to deck cargoes. If cargo or passengers were actually carried in the light erections, let those spaces be reckoned into the taxable tonnage; if not, let them be exempted. Should an authoritative load-line be compulsorily fixed for all ships, as seems not unlikely to happen, then, whatever factor of reduction may be employed in assessing the spare buoyancy of light erections, might also be employed in connection with the estimate of the contributions of these erections to the tonnage. Lastly, as to the deductions for machinery. The attempt made to define permanent bunkers, as Mr. Rothery has shown, is not likely to prove entirely successful; but this is probably a matter of small importance, in view of the alternative allowance proposed in the form of a percentage upon the measured machinery space, and in view of the maximum deduction allowed. High-speed steamers making long voyages will reach the 33 per cent. maximum deduction, without any refinement in measurement of coal space. All other seagoing steamers will profit by the percentage allowance upon measured machinery space. It may be assumed that agreement with the Suez Canal rules was the main motive for making this amendment, and almost everyone will agree that the abolition of the special percentage allowances of the Act of 1854—for ships in which measured machinery space lies between 13 and 20 per cent. of gross tonnage—is an advantage. But it appears remarkable that while the limit of reduction for the Suez Canal is 50 per cent. for screw steamers, the Majority Report should recommend 33 per cent. The bearing of this amendment upon international tonnage does not appear to have been regarded, and I have not been able to trace any reason for the change. No doubt 33 per cent. represents a large deduction in most existing types of sea-going steamers. But some existing high-powered sea-going steamers can actually claim a greater deduction under the existing law; and looking to the future, with its certain increase of speed, the limitation proposed seems unreasonably low, if the principle is to be accepted that spaces actually occupied by machinery and coals are not freight-earning. It had always seemed to the author that Moorsom was justified in his preference for gross tonnage as the fairest measure for assessment. But accepting facts, and assuming that deductions will continue to be made, it does appear unreasonable to lower the maximum limit of possible deduction below what may reasonably be expected to be reached in many ships, if the present types of machinery are continued in use. On the other hand, the proposal to allow 75 per cent. for coal space, &c., makes a very handsome present of available space to the great majority of cargo steamers fitted with compound engines, and ignores the probable increase in economy of coal consumption which may be looked for in the immediate future. A careful examination of the subject, by Mr. Kiaer, shows that from 70 to 75 per cent. of sea-going screw steamers now come under the 32 per cent. deduction rule of the law of 1854. These figures quite bear out the opinion just expressed, and seem to show that the amended rule for deduction rests upon no more scientific basis than that which it is proposed to abolish. The maintenance of the present basis of measurement can only be defended upon the grounds of expediency and convenience. These grounds are sufficient to make it necessary for the advocates of new methods of measurement to show that their proposals are less likely to cause difficulties, or anomalies, than the present system. However amended, internal measurements will give rise to disputes as to the spaces to be reckoned into gross tonnage, and the deductions to be allowed therefrom in estimating registered tonnage. But no less serious difficulties might arise in connection with alternative proposals. The principal proposals recently made proceed upon old lines, which formed the basis of earlier discussions. First, the dead weight basis of measurement. This is ably advocated by Mr. Waymouth, who would revert to the earliest basis of tonnage measurement as the fairest, under existing conditions. No one can fail to remark how the adoption of dead-weight measurement would tend to remove most of the difficulties attaching to the present tonnage law. Disputes would no longer arise as to deductions for propelling-space, or water-ballast, or light erections above the upper deck. Builders and owners would be left perfectly free in all these respects. Respecting passenger steamers and vessels carrying light cargoes and not worked on a dead-weight basis, Mr. Waymouth makes the following proposal:—"I am in favour of a passenger ship being treated exactly as if she were a cargo ship, and her load-line being marked at her utmost carrying capability compatible with safety, and for the reason that no shipowner will carry light freight, passengers, or cattle unless he earns at least as much as if he were carrying a dead-weight cargo. In first-class passenger ships he would no doubt earn more, and it is no hardship to make such a ship pay a tax equal to that paid by a cargo-carrying ship, whether she be as deeply immersed in the water or not." The majority of the Commission dissent from this mode of dealing with the difficulty, and it must be admitted that their objection is a forcible one. For special services special types of ships are built, and will be built, not a few of which cannot be treated as cargo-carriers pure and simple, even in fixing a load-line. For instance, take vessels like the Holyhead packets, or the fast Channel steamers, and consider where their load-lines would be placed; or take a high-speed Transatlantic steamer, and in imagination convert her into a cargo vessel. Another and perhaps less serious difficulty would arise in connection with the statistical uses of tonnage measurements. The actual weight of cargo on board, at any time, is suggested as the basis on which dues should be paid, and to assist in determining this weight, for a given draught, an officially guaranteed curve of displacement is to be carried. The tonnage of a ship would thus be a variable quantity, which is objectionable. What is still more objectionable is the attempt to assess earnings by the dead weight on board passenger steamers or vessels carrying light goods. As regard statistical uses, this form of tonnage would be impracticable. The next alternative system of measurement to be noticed is the "displacement tonnage," supported with so much ability by Mr. Rothery. This, also, is a revival of a proposal made long ago. In supporting it, Mr. Rothery follows the lines previously traversed by other writers, who considered service rendered, and not earnings or earning power, the proper basis for assessing dock and harbour dues. The general principle of service rendered has much to recommend it for adoption, were a change of system to be made. But the use of displacement as a measure of the space occupied does not commend itself, for reasons that have been repeatedly stated. For all practical purposes the water-space occupied may be taken as the parallelopipedon, of which the length equals the length extreme of a ship, the breadth her breadth extreme, and the depth her mean draught, except she trims excessively by the stern. For it is evident that if these three leading dimensions are the same, the possibility of berthing other ships at a wharf or in a dock is not sensibly altered by variations on the "co-efficient of fineness" expressing the ratio of the volume of displacement to the volume of the parallelopipedon. Another proposal deserving notice is what may be termed "parallelopipedon tonnage." Accepting the principle of service rendered, the volume of the parallelopipedon whose sides are the length extreme, breadth extreme, and mean—or extreme—draught is to be taken as a basis for tonnage. A factor of reduction would be required to bring the register tonnage on this basis into approximate agreement with the present register tonnage. Here also difficulty must arise in obtaining a factor which would apply equally well to different existing types of ships: but passing this by there are other objections to be considered. It is alleged, for example, that "box-shaped" vessels would be built, and vessels of decent form handicapped. Further, it is asserted that the evils of the old B.O.M. rule would reappear. Mr. White did not think that either of these results would follow. On the whole, the parallelopipedon system of measurement deserves careful consideration, if any new departure should be made hereafter; but this would be equally true of any new system. Like dead-weight and displacement, it would avoid the difficulties peculiar to internal capacity, but would bring in the difficulties incidental to fixing the load-line, and perhaps others not yet foreseen.

In commencing the discussion on this paper, Mr. Waymouth proposed that the 1854 law should be printed for reference in discussion on the subject. Respecting the recent report by the Commission, he said it was not really the report of the Commission, but only partly so. The 1845 law was based on freight earning space. As to cellular bottom ships, it was wrong to dip down into the water ballast and call it freight space. Mr. Denny had done good by his resistance to this measurement of the cellular bottom as freight space. He then spoke of the anomalies of the existing law, and mentioned a case in which by taking 12 tons out of the engine and bunker space the freight charge on the vessel was reduced from over 1100 to 900 tons. The law as it stands taxes shipbuilders and owners for improving the safety of their ships, and prevents the obtainment of proper freeboard.

Sir Edward Reed said it was only under certain conditions that a dip was made into the ballast for freight. The Commission was necessary, because the law needed protection, and Mr. Waymouth's propositions were to some extent absurd, as such vessels as the Holyhead steamers, with little immersion on one hand, and, on the other hand, deep screw vessels, could not be rated by them, and passenger ships could not be loaded so as to pay a proper freight due.

Mr. Denny said the measurement of the double bottom as freight could not be justified. If we measure part of it, why not all? This measurement prevents improvements, as it taxed them, and short voyage steamers got great advantage because bunker space could be so small. On long voyages shipbuilders grudge the space needed for the valuable safe double bottom, because it could not be used for freight, and yet was charged as such.

Mr. Scott spoke of the origin of the discussion, and referred it to the action of the dock boards, one of which had its receipts of £1400 reduced to nothing owing to the Act.

Mr. Rundell was of opinion that double bottoms contributed to freight earning in some cases, but the system of measuring and deductions was vicious, and one effect of the law had been during the past eight years that, on an average, vessels had 9 per cent. less freeboard and took 15 per cent. more cargo than previously.

Mr. John could not see what advantages Mr. Rothery could get by giving up space element for weight element, but encouragement should be given to the out-of-the-water part of the ship.

Mr. White, in reply, said Moorsom only intended to measure available cargo space, and this "service rendered" measurement was strongly supported by Bougier in his *Traité de Navire*, instead of measurement by earnings. He thought it was not by a Royal Commission, but by competent scientific naval architects, and such men as Moorsom, that this question could be settled.

The President remarked that the general opinion seemed to be against these reductions; and respecting the dipping into the cellular bottom to measure freight, it appeared the law interfered with safety, and, if so, the law was bad.

The next paper read was by Mr. W. W. Rundell, on

Tonnage Measurement, Moulded Depth, and the Official Register in Relation to the Freeboard of Iron Vessels.

Tonnage measurement was only referred to in this paper as far as it relates to the question of freeboard. Under-deck tonnage is an element which has been introduced more or less directly into all schemes for indicating on a ship's side percentages of spare buoyancy. A ship's registered tonnage is, however, of no value for this purpose any further than it approximates to or bears some fixed proportions to her total displacement. Until recently the proportion between the two has not differed very widely. Recently, however, by the introduction of double bottoms on the longitudinal construction in steamers the case has been much altered. In these vessels the difference between

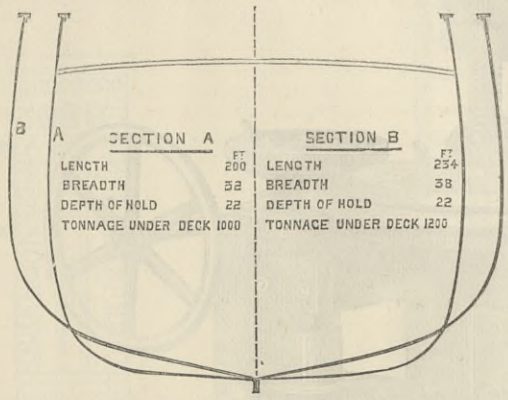
the internal and external measurements is so great that neither under-deck tonnage nor registered depth of hold are any longer satisfactory guides to their carrying power and freeboard. A continuous double bottom of twice the depth of ordinary floors is not at all unusual. A good many vessels of this type have been built, and are now building. Probably about one out of every eight steamers built during the past year was of this kind. Something more therefore than is now recorded in the official register of such vessels is requisite for estimating their freeboard. How can this deficiency in the official measurements be amended? What other recognised measures can be substituted for them? Among the first recommendations made by the late Tonnage Commission were proposals to give greater freedom to the official measures; to make new rules for measurement suited to the present state of shipbuilding; to make regulations for fixing a normal or standard depth for floor plates. Their motives for making these recommendations were evidently a desire to retain the Moorsom system of internal measurement, to equalise the incidence of tonnage dues, and to avoid any break or irregularity in the general tonnage statistics of this country. One may reasonably doubt the propriety of attaining either of these desirable ends by fixing a standard depth for floor plates. The remedy he submitted for consideration rigidly retains the principle of making one hundred cubic feet equal to one register ton. Under-deck registered tonnage will be obtained by multiplying total displacement in cubic feet by the proper fraction as indicated in the above table, and then dividing the quotient by the present divisor of 100. A vessel's registered depth of hold has never been more than an approximate index to her real depth, but its entry upon the ship's official register, and the ease with which it can be ascertained, have made it a very convenient factor in estimating freeboard. In the new type of steamer, as depth of hold bears no regular relation to the actual depth of the vessel, moulded depth becomes of immediate importance. Under the proposed mode of obtaining under-deck tonnage a record of depth of hold would no longer be needed, and moulded depth would naturally take its place on the official register. He referred here to a relation between moulded depth and total displacement, to which he directed attention in 1874. The chief point is that in vessels of medium form 30 per cent. of total displacement corresponds exactly to 25 per cent. of moulded depth, thus giving a simple mode of cutting off or indicating 30 per cent. of spare buoyancy in all vessels which approach the average form, and as there is usually very little difference in a vessel's displacement per foot above this point, it becomes very easy to indicate any smaller percentage.

The argument of the greater part of the remainder of this paper was founded on certain tables of freeboard which had only been issued tentatively by Lloyd's, and which are still under consideration. It was, therefore, considered that this was a matter still private to Lloyd's and not open for discussion. The reading of the paper was therefore stopped here by show of hands.

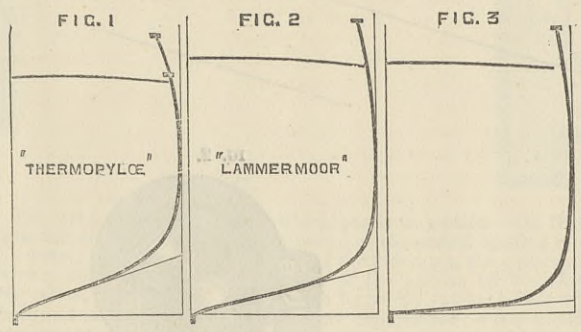
The next paper read after Mr. Rundell's had been stopped was by Mr. B. Martell, on

The Basis for Fixing Suitable Load-lines for Mercantile Steamers and Sailing Vessels.

In a recent issue of rules by the Government for the guidance of their officers relative to the load-line to be permitted to mercantile steamers and sailing vessels, it is observed that the load-line for steamers is to be determined in relation to the length of the vessel by allowing so many inches per foot depth of hold as the length varies; and for sailing vessels the freeboard is to be regulated by so many inches per foot depth of hold in relation to the tonnage. Here, then, we have two distinct principles; and as the Government have legal authority to detain vessels which are loaded to a greater depth than considered proper by their officers, whilst the Committee of Lloyd's Register have just provided a column in that register for the insertion, when desired by the owner, of the freeboard considered suitable for any vessel, it will, it is thought, not be considered uninteresting to glance briefly at the principles involved in the two rules referred to, and to their practical application. The rule of determining the freeboard of vessels by a proportion of the depth of hold is the oldest known, and it has many of the disadvantages which attached to the old rule for computing the tonnage of vessels, where their length and breadth only were taken, irrespective of the depth, and which led to the construction of narrow, deep vessels, having the least rise of floor and the smallest margin of stability. To perpetuate such a rule would be to hold out a direct encouragement to build the worst types of vessels, and if it were enforced, would do an injustice to, and render unprofitable, the finest sailing ships in the mercantile marine. To illustrate this, the diagram shows the forms of midship section of two sailing vessels. Section A shows the form adopted in olden times, and Section B that of many modern ships. If we suppose the narrow ship to measure 1000 tons, by the "depth of hold" rule in question, she would be permitted to load with a freeboard of 2·7in. to every foot depth of hold, which in this case would be 4ft. 11½in. If, however, the form be improved, by giving increased breadth and a more shapely rise of floor, as shown in Section B, and if by this desirable alteration the tonnage be increased to 1200 tons, discouragement is given to this improved type by increasing the freeboard, and thereby compelling the vessel to carry less cargo. The freeboard in this case would have to be increased from 4ft. 11½in. to 5ft. 1½in., representing a loss in carrying capacity of 32 tons of dead-weight; whilst, on the other hand, if these vessels were both laden so as to have the same percentage amount of surplus buoyancy, or lifting power, the broader vessel—Section B—would require to have 4in. less freeboard than the narrow, full vessel. By this comparison—if the same height of freeboard for both forms of vessels were insisted on—a loss is represented in carrying power of the better formed and safer vessel of about 100 tons; and the reason assigned for this appears to be that such vessels, with "great rise of floor, are more uneasy in a seaway." Such a reason as this will create amazement in the minds of many owners and captains of these fine vessels, as it is well known that this improved form of ship has been successfully sailed for years, not with increased freeboard, but with less, corresponding with the same amount of surplus buoyancy in the two cases. As differences of opinion, however, may exist as to what may be regarded as "great rise of floor," Figs. 1 and 2 are given, as showing midship sections of well-known vessels, having for their size as great or more rise of floor than any other vessels in the mercantile



marine. Section, Fig. 1, is that of the Thermopylæ, the celebrated Australian clipper, of about 1000 tons, belonging to Messrs. G. Thompson and Co., which vessel has now been running uninsured for the last fourteen years. Fig. 2 shows the Lammermoor type of vessel, of which many have been built in the Clyde for Liverpool owners. These vessels are about 1600 tons, and have been running for years, and are known from long experience to be some of the finest sailing ships in the world, carrying their cargoes without damage, and with the greatest comfort to their crews. The freeboard at which these latter vessels invariably sail corresponds with an amount of surplus buoyancy of 28 per cent. of the total volume of the vessel. Fig. 3 is the midship section of a full-formed vessel, similar to very many now built, and of the same principal dimensions as the latter. The inapplicability of a rule requiring the same height of freeboard for two such ships of dissimilar form is apparent, when it is considered that if the required height of free-



board of 5ft. 9in. were applied in the two cases, it would cause the more finely-formed ship to have a much greater height of freeboard than that corresponding with 28 per cent. of surplus buoyancy, with which she has been safely sailing for years, and would reduce the dead-weight carrying power of this fine class of ship by 200 tons, without, as far as can be seen, any corresponding advantages as to safety. The operation therefore of these two rules would appear to be that, by the rule of requiring the same percentage amount of surplus buoyancy, or lifting power, for all vessels of the same size, it can be fairly adapted to meet the requirements of vessels of various degrees of fineness; whereas by the application of the old inelastic rule of "Inches per foot depth of hold," vessels of the shapeliest form, which experience has shown exhibit the finest sea-going qualities, cannot be sailed in fair competition with those whose sections approach more nearly to a rectangular form; or, in other words, which, under the same principal dimensions, can, with the same height of freeboard, carry the greatest amount of dead-weight cargo. To frame a rule for freeboard which would be generally considered satisfactory for all types of sailing ships is simple as compared with that of determining what would be accepted as suitable for the various types of steam vessels now in existence. When once the principle was determined and rules framed for flush-decked sailing vessels, it would be only necessary to consider the allowance fairly due to the additional safety afforded by a well-constructed forecastle and poop. But in reference to steamers, it may be safely affirmed that having in view the large deck openings found to be necessary in steamers in the engine and boiler spaces, and for rapidity of loading and discharging, those which are quite flush-decked are exposed to greater danger than where such openings have substantial superstructures over them 6ft. or 7ft. high. There is no doubt that whilst greater safety is provided by these erections, there is to some extent an element of danger imported. Where, for instance, a vessel has a long poop and bridge-house connected, in addition to a forecastle, the space between the front of the bridge-house and after part of the forecastle being enclosed, as is sometimes the case, by high solid bulwarks, a space, or "well"—a term it is often known by—is formed for the reception of water which may find its way into it in rough weather. This danger, however, has, in comparison with the additional safety afforded by a long raised deck, or poop and bridge-house and forecastle, been much magnified, when low bulwarks and proper freeing ports are provided, and a strong prejudice in the minds of some has been unnecessarily created against this type of vessel, which experience of their relative immunity from loss shows to be unmerited. The liability of small flushed-decked cargo steamers to great peril in encountering heavy gales at sea, from the certainty of the deck being inundated, is so clearly recognised by steam shipowners of experience, that such vessels are very rarely built for cargo-carryin purposes for over-sea voyages, but, as a rule, are protected by substantial superstructures extending over varying lengths of the upper deck, and instead of owners being discouraged from incurring the extra expense, it is thought that every encouragement should be held out by allowing a much fairer reduction for the additional safety provided. The element of length is one of considerable importance in assigning a proper amount of surplus buoyancy or freeboard. Many steam vessels, however, exceed any normal proportionate length which might be taken as a basis, and for these additional freeboard should be provided. Probably the simplest way in which this provision can be made is by arranging a table upon the basis of surplus buoyancy for steamers of normal proportions, in which the length does not exceed twelve times the moulded depth, and then requiring additional freeboard for vessels of greater relative length, the amount of increase being dependent in each case upon the excess of the ratio of the length to the depth above that limit. Where, however, as is the case in many one and two-decked vessels, a considerable portion of the length of the deck is covered by erections of a substantial character, there does not appear to be any necessity for this increase; and, for a similar reason, in spar and awning-decked vessels the amount of the freeboard should not be made strictly dependent upon that assigned to flush-decked vessels of the same proportionate length and depth to the main deck. Any general scheme for fixing safe load-lines for vessels cannot be satisfactory if it be known that vessels of certain types and proportions will be frequently loaded—and, in fact, are built to be loaded—with cargoes of such a nature that when immersed to the line assigned they will be unseaworthy from instability. This and many other points may be provided for either by fixing on a sufficient proportion of surplus freeboard buoyancy, giving a safe range of stability for the proportionately narrowest vessel; or by fixing this amount for vessels of ordinary definite proportions, and requiring a greater amount for vessels where the proportionate breadth is less than this. The best and justest course would be to provide for the ordinary and best description of vessels, and leave the badly-proportioned to be dealt with by a special rule.

Mr. Denny, in the discussion which followed this paper, and which was influenced by, if not to some extent upon, Mr. Rundell's paper, seemed to consider that the Institution should not endorse the idea that large vessels needed greater surplus buoyancy. When a ship is foundering, as great an amount of surplus buoyancy is wanted so as to give time for escape from a small as from a large vessel. As to freeboard or surplus buoyancy for stability, he considered that static stability measured by metacentric height and dynamic stability as measured by freeboard, were convertible values, as a ship may be equally safe and good with small metacentric height and large freeboard, or with large metacentric height and low freeboard. Mr. West referred to certain freeboard tables mentioned by Mr. Martell, and said that the question had been brought forward by the latter much as a matter of strength, which he did not agree with. Neither was the question to be settled by any reference to coefficient of fineness or dead weight stability. He could not see why the influence of length should be brought in at $\frac{1}{12}$, it might with equal reason be brought in at $\frac{1}{9}$. Safety he considered could not be other than relative, and, if so, the question was how much safety was required. If safety was to be the chief condition, then ships would be built of a form to meet that requirement, but speed and some other considerations would have to be proportionately given up. His meaning he illustrated by saying that if every vehicle which passed through the city of London were prevented exceeding four miles an hour, probably all of the several hundred lives lost per annum by street accidents would be saved. But the speed was a necessity, and safety a question of how much risk is it worth while to run. Mr. Withy, whose firm has built a good many well-decked ships, denied Mr. Rundell's statement as to deeper loading now than eight years ago. He gave some figures, showing the safety of well-deckers, and laid much stress on the value of shear, which in these ships was often 20in. in 100, so that with 2ft. freeboard amidships they had 4½ft. aft and 8ft. forward, and one ton buoyancy in shear was more valuable than one ton amidships. Well-deckers have really, he said, less well than any other ships. Mr. Scott maintained that it was necessary to have greater surplus buoyancy in large than in small ships, as large ships took such heavy seas, and where a big ship would go through seas or roll in a trough, the smaller ship, with less surplus buoyancy, would ride the seas and be the safer. Under the present rules shipbuilders were placed in an absurd position as to freeboard, as proved by the recent cases in Glasgow, which could not be settled because scientific witnesses could not agree as to freeboard. One speaker said the wealth of the several ship insurance companies refuted what had been said as to deeper loading and less safety than years ago. There were unsafe ships and unprincipled owners, but the rules generally should not be specially framed to meet an evil which only relates to 5 per cent. of the shipowing community. These should be separately dealt with.

Mr. Martell then replied to the discussion; and the next paper read was by Mr. W. Denny, "On Launching Velocities," which will be found on another page.

(*For continuation see page* 254.)

The Work of Inventors.—The number of applications for patents for the first three months of the present year reached 1582, showing an increase of 153 over the number for the corresponding period of last year. Should this increase be maintained, the total for the year 1882 will probably exceed 6000. A considerable proportion of the applications came from abroad, and in the period above named, France furnished 126, Germany 120, and the United States 209. No less than 367 originated in London. Thus France, Germany, the United States, and London, together, contributed 822, or considerably more than one-half of the total number for the first three months of 1882.

WORSSAM'S CASK-MAKING MACHINERY.

Fig. 5.

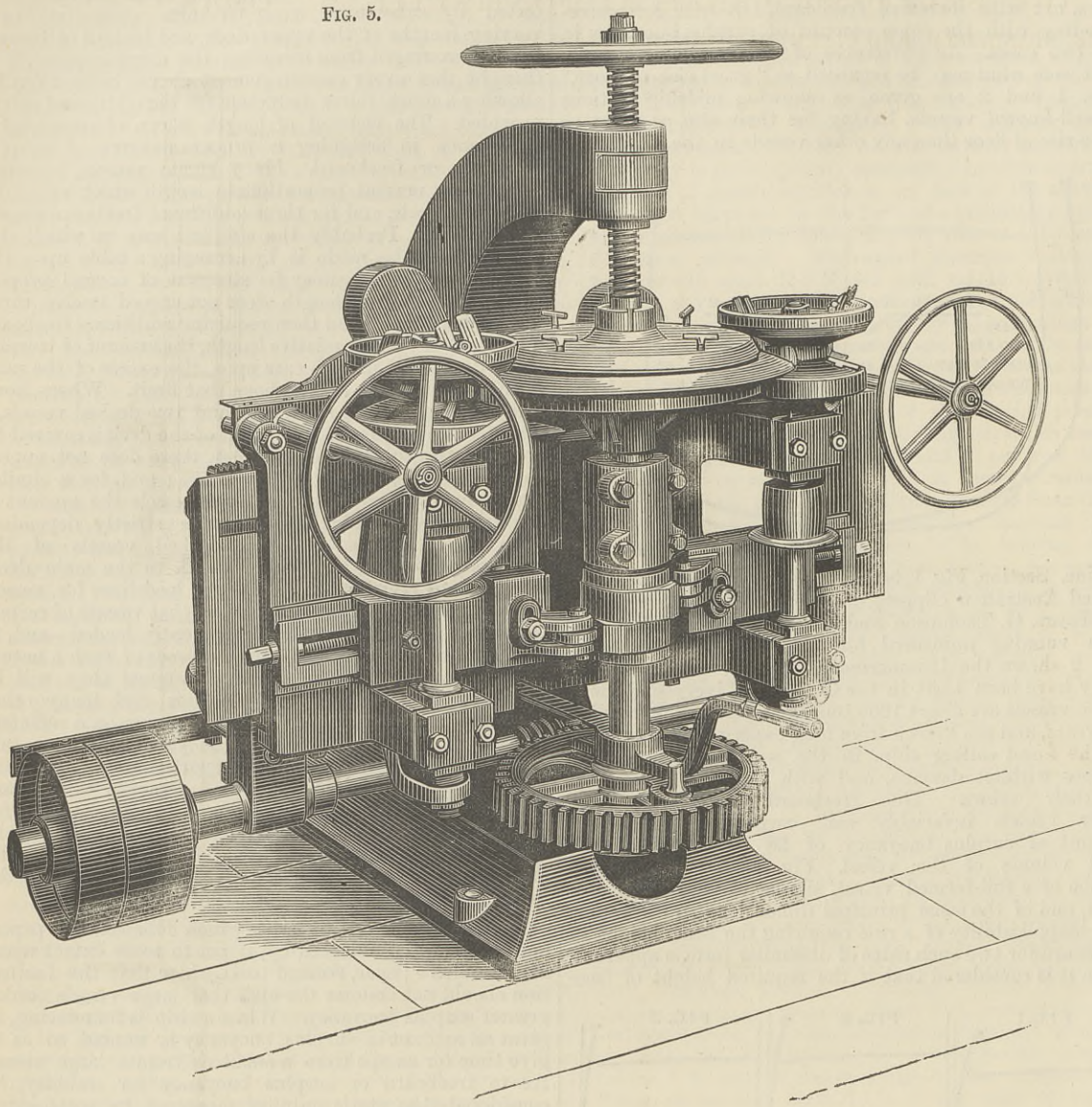


Fig. 1.

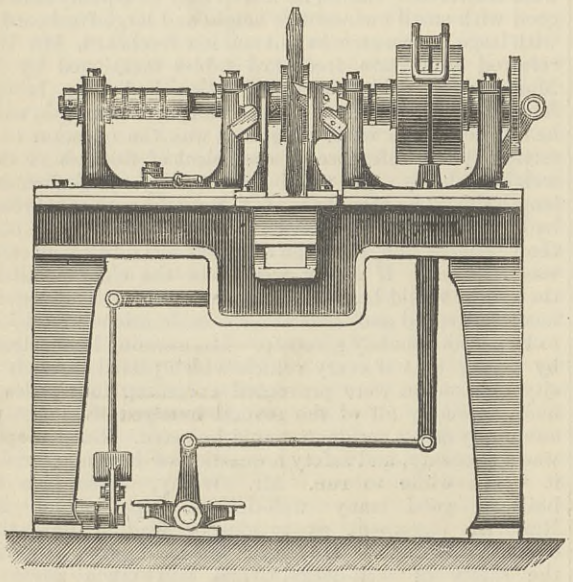


Fig. 2.

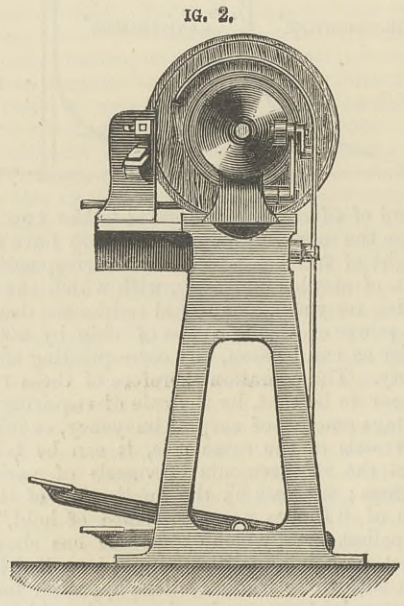


Fig. 3.

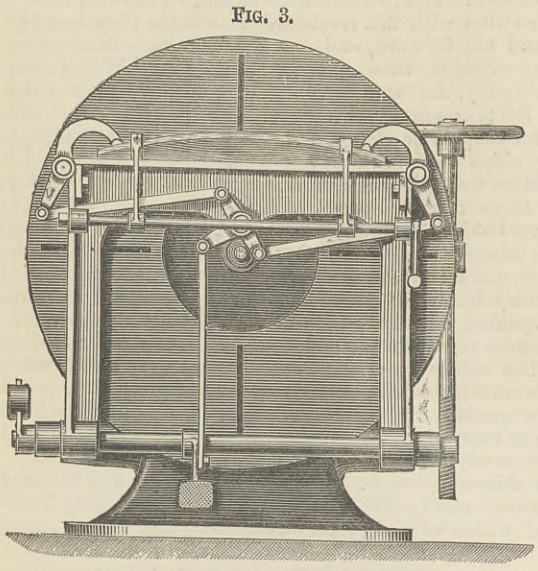
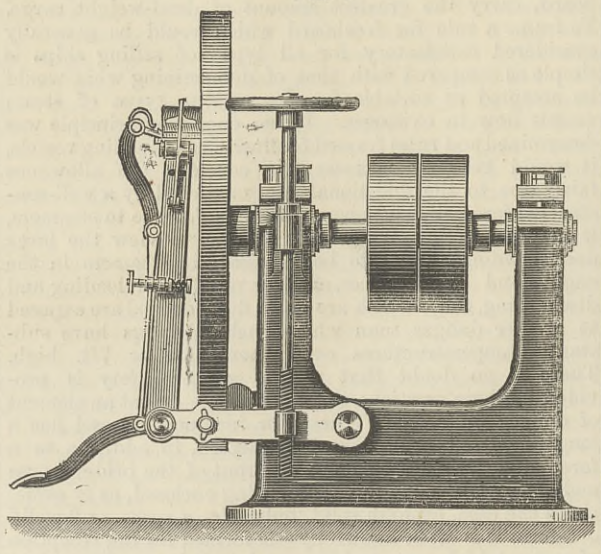


Fig. 4



A number of new machines for cask-making plant have recently been made by Messrs. S. Worssam and Co., Chelsea. The machines now made by the firm for the manufacture of slack, semi-tight, and tight casks are of several kinds, and present some interesting features in mechanical design. Amongst the machines for making casks for cement, flour, and other dry goods, is the head-turning machine shown at Figs. 1 and 2. Heads for this purpose may be turned truly circular, which is not the case with others to be referred to. After the pieces forming the head have been dowelled together, they are then ready for the head-turning machine. The head is clamped between two flat circular plates, which revolve rapidly. The headstocks carrying the revolving head are moved to the right and left against cutters fixed to a bracket on the front of the machine, and which give the desired shape or configuration to the head, cutting it either square or bevelled. A foot lever in connection with one of the headstocks serves to set the head in motion, and at the same time clamp the head. The reverse motion of the treadle arrests the motion of the head and unclamps it. A second lever in connection with the bracket carrying the cutters serves to bring forward the cutters, according as the head is to be squared or bevelled.

Various sizes of heads can be made in this machine by simply adjusting the cutters to suit the dimensions of the required heads, and by employing different and suitable sizes of circular plates screwed on the mandrils of the headstocks. This cask head is driven at about 500 revolutions per minute. For making semi-tight casks for sugar, coffee, salt, fish, &c., another form of head-turning machine is employed, but the same end is attained by similar means.

A machine exhibiting much ingenuity in design for jointing staves for this class of cask, is shown by the engravings, Figs. 3 and 4, of a single disc stave jointing machine. This machine consists of a standard carrying a spindle, on one end of which is mounted a disc, fitted with four cutters, and running at about 300 revolutions per minute. This disc is made slightly concave, so that the stave does not require to be so much bent when presented to the cutters as would be requisite were the disc quite flat.

The stave to be jointed is secured to a wood template of the curvature of the inside of the required barrel, screwed to a carriage in front of the cutter disc. This carriage is hinged or pivotted, so that the stave can be brought into contact with or removed from the disc. The stave is held by fingers at each end of the carriage, actuated by levers and a foot treadle, and cannot be loosened until the carriage is withdrawn from the disc and the foot removed. After one end of the stave has been jointed it has to be removed from the clamp and reversed, to joint the other edge. In order to secure both ends of the staves being of equal width, stops are provided, against which the already jointed edge of the stave is pressed. These stops work on one spindle, and have a simultaneous movement parallel to the face of the disc. A foot treadle serves to bring these stops into action or remove them as the case may be.

The engraving represents a machine with one disc only. It can, however, be converted into a double machine by the addition of a second disc mounted at the opposite end of the spindle, and an extra carriage. In some cases the discs are surrounded by wrought iron cases in connection with a pneumatic apparatus for drawing off the dust generated by the cutters. In making tight casks for petroleum, wine, beer, &c., it is necessary to take into consideration the different expansions or shrinking and swelling of the wood transverse to or in the direction of the grain. In turning and bevelling the heads for these casks, for instance, an oval form has to be adopted, the longest axis of the oval being that across the grain. A machine for doing this is shown in the engraving, Fig. 5. This machine completes the heads at one operation ready for insertion into the casks. The head to be operated upon is clamped between two circular plates mounted on vertical spindles, to which a slow motion is given by a worm wheel and worm keyed to a shaft driven by a pair of fast and loose pulleys. The top circular plate is fitted with steel points, and adjusting screws, which press into the head and prevent the possibility of any of the pieces composing it getting loose whilst under the action of the cutters. The cutters are fitted to gun-metal heads mounted on vertical spindles revolving in different directions at a high speed in slides or carriages, which are adjustable to suit different sizes of heads. In consequence of the grain of the wood of which the head is composed expanding in one direction more than in the other, the head has to be made oval, the longer axis being across the grain of the wood.

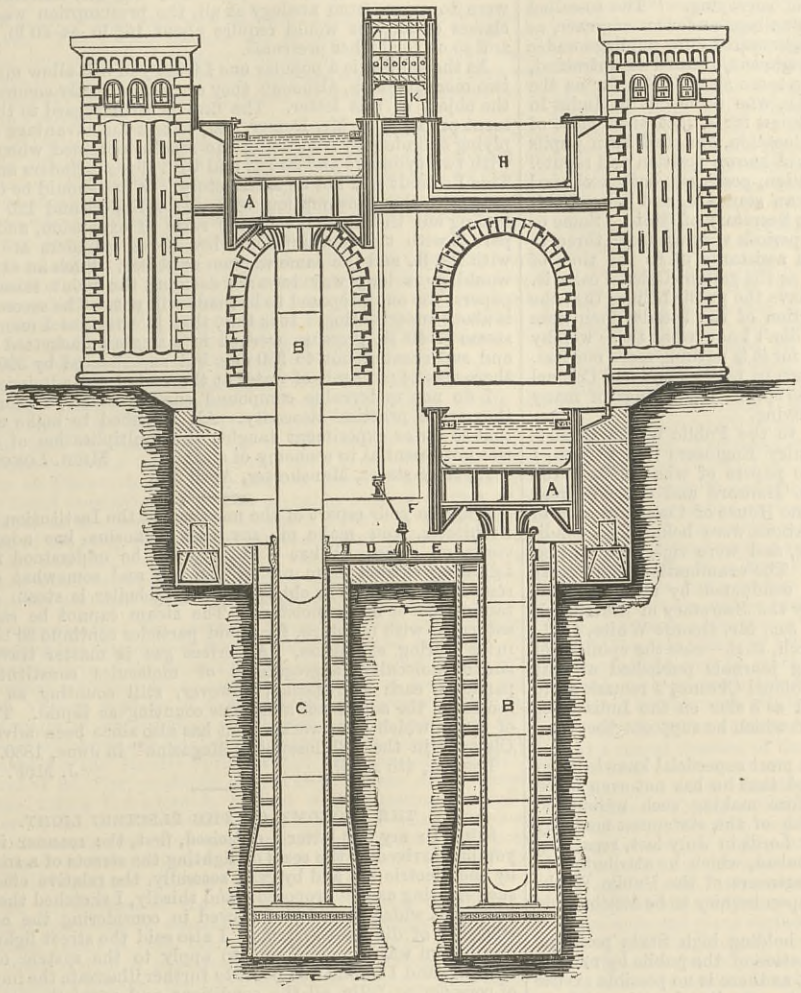
The ovalling motion is obtained by means of cams keyed to the lower vertical spindle, acting on the slides which carry the cutter spindles. The slides are fitted with antifriction rollers, which are pressed against the arms by means of weighted levers. A hand wheel and rack and pinion serve to withdraw or bring into work the slides and cutters.

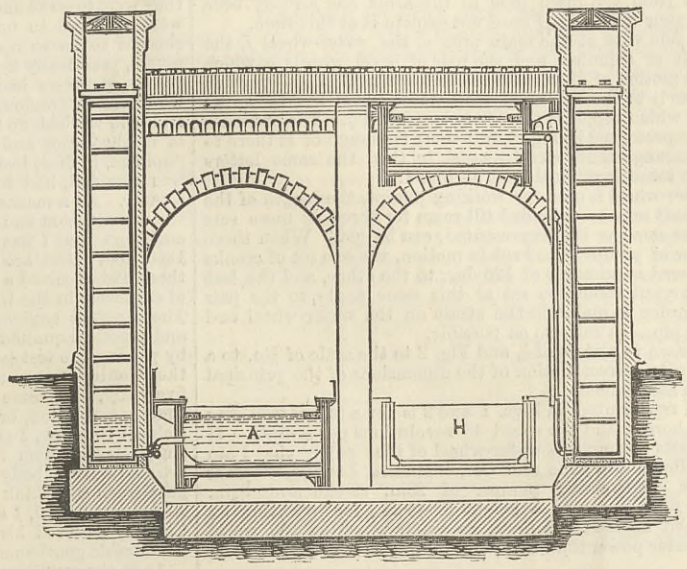
So soon as the head is turned and the ovalling motion performed, a stop on the worm wheel previously referred to comes in contact with a lever, and throwing the belt on to the loose pulley, averts the motion of the head. The object of having two cutter heads revolving in contrary directions is to ensure the clean production of the head, no matter what may be the direction of the grain of the various pieces composing it. The cutters can be sharpened without removal. This machine is capable of turning out 200 pairs of average sized heads per day. This machine takes about 3-horse power to drive it, and the cutters are driven at 650 revolutions per minute.

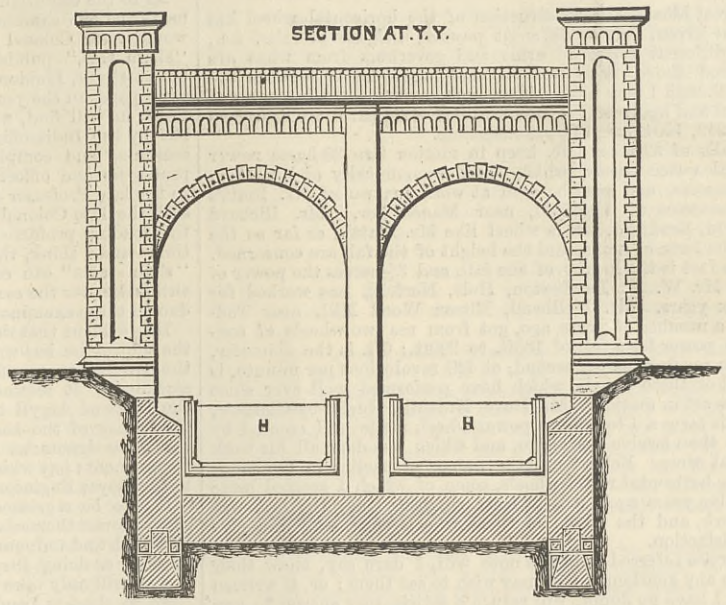
American Society of Civil Engineers.—On March 15th, 1882, the Society met at 8 p.m., Mr. Ashbel Welch, president, in the chair. The death of Gen. W. W. Wright, member of the Society in Philadelphia, March 9th, 1882, was announced. A paper by Mr. E. H. Keating, City Engineer of Halifax, was read by the secretary. The paper described the results of the mechanical removal of incrustations from the water-pipes of that city. These incrustations had become so serious as to reduce the pressure so that in many places the water would not flow from the street hydrants. In some pipes the deposit was over 1¼in. in thickness; 6in. pipes were found reduced to an internal diameter of 3¼in. to 3½in. In the years 1875 and 1876 a number of miles of old 3in. pipes were cleaned by a scraper attached to iron rods and propelled by hand. The scraper had four arms or knives attached to a centre, and spring outward by a thick rubber disc. This method was not practically applicable to pipes of large diameter, but in 1880 over a mile of 12in. pipe was cleaned by a scraper forced through the whole length by the head of water in the pipe. This scraper was one imported from Scotland, and its work was fairly successful. In 1881 the author of the paper constructed new scraping machines, which differed from the others in having additional springs for the cutters and the pistons. These scrapers consist of an iron rod, to which are attached two pistons and two sets of cutting tools, one in front of the other. The cutters are each made up of four strips of steel, 2½in. broad, sloping backwards from the rod, and at their outer terminations shaped and sharpened like the barbs of an arrow. Thus they can yield when requisite, and the cutting diameter can be altered by moving the steel strips. The pistons are of iron, lead and leather, to which Mr. Keating adds rubber springs. With this apparatus, and with the ordinary head in the pipes, about twelve miles of 24, 20, 15, and 12in. pipes were cleaned at a total cost of $2\frac{8}{10}$c. per foot. The results were remarkably satisfactory, as is shown by the fact that the average pressure on twenty-five hydrants on the wharves increased from $34\frac{2}{10}$ lb. in February, 1880, to $52\frac{4}{10}$ lb. in February, 1882. These were on the low service, the source of which is four miles from the city and 200ft. above tide. On the high service, the source being eight miles from the city and 360ft. above tide, there is now a pressure of 19 lb. per inch at hydrants where the water did not flow at all. Some remarks were made on the overflow of the Mississippi river by Mr. Lyman Bridges, member Am. Soc. C.E. The area of the watershed at that river is 1,147,000 square miles, with an annual rainfall of 80,000,000,000,000 cubic feet, and a drainage of 20,000,000,000,000 cubic feet. The mean annual amount of sediment passing the mouth of Red River is given by Humphreys and Abbott as 812,500,000,000 tons. The deposit of this at certain points is a source of constant danger. The speaker suggested, as a means of relief, the improvement of the old channel near the mouth of Red River, the improvement of the Atchafalaya and its parallel bayous, a connection with the Mississippi at Plaquemine, and the improvement of the outlet to Atchafalaya Bay.

HYDRAULIC ELEVATOR ON THE NEUFFOSSE CANAL AT FONTINETTE, ST. OMAR.

MESSRS. CLARK, STANDFIELD, AND CLERK, WESTMINSTER, ENGINEERS.







In The Engineer of the 27th August, 1880, we gave illustrations and a full description of the lift on the river Weaver, at Anderton, as designed by Mr. Edwin Clark, Mr. Leader Williams, and Mr. Erdingham Duer. This establishes communication between the river Weaver and the Trent and Mersey Canal, and has a lift of 50ft. 4in. We now give illustrations of a new canal lift constructed for the French Government from the designs of Messrs. Clark and Standfield, Westminster, by MM. Cail et Cie, and erected by them on the Neuffossé Canal at Fontinettes, near St. Omar. The lift consists of the same essential parts as the Anderton Canal lift, with an improvement which will be referred to further on. The *bacs*, as the French term the lock troughs or tanks, are 5 metres in width, 45 metres in length, and 2 metres in depth. These are balanced upon hydraulic rams, 6ft. 7in. diameter, in press cylinders, which are at will in communication. The difference in level at Fontinette is 13·13 metres, or about 11ft. less than at Anderton. In our illustrations, A are the troughs, B, the rams supporting the troughs; C, the press cylinder; D, supply pipes communicating with both presses; E, valve above referred to; F, see transverse section rod for working the valve E; G, permanent aqueducts; H, gates closing the aqueducts and troughs; I, dry reception chambers for the troughs to descend into; J, accumulator; K, valve house. We shall not here describe the whole of the details of this lift, as they are, with one exception, the same as at Anderton, described at length in the above-mentioned impression. There is, however, one point to which attention must be drawn. Although the two troughs balance each other, it will be seen that when one is raised or the other depressed, there is an unbalanced head under the higher trough. If left to themselves, the two troughs would, of course, assume the same level. If, however, one of them be forcibly depressed, say 40ft., so as to elevate the other 40ft., it will be found that a weight of about 38 tons will be required to balance the weight of the head of water under the elevated trough, and the differential work expended in effecting this balance represents a certain waste of power and water every time a barge is lifted or lowered. This, though common to the usual arrangement of lifts, is avoided by Messrs. Clark, Standfield, and Clerk, by an ingenious compensator arrangement, which maintains perfect equilibrium of the presses in all positions, and enables them to be used without any loss of power, except that due to friction.

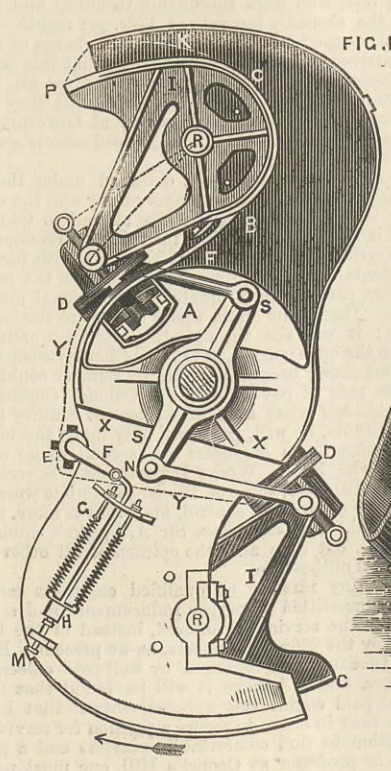
As compared with the Anderton lift, the Fontinette loss of water is in the ratio of 1in. to 5ft., that is, $\frac{1}{60}$; and by comparison with an ordinary lock, the loss of water is only as 1in. to 45ft., that is, less than $\frac{1}{360}$. As previously described, when loaded barges are descending and empty ones ascending, a volume of water equal in weight to the difference between the weights of the descending and ascending barges is raised and passed into the upper canal.

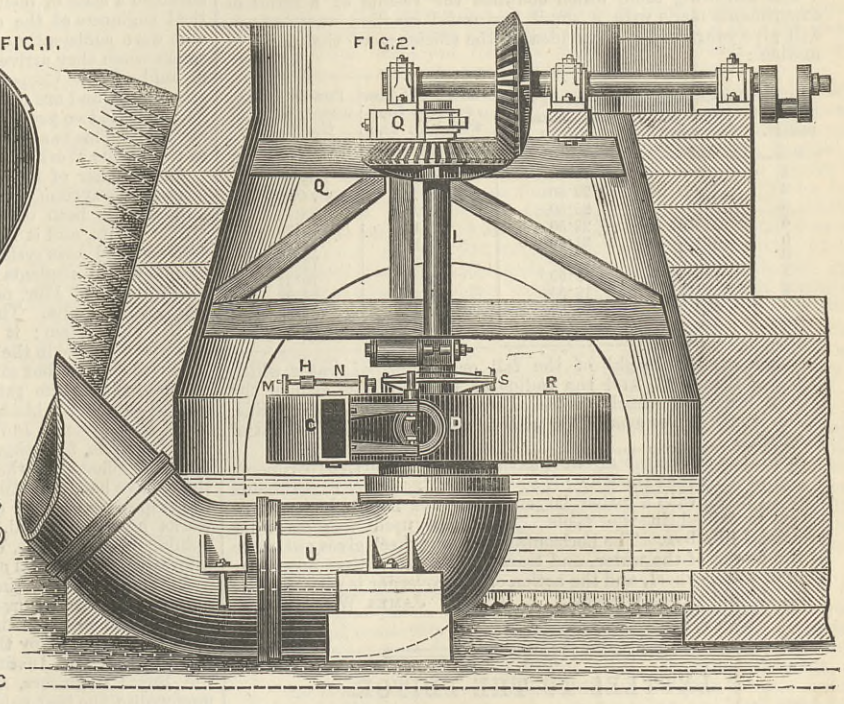
Besides a second series of lifts which have been designed for the French Government, two series of lifts of somewhat similar dimensions have been designed for the Belgian Government. This series of lifts was designed for passing a canal over a range of hills, between Charleroi and Brussels, where water is not obtainable. The Brussels-Charleroi lift has troughs 5·76 metres in width, 45 metres in length, and 3·06 metres in depth. We need hardly say that these lifts are of very great importance in inland navigation, as they make it possible to carry canals through countries where water is scarce.

WHITELAW'S TURBINE.

In the course of the discussion on turbines which has taken place in our pages, allusion was made to Whitelaw's turbine. The following description appears in an old copy of the *Mechanics' Magazine*, and was written by Mr. Whitelaw himself:—

Fig. 1 is a plan of the water-wheel, partly in section. On the right side of that figure are shown part *a* of the central opening for the water, an internal view of *b* one of the two arms, the governor valve *c*, and the cylinder *d*, with one of the pistons for working the valves. On the left side of the figure an external view of these and some of the other pieces are represented; *e* is a small four-way cock worked by the lever *f*, and *m n* a flat rod, which has a weight *h* fastened on it. This rod slides in guides, as represented, and is at the inner end connected by a pin to the end of the lever *f*. To a cross piece on the rod *m n* one end of each of a pair of spiral springs is hooked, and the other end of each spring is connected to an eye at the end of a small screwed pin *g* fastened to the innermost guide for the rod *m n*, and by means of nuts





WHITELAW'S TURBINE.

these pins are adjustable, so that the tension of the springs may be increased or diminished, so far as is required to allow the water-wheel to revolve at its proper speed.

One of the pipes of the stop-cock *e* communicates with the inside of the arm; the water escapes from the cylinder by a pipe placed opposite the one now referred to. By one of the pipes at the side of the cock the water is passed to the inner end of both cylinders, and from the pipe on the other side the water is led to the outer ends of the two cylinders. The thick dotted lines *y* show the pipes leading from the stop-cock to the outer ends of the cylinders, and the two thick lines *x* represent the pipes which communicate with the inner ends of both cylinders. The two pipes last spoken of are jointed to the outer ends of the cylinders, and the water passes from them to the other end of the cylinders through a hole bored in a strip or rib cast outside of each cylinder.

It will now be seen that if the springs are adjusted to the proper extent, the centrifugal force of the weight *h* will, when the water-wheel goes too fast, cause the rod, *m n*, to carry the end of the lever *f* outwards, and when the wheel revolves at too slow a rate the tension of the two springs will pull that rod so as to make the lever of the stop-cock turn in the opposite direction. This being the case, if the stop-cock and the connections with it and the ends of the two cylinders are properly formed, the pistons being pressed by the water from the arm will, by acting on the levers marked *i*, open the two valves, or close them, as the case may be, just far enough to maintain the proper speed of the wheel.

The wheel revolves in the direction indicated by the arrow, and, as is well known, its motion is produced by the reaction of the water escaping from the jet orifices and by the pressure of the water in the arms. I may add that the valves turn on the gudgeons marked *r*. *s* is a lever which fits loosely on the water-wheel shaft; each end of this lever being connected by a rod *t* to a pin fastened on each of the levers which work the valves, and by this arrangement the one valve is prevented from travelling quicker or slower than the other, so as to keep the jets, or the jet orifices, at all times of the same width. The dotted line *k*, drawn inside the jet piece of the arm, on the right side of the Fig., shows the position of the end of the valve when shut; the arc *p* is that in which the extreme point of the valve moves; and the other dotted lines at the place named are put there to assist in explaining the motions of the valve and that of the lever which works it.

The regulating valves are packed with leather. One piece bears against the face or side surface of the rim, near the inner end of each valve, and is kept in its place by a plate bolted to the outside of the arm, as represented on the right side of the Fig., and there is a groove cut in the middle of the top and bottom of each rim, wh a is filled with a strip of leather, so as to prevent the

water from escaping at the places named, and thus no water can get away, except by the jet orifices. A line drawn in the middle of the thickness from near the outer end to the inner end of the rim of the valve, on the right side of the Fig., represents one of the four grooves referred to. As the water-tight joint through which the water passes from the main pipe to the arms has already been described in your magazine, I need not explain it at this time.

Fig. 2 is a side view of the main pipe *u*, the water-wheel *j*, the upright shaft or spindle *l*, and the pair of bevel wheels *o*, which transmit the motion of that shaft to the horizontal shaft *w*, which communicates it to the machinery the water-wheel has to work; the framing which supports the whole is marked *q*. The governor is not fully represented in Fig. 2, but there is enough of it there to explain the arrangement, and to assist in this, the same letters point out the same parts in this as in Fig. 1.

If the water-wheel is used for working pumps, the length of the horizontal shaft may be extended till room for three or more sets of cranks, the same as that represented, can be got. When three is the number of pumps to be kept in motion, the one set of cranks should be placed at an angle of 120 deg. to the other, and the last or outermost crank should be set at this same angle to the pair before it, in order to maintain the strain on the water-wheel and the eduction pipes as uniform as possible.

Fig. 1 is drawn to a scale of $\frac{1}{4}$, and Fig. 2 to the scale of $\frac{1}{8}$in. to a foot; so a pretty correct notion of the dimensions of the principal parts may be ascertained.

The wheel represented in Figs. 1 and 2 is for a fall of 22ft., its power is 200 horses, and the speed 48 revolutions per minute. It in most respects resembles a water-wheel of that power that I am making for Messrs. Gwynne and Co., engineers, London, which is to work six single-acting pumps, of 20in. stroke and $8\frac{5}{8}$in. diameter, to raise water to a height of 460ft., for irrigating an estate. When finished I believe, no water-wheel in the world will be of greater power than this; but be this as it may, it will be a large one.

A correct idea of the construction of the horizontal wheel has now been given, but as different powers, heights of falls, &c., require different forms of arms and governors from what are represented above, it is not all that might be written on the subject, though I may have said enough, as the different forms of the wheel and many of the modifications of its parts are described in Nos. 913, 1004, &c., of your magazine.

Two falls of 32ft. or 33ft. keep in motion two 30-horse power horizontal water-wheels, which work economically and well in other respects, and may be seen at work in two of Mr. Platt's cotton factories at Hadfield, near Manchester. Mr. Richard Butterfield, Bradford, has a wheel like Mr. Platt's, so far as the power, the form of arms, and the height of the fall are concerned. Nineteen feet is the height of the fall, and $3\frac{3}{4}$-horses the power of a wheel Mr. W. H. Pemberton, Holt, Norfolk, has worked for about six years. Mr. Helliwell, Kitson Wood Mill, near Todmorden, a number of years ago, got from me two wheels of considerable power for a fall of 180ft. to 200ft.; 6ft. is the diameter, and seven revolutions per second, or 420 revolutions per minute, is the speed of these wheels, which have performed well ever since they were set in motion. Mr. Dove, Nutshill, Hurlet-by-Glasgow, has on his farm a 4 to 5-horse power wheel, made and erected by me more than twelve years ago, and which has done all his work since that time. Below* are the names of parties in Greenock who have horizontal water-wheels, some of which I erected more than twelve years ago; it is at least six years since the last was set to work, and the whole of these wheels work well and give great satisfaction.

The parties referred to in the note will, I dare say, show their wheels to any gentlemen who may wish to see them; or, if written to, they, I have no doubt, will return a satisfactory answer to any questions that may be asked; and as the first wheel Mr. Platt got from me is in the same place, and turns the machinery, that a good overshot wheel of about 40ft. diameter by 6ft. wide in the buckets once worked, he can give an account of the efficiency, the uniformity of the speed, and the way in which the new wheel works in connection with his steam engine, as compared with the performance in these respects of the overshot wheel; and as the second wheel Mr. Platt got has a governor of the kind described in this letter, he can give his opinion respecting it also. I could refer to many other parties, were it not that it appears to me, that the list below is not too short for your magazine; but I dare say you will allow me to add, that Mr. Harrieson, C.E., Frocester-court, Stroud, Gloucestershire, can give an accourt of how a horizontal wheel he has had in operation for a length of time does its work.

The following table which contains the results of a series of experiments made with a small horizontal reaction water-wheel, will give your readers some idea of the efficiency of that kind of motion :—

No. of experiments.	Revolutions of wheel per minute.	Weight on friction brake in ounces.	Ounces of water used by the wheel in one minute.	Power of the wheel, that of the water being 100·
1	000·0	45·50	4923	00·00
2	138·0	24·50	7130	74·92
3	153·5	23·50	7557	75·41
4	173·5	22·50	8141	75·76
5	194·0	21·50	8761	75·21
6	203·0	20·50	9041	72·72
7	214·0	19·50	9389	70·21
8	222·0	18·50	9644	67·28
9	229·0	17·50	9872	64·13
10	294·0	00·00	12040	00·00

63·46in. is the height of the fall or column of water which actuated the wheel, and the radius or length of the arm of the friction brake the wheel was tested by is 15·96in., and the radius, or the length of the arm of the wheel, is about the same as that of the brake.

75·76, the coefficient of effect as shown by the fourth experiment, is high, seeing that the wheel is so very small. Other experiments which I made with a rather larger wheel gave results higher than those contained in the table. The water used was carefully measured in a box. The horizontal reaction wheel gives out more of the power of the water, and transmits it better than any other kind of water-wheel, and the action of the governor is very perfect.

13, Ronald-street, Glasgow. James Whitelaw.
April 22nd, 1854.

LETTERS TO THE EDITOR.

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

COLONEL CHESNEY, R.E., AND THE "STANLEY ENGINEERS" OF INDIA.

Sir,—A letter appeared in your issue of 13th January last, signed by Colonel C. Chesney, R.E., late Principal of the Royal Engineering College, Cooper's Hill, in which he endeavours to defend the engineers turned out by that institution at the expense of the so-called "Stanley Engineers" or old Competition Wallahs.

I being one of the "Stanley Engineers," think it my duty to correct Colonel Chesney's mis-statements in as public a manner as they were made, and I trust for this reason you will be good enough to publish this letter in your widely circulated journal. The first mis-statement I would draw attention to is the following:—"Some of them—Stanley Engineers—may have had some practical training, but a large proportion of them had had none whatever. The conditions of admission to the Indian Public Works Department in those days were the passing a very elementary examination, and the having served for one year as pupil to an engineer. But as it was not specified what sort of an engineer they were to serve under, or what amount of practical training they were required to undergo during that year, and as any one who chooses to do so may dub himself as a civil engineer and take pupils, practically the preparation of a large proportion of these young engineers had fallen into the hands of a few crammers" who lived in London, who had no professional practice to speak of, and who worked up their pupils to pass the needful examination in mathematics and the elements of surveying. "The so-called pupilage, in fact, instead of being pupilage under an engineer, as was intended, had in many cases degenerated into pupilage under a tutor. As a means for selecting engineers, trained or untrained, the examination and the test were a mere sham." So far as the engineers that I was acquainted with, who came out to India in 1866, 1867, 1868 are concerned, I know for a fact that most of them had received a good college education, and had been pupils of engineers in the United Kingdom of known position and repute. These young engineers, I may mention, possessed both technical and practical qualifications of no mean standard, and proved this by passing the test laid down by the Secretary of State. Some of the Stanley men were articled for periods varying from three to five years, and some even had been assistants up to the time of their examination, or "sham test," as the gallant Colonel calls it. Colonel Chesney, I observe, would have the public believe that the engineers to whom the greater portion of the Stanley men were articled were a body of quacks! I don't know what these worthy gentlemen will think of this insult, for it is nothing more nor less. Anyhow it would, I submit, have been in better taste had Colonel Chesney reserved his remarks, and so spared the feelings of many honourable gentlemen who are still living.

As to the conditions of admission to the Public Works Department and the examination the Stanley Engineers had to pass, I would refer Colonel Chesney to the papers of what he calls the "sham test," published by Messrs. Hansard and Co., of Great Queen-street, London, by order of the House of Commons, and in your paper in the years the examinations were held. The conditions, he will find, were most strict, and were rigorously carried out by the India-office authorities. The examinations were most searching and complete, and were conducted by most eminent professors and officers appointed by the Secretary of State, such as the late Professor J. Cape, A.M., &c., Mr. George White, C.E., and the late Colonel C. D. Newmarch, R.E.—*vide* the opinions of the leading professional engineering journals published at that time—and I think, therefore, that Colonel Chesney's remark as to "sham tests" can only be intended as a slur on the India-office authorities for the careless manner in which he supposes they conducted these examinations.

It is evident that the Colonel has a most superficial knowledge of the subject he has written about, and that he has not even taken the trouble to search for facts before making such unfounded assertions. It reminds me very much of the statement made by the Duke of Argyll in the House of Lords in July last, regarding the failure of the barracks at Allahabad, which he attributed to the gross ignorance of the civil engineers of the Public Works Department; but which turned out upon inquiry to be attributable to the Royal Engineers.

It is to be regretted that officers holding high State positions should lower themselves in the estimation of the public by making such rash and unfounded statements, as there is no possible excuse for their so doing, they having every opportunity of getting at facts if they will only take the trouble to do so.

As to the few London "crammers," into whose hands Colonel Chesney says the greater proportion of these engineers had fallen, it hardly needs comment; but I would again refer him to the parliamentary papers before alluded to, and he will find from them that the greater portion of the "Stanley Engineers" had undergone an expensive technical education at some university or college recognised by the Secretary of State, and had been articled to well-known engineers residing in the United Kingdom. I know for a fact that many of the Cooper's Hill students are sent to the very firms of engineers—"quacks" as Colonel Chesney implies—for their period of practical training varying from six to twelve months, whereas many of the "Stanley Engineers" were articled for terms of from three to five years.

The great advantage Government gained in obtaining engineers in the open market by the old competitive system was that they obtained a class of men who were thoroughly technical and practical engineers at the absurdly low rate of 170r. per month—men who were sufficiently experienced to be placed in charge of large works when they arrived in India. I regret to say that this cannot be said of the Cooper's Hill students, who are, after all, mere schoolboys, and are of very little use to the State until they have had at least two years' experience in the country at Government's expense. This is a well-known fact to unprejudiced officers serving in the Public Works Department in India.

Any number of men could have been obtained under the old competitive system, had the same advantages of pay and the other inducements been offered to them as are now offered to Cooper's Hill students, and it would have been by far the most economical, efficient, and best system for the State; 350r. per month for raw Cooper's Hill students is a very different matter from the miserable pittance of 170r. per month for qualified professional men to start with in India. There is no doubt this is the key to the failure of the old system; it was not through the inferior quality of material obtained in the open market, as Colonel Chesney wishes the public to believe, but rather because a sufficient number could not be obtained at the rate of pay offered. If Colonel Chesney is unable to see for himself what kind of service the Stanley engineers have given in India, he will, if he will only make the necessary inquiries, find that these engineers are second to no other class of officers in the Public Works Department. Several of them have had, and still have, some of the largest public works in the empire under their charge and control, and what is more, their works have not failed. Not only does Sir A. Clarke's unbiased opinion bear out this, but it is also the opinion of all other disinterested professional authorities.

As before stated, any number of qualified engineers can be obtained by open competition if proper inducements and a fair share of the prizes in the service are offered, instead of the bulk being monopolised by the Royal Engineers, as at present. Even the Cooper's Hill Institution is managed by well-paid officers of the Royal Engineers, and I believe it will be found that they monopolise the best paid engineering appointments in that Institution. It appears that in order to secure a pension for service in India, and in addition to find comfortable quarters and a good salary as principal or professor at Cooper's Hill, one must needs be a Royal Engineer. No wonder then that Colonel Chesney upholds his pet college; but he will find that it will only answer for a few years longer, as it is rapidly losing the popularity it at first enjoyed. The general opinion both in India and at home is that the sooner this institution is closed the better for the Government and the Indian taxpayer.

India, February 28th. An Abused Stanley Engineer.

STEAM ENGINE ECONOMY.

Sir,—In your report of the meeting of the Institution of Naval Architects, in The Engineer of the 31st March, there is a mistake as to what I said with respect to Messrs. Kirk and Parker's papers which, if you will permit, I should like to put right. The hour was late, and I spoke against time, and as fast as I could, and can quite understand that your reporter had some difficulty in getting my words down correctly. I need not repeat what I am reported to have said. What I did say, so far as the words incorrectly reported are concerned, was in substance this: That *à priori* reasoning about steam engines was fallacious; that experiment was the only safe guide; that experiment had shown that, with pressures of about 60 lb., there was a certain ratio of expansion for each kind of engine which gave the best results; that these ratios for jacketted engines were as follows:—For single cylinders, about seven expansions; for compound engines, with cylinders in the ratio 1 : 2, about eight expansions; with cylinders 1 : 3, about ten expansions; with cylinders 1 : 5, about fifteen expansions; and that, under these conditions, the consumption was the same for all within 2 or 3 per cent., and was practically 18 lb. of water. I also said that, with about 80 lb. pressure, the consumption for one class—viz., that with cylinders about 1 : 3, whether tandem or with cranks at right-angles, was practically $16\frac{3}{4}$ lb.; therefore, if we were to argue from analogy at all, the presumption was that all classes of engines would require about $16\frac{3}{4}$ lb. at 80 lb. pressure, and so on for higher pressures.

As the subject is a popular one I trust you will allow me to make two more remarks, although they are not directly connected with the object of this letter. The first is with regard to the experiment proposed by Mr. Denny, viz., to test the advantage of multiplying cylinders by comparing the results obtained when working with two cylinders and 90 lb., and with three cylinders and 120 lb. This I submit will not be satisfactory. What should be done is to ascertain the consumption with two cylinders and 120 lb. after finding out the most favourable ratio of expansion, and to compare it with the consumption when three cylinders are working with 120 lb. and the same vacuum as before. Such an experiment would go a long way towards deciding the point raised in the papers, the one proposed to be made will not. The second remark is about superheating. It is this, that in the case I mentioned of steam of 40 lb. pressure worked in a single unjacketted cylinder, and superheated not to 380 deg. but superheated by 300 degrees, there was 24 per cent. of water at the end of the admission.

I do not undervalue compound engines at all; in many cases they are a practical necessity. All I wished to make clear was that so far as experiment taught, the multiplication of cylinders was not essential to economy of steam. Mich. Longridge.

12, King-street, Manchester, April 3rd.

Sir,—In your report of the meetings of the Institution of Naval Architects, you make me say that Clausius has adopted my views of steam. What I did say will be understood from the following extract from my written out and somewhat extended remarks:—"Steam as obtained from the boiler is steam gas, containing less or more moisture. The steam cannot be said to be saturated with moisture, for liquid particles continue to be formed in it during expansion. A perfect gas is matter travelling in single molecules, aggregations of molecules constitute liquid particles, each aggregation, however, still counting as one gas molecule, the additional molecules counting as liquid. This view of steam which I am working out has also since been advanced by Clausius in the 'Philosophical Magazine" in June, 1880."

London, 4th April. J. McF. Gray.

THE ECONOMY OF THE ELECTRIC LIGHT.

Sir,—In my last letter I criticised, first, the manner in which you had arrived at the costs of lighting the streets of a small town by the electric arc and by gas; secondly, the relative efficiency of such lighting as you proposed; and thirdly, I sketched the general principles which should be followed in considering the costs and efficiency of different systems. I also said the street lighting of a small town was a severe test to apply to the system of "arc" lighting, and I intend this point to further illustrate the importance of considering fully all the conditions and requirements of each case before any comparisons of cost and efficiency of different systems are made.

With gas it is not, in small towns at least, the street lighting which yields the companies the chief return; but that of the shops, factories, and private houses, together with the sale of secondary products. If management, plant, mains, and working expenses had to be provided solely for the street lighting, the price per 1000 cubic feet might be an indefinitely greater amount in place of the 5s. which you have taken. In fact by taking gas at 5s., the comparison, supposed to be in similar cases, has really resulted in one between "arc" lighting upon a limited and gas upon an extensive scale.

I do not go so far as to say that under no circumstances would this comparison be of use, but I think it is one of limited application, and not bearing much upon the main question as affecting the commuity at large.

If in the case before us, "arc" lighting is to be applied solely to the streets, or even also to a few of the more important buildings and factories, whilst gas has still to be retained in the great majority of houses, then not much good to the community can result. A few trades may benefit conspicuously; but the price of gas will in general be raised in consequence of reduced consumption. In "arc" lighting three of its more important advantages, which under other circumstances might be well worth paying for, are, when applied to street lighting, of no account, namely—first, slight contamination of the atmosphere; secondly, small amount of heat given off; and thirdly, the white colour of the light.

Geo. P. Culverwell, Assoc. M.I.C.E.

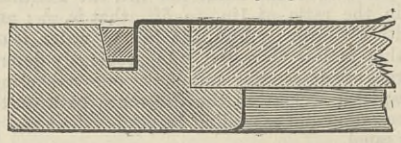
Co. Donegal, April 3rd.

LOW'S DRAWING BOARD.

Sir,—I notice in your issue of 31st March an illustration and description of "Low's drawing board," the principle of which so closely follows that of a board I designed for my own use some eight years ago, and have since continually used, that I feel called upon to give you a sketch of its detail.

The board proper of the usual soft wood is pannelled in an oak margin, in the solid wood of which is cut a continuous groove, inclined on the outer side, and vertical on the inner. Four oak slips forming continuous wedges fit the groove in the two sides and two ends of the board. The paper is damped, turned over the vertical edges into the grooves, and the wedges are pressed into place by a slight tapping all over.

A sheet of double elephant has remained as long as six months on one of these boards without getting loose. They have been made for some years back by Mr. W. F. Stanley, in four sizes, up to 54in. by 33in. Several of them are in constant use in my office, and are a source of great convenience and saving of time. They are as clean and smooth as the day I got them.



Notwithstanding the hard wood and broad bearing surfaces of my wedge slips and grooves, I find that after a few years' work the slips get a little slack, but they are easily brought up to work by a ply or two of drawing paper neatly glued on the back, and trimmed off to the depth of the slip.

With the thin edges shown on Mr. Low's slips there will be considerable tendency to get out of adjustment, even with the use of hard wood slips, and with them there will be the strong probability of their compressing the fibre of the soft wood board and enlarging the groove, more especially in the long groove at the side of the board.

I have never sent you a sketch of my board, as I considered it too trivial to receive notice amongst engineering works.

F. G. M. Stoney.

4, Westminster-chambers, Victoria-street, London, April 4th.

Low's Drawing Board.—In our notice of this patent board last week, we omitted to say that Messrs. Wrinch and Son, Ipswich, are the makers.

* Messrs. Fleming, Reid, and Co.; Mr. Houston, dyer; Mr. John Poynter, drysalter; Messrs. Patten, sugar-refiners; and Messrs. Macnab and Clark, engineers. To these gentlemen I may add Mr. Hollins, Pleasley Works, Pleasley, Mansfield; Mr. Wm. Peel, Taliaris Park, Llandillofawr, Carmarthenshire; Mr. Wm. Thompson, Hazlewood-hall, Tadcaster, Yorkshire; the Culcreuch Spinning Company, Glasgow; and J. Macnab, Midton, Paisley.

RAILWAY MATTERS.

Mr. Michael Reynolds, author of "Locomotive Engine Driving," "Model Engineer," "Stationary Engine Driving," "Engine Driving Life," "Continuous Brakes," and "Engineman's Companion," has returned to the London and Brighton Railway as one of Mr. Stroudley's assistants.

The new railway from Bourg to Bellegarde *vid* Mantua was opened on the 1st inst. Besides shortening the journey from Paris to Geneva about thirty miles, the new route offers great attractions in the way of scenery. The highlands between Bourg and the Swiss frontier are among the most picturesque and romantic in Europe.

The grant of free passes on railways in Australia is a prominent question. The French Senate has agreed, by 145 to 53, to the scheme for enabling legislators to travel on any of the French railways for 120f. a year. The *Times* Paris correspondent observes, "instead of Parliament buying up the railways, the railways are to buy up Parliament."

It is stated, though not officially, that Sir Edward Watkin having driven his heading to low-water mark, has received an intimation from the Government that he must proceed no further at present with the undertaking. Sir Edward may, perhaps, find time to reform some of the abuses which render the South-Eastern Railway, to put it mildly, unsatisfactory.

If the London, Chatham, and Dover Railway Company would repair the roof of Ludgate-hill station, it would be no longer necessary for passengers waiting for trains to put their umbrellas up. In wet weather it is not easy to find a dry place on either of the two platforms. The new station has not been begun; the present roof (?) will not last till it is finished.

The line which the London and North-Western Railway Company has recently constructed between Rugby and Roade was opened on the 3rd inst., and will considerably facilitate communication with Northampton. Up to the present time passengers, whether from the north or south, have been obliged to change trains at Blisworth Junction, and on arriving at Northampton have found themselves landed at a shabby-looking station in the outskirts of the borough, the approach from the station to the centre of the town being both disagreeable and inconvenient. Now that the new line is completed they will be landed at the Castle station, which is much more easy of access, and is considerably nearer the principal business thoroughfares of the town.

It appears that the proposed tunnel through the Pyrénées is attracting the attention of French politicians, and especially of the representatives of the departments which have most to gain by this important scheme. When recently a number of Senators waited on M. Varroy, Minister of Public Works, to impress upon him the advantages of constructing the tunnel at the extremity of the railway which runs through those departments, General Deffis, the Senator for the Hautes-Pyrénées and Governor of the Military School at St. Cyr, produced several sketch maps of the proposed routes, urging the adoption of that which, passing through the valley of the Neste, enters the Pyrénées at a point almost equidistant from the Mediterranean and Atlantic coast. This point is in direct communication with Paris by railway through Auch, Agen, Limoges, and Orleans.

The termination of the conference *à quartre* in Vienna has created considerable sensation in Constantinople, because the practical result is that the union of the Oriental lines with the European system is postponed and made dependent upon a new arrangement between the Porte and Baron Hirsch. It is believed, in diplomatic circles, according to a Reuter's telegram, that Germany, in the interest of Europe, will co-operate with the other States immediately interested in bringing about the junction of the railways, by representing to the Porte that the understanding existing between Austria, Servia, and Bulgaria in favour of the execution of the clauses of the Berlin Treaty dealing with the railway question, renders it necessary that the Porte should ask Baron Hirsch to modify the convention of 1872 in such a way that Turkey may be able to give her adhesion to the general agreement.

A fully-attended meeting of the Central Committee of the railway servants' nine hours movement was held on the 2nd inst. at the chief offices of the Amalgamated Society of Railway Servants, City-road, an engine-driver in the chair. Mr. George Boon, one of the joint secretaries, reported that the movement was making steady progress among the railway servants of the country. That was especially the case on the lines in the north-eastern and Welsh districts. The railway men in Sheffield were loyally pursuing the movement; and in other railway centres the men were taking up the question and starting local committees. A considerable sum of money had been remitted to the central office, being composed of a day's pay towards agitating the question. In the course of a discussion it was stated by a railway servant that there was a general tendency to reduce the hour of labours on railways.

The *Railroad Gazette* record of American train accidents in January last shows a total of 137 accidents, in which 41 persons were killed and 198 injured. Twenty-three accidents caused the death of one or more persons; 33 caused injury, but not death; and in 81, or 59·1 per cent. of the whole number, no serious injury ir recorded. These accidents are thus classed as to their nature and causes as follows:—Collisions: Rear collisions, 45; butting collisions, 15; crossing collisions, 4. Derailments: Broken rail, 7; defective rail-joint, 1; broken bridge, 2; spreading of rails, 4; broken wheel, 4; broken axle, 3; land-slide, 1; wash-out, 1; snow, 2; accidental obstruction, 4; misplaced switch, 10; rail purposely removed, 2; unexplained, 28; boiler explosions, 2; broken connecting rod, 1; car burned while running, 1. This shows a total of sixty-nine derailments, no less than twenty-one of which happened to passenger trains, and by which fourteen people were killed in the one month.

A high railway bridge is described in the *American Manufacturer*:—The Kinzua Creek flows at the bottom of a ravine between Bradford and Alton, Pa., over 300ft. deep and 2250ft. wide. This chasm has for years prevented a railroad connection between that city and Pittsburgh. The Erie Railway is now spanning the ravine with a bridge, to make the long-desired connection by extending its Bradford branch to Johnsburg, Pa. The bridge will be the highest railroad bridge in the world—305ft. This is 60ft. higher than the Niagara suspension bridge; 170ft. higher than the bridge across the Ohio at Cincinnati; 189ft. above High Bridge, New York; 170ft. higher than the East River Bridge, and 45ft. higher than Portage Railroad Bridge over the Genesee River. The Kinzua structure will consume 40,000,000 lb. of iron. It will require 30,000 yards of masonry. The cost will be over £100,000. The Bradford branch will connect with the Low Grade Division of the Allegheny Valley Railroad, and will make a short through route between New York and Pittsburgh.

No less than 8242 miles of new railways were placed and opened to traffic in the United States during 1881. It is thought that more complete information will raise the total to 9000. This is the highest figure ever reached in one year. In 1880 more than 7100 miles of line were laid; in 1871, a time of extraordinary activity, the development did not exceed 7379 miles. The works have been executed in 42 States or territories. Only two States—Connecticut and Delaware have not shared in the growth. Texas stands at the head, with a construction of at least 1411 miles of line. Colorado comes next with 500 miles, 370 of which have been laid by the narrow-gauge railway company of Denver and Rio Grande, which undertook in 1881 the construction, in whole or in part, of ten different lines. In Indiana, Illinois, New Mexico, and the State of New York the increase has varied from 300 to 400 miles. The adoption of the narrow gauge has been increasing in the United States. Of the 258 different lines worked at in 1881, there are 43, or more than 17 per cent,, with a 3ft. gauge. This gauge is adopted on 1490 miles of the 8242 miles above referred to.

NOTES AND MEMORANDA.

On the 2nd inst. there was a severe storm near Philadelphia with a whirlwind which caused much damage. A water tower at Reading was blown over, crushing three people who had sought refuge there, and injuring three. Some loss of life is reported elsewhere. A very high wind pressure is thus to be allowed for, as has been shown by previous incidents in America.

When rubber plates and rings are used for making connections between steam and other pipes, leaking of joints may be prevented by using a cement prepared by dissolving shellac in ammonia. The pulverised gum shellac is soaked in ten times its weight of strong ammonia, when a slimy mass is obtained, which in three or four weeks will become liquid wihout the use of hot water. This, the *American Miller* says, fastens well both to the rubber and to the metal or wood, and becomes by volatilisation of the ammonia hard and impermeable to either gases or fluids.

Induced currents of polar interversions, by M. du Moncel. The currents from displacement of a coil on an iron bar, through a fixed magnetic field, are not of the same nature as those from displacement—in a fixed magnetic field—of this bar, reacting directly on the coil. In the former case those generated by each half of the magnetised bar are in contrary directions, whereas in the other case they are always in the same direction, and their intensity increases with the amount of dlsplacement, but it becomes almost *nil* in a complete movement of the coil in the former case.

The total population of France present on the 18th December, 1881, was 37,321,000, against 36,905,000 in 1876, an increase of 416,000. The increase is almost entirely confined to the larger towns. The forty-six towns of 30,000 inhabitants and upwards show a total increase of population of 488,000. Only eight of them reveal a diminution, and only four of these eight reveal a diminution of any moment. These are St. Etienne, which has lost 5800 inhabitants; Brest, which has lost 2200; Cherbourg, which has lost 1800: and Versailles, which has lost 1500. On the other hand, Paris has gained 237,000, Marseilles 38,000, Lyons 30,000, Nice 25,000, Lille 15,000, Rheims 12,000, and Havre 10,000.

To ascertain the number of bushels of wheat, for instance, a bin contains, level the surface of the wheat, measure the depth in inches, and the length and breadth of the bin also in inches; multiply these together and divide by 2150, which is the number of cubic inches in a struck bushel. For instance, a bin 22½ft., or 150in. wide, has a surface of 6450 square inches, and for every inch in depth there will be precisely three bushels; if the wheat is 30in. deep in such a bin, there will be 90 bushels in it. As 12½ft. by 3ft. 7in.—or 150in. by 43in.—is a convenient size for a granary bin, it would be easy to mark the inches on the end or side, and for each inch to mark three times the number of bushels. A mere glance at the mark will then give the quantity in the bin.

Mr. S. K. Devereux, of New Brunswick, exhibited and explained, at a recent meeting of the Polytechnic Association of the American Institute, his new art, called Koptography, recently patented. Cherry, or other tolerably hard wood, is treated on and near the surface with any suitable "filler," and smoothly finished. It is stained preferably a very dark colour. Then any designs—preferably hand-made and highly artistic—being drawn or stencilled thereon, the portion of the surface representing these designs is sunk by a rough-pointed instrument, worked by hand with a hammer or by any suitable machinery. The figured portion, with a portion of the adjacent plane surface, is then treated successivcly with shellac and gold size, and all which lies on the plane surface is wiped off. When the size is just sufficiently dried, gold leaf is applied. The gold leaf is retained on the sized surfaces only, and is protected by its sunk condition from any wear in the wiping or other treatment of the work. The invention, the *Railroad Gazette* says, is being tested on some of our standard manufactures of wood-work, including Stevenson's cars and Steinway's pianos. A picture of the landing of the pilgrims is being prepared by this process on a panel 6½ft. by 6ft., for the steamer Pilgrim, being built at Chester.

At the meeting of the Society of Telegraph Engineers on the 23rd ult., Professor A. E. Dolbear, of Tufton College, read a paper on "The Telephone." Amongst other things he showed a telephone by which communication could be received by induction, when the telephone was 30ft. or more feet from the wire terminals of the sender. Professor Dolbear observed, that in Rice's system the electricity was transformed into magnetism, which was transformed into the vibratory motion of the plate. There were two transformations in that case. In this—the lecturer's—case the electrical transformation was but a single one. The electrical condition itself was immediately transformed into the vibratory motion of the plate, without the intermediary of magnetism. The simplicity of the instrument was very great indeed. He could hardly conceive how it was possible to make anything more simple, consisting of two plates in proximity to one another surrounded by a convenient handle, and it could be carried from one place to another. He had heard it 50ft. from the terminal. It was only necessary to bring wires anywhere in the neighbourhood, and as many as were present who could be provided with instruments could hear all that was said.

When the gas explosion took place in Tottenham-court-road, the velocity of propagation of explosive phenomena was a question of importance. MM. Berthelot and Vieille have made experiments on the subject, and the results are of a somewhat unexpected nature. A straight horizontal lead tube, about 133ft. long and ⅛in. interior diameter, was filled with a mixture of hydrogen and oxygen at atmospheric pressure, and the explosion started by means of an electric spark at one end. The flame, as it went along, ruptured two electric circuits, by acting each time on a grain of fulminate of mercury applied to a thin strip of tin. Thus a delicate chronograph was affected—the Le Boulengé, having a precision equal to 1-20,000th of a second. When the tube, instead of being placed straight, was arranged in several parallel pieces with bent joints, the velocity seemed to be the same. The general average for both cases was 2841 metres, or about 9470ft. per second. The velocity appeared to be uniform throughout the tube; and with pressure varied between 1 and 3, the velocity seemed independent of pressure. The velocity is different in different gases; thus, in a mixture of carbonic oxide and oxygen, it was found to be 1089 metres, and dilution of the other explosive mixture, of hydrogen and oxygen, with air, reduced the velocity. For instance, in a mixture containing 45 per cent. of the explosive gas, the velocity was 1439 metres.

Professor S. Thompson recently stated that the observed diminution of the resistance of carbon under pressure in such instruments as the microphone transmitter is really due to the contact between the electrodes and the carbon. Mr. Herbert Tomlinson writes that there is no doubt the greater portion of the diminution of resistance is due to this cause, as pointed out in his paper on "The Influence of Stress and Strain on the Action of Physical Forces," Part ii., "Electric Conductivity," read before the Royal Society on January 26, and referred to in this column. The effect of a given amount of longitudinal traction or compression per unit area on the electrical resistance of some carbon rods was not greater than is the case with the metals tin and lead, for whereas a stress of one gramme per sq. cm. produced a variation of conductivity of from 7684×10^{-12} to $11,420 \times 10^{-12}$ per unit in the case of five carbon rods, the corresponding numbers were, with tin and lead, $10,540 \times 10^{-12}$ and $17,310 \times 10^{-12}$ respectively. The carbon rods were of the sort used for the purposes of electric lighting, and their elasticity varied in almost the same proportion as their susceptibility to change of resistance from stress, so that, the alteration of resistance divided by the strain produced, ranged in the five specimens between the limits 2·144 and 2·835. The corresponding numbers in the case of most pure metals (aluminium is an exception) are greater than these, and in the case of nickel, with which metal curiously enough the effect of moderate longitudinal traction is to decrease the resistance, the alteration of conductivity, Mr. Tomlinson says, is much greater.

MISCELLANEA.

A law has been passed by the French Chamber abolishing the system of workmen's *livrets*, as interfering with personal liberty.

The New York *World* is printed by Hoe perfecting presses, one of which prints, cuts, pastes, and folds into size for post at the rate of 15,000 per hour.

Balmain's luminous paint has been used on the Black Jack Buoy, Isle of Wight passage, and four captains of the steamers plying to the island have spoken very highly of its value.

An accident recently occurred to the Hammersmith Bridge, so that repairs are necessary, and while they are going on only single horses and carriages will be allowed to pass over the bridge.

One would say that if gas-illuminated buoys were requisite anywhere it would be between Southampton and the Isle of Wight, but the captains are even thankful to get a buoy painted with Balmain's luminous paint.

The total loss by fire in Birmingham in the year past has been £23,344, and £461,715 is the value of the property at risk. As compared with last year, there has been an increase of £9519 in the estimated loss, and of £181,729 in the amount of risk.

A pamphlet, addressed to mechanics, has just been published by the Tanite Company, of 42, the Temple, Dale-street, Liverpool, to draw attention to the very numerous applications of the emery-wheel as a rotary file, and giving instructions as to the choice of solid and other forms of emery-wheels for various work. It illustrates a large number of machines for shaping, fitting, &c., by means of emery-wheels.

After 'Change in Wolverhampton on Wednesday, the consumers of finished iron and not a few pig masters, expressed the conviction that at next week's quarterly meeting there will be a declared drop in marked finished iron of 10s., since, at the close of last week, before the drop in coal, certain firms were selling that iron under list rates, and it transpired that some sheets are procurable at 20s. down on the month.

The town refuse treating machinery and apparatus made by Messrs. Manlove, Alliot, and Co., is being very extensively and successfully adopted, one reason for its success being that the cinders, cabbage stalks, &c., in the refuse furnishes the fuel for doing the work. What is more—and this is dreadful—is that the fuel so provided is much more than is required for the work, and it is proposed to light some places by electricity by means of this waste.

The prospectus has been issued of another electric lighting company, namely, the Great-Western Electric Light and Power Company, with a capital of £250,000. It has secured a concession from the Anglo-American Brush Electric Light Corporation, under which the exclusive right of use or sale of their dynamo-machines and arc lamps, together with a license for exclusive rights of use or sale of the "Lane-Fox" incandescent lamp, is secured for the counties of Gloucester, Somerset, Devon, Cornwall, Dorset, Wilts, Monmouth, Glamorgan, Pembroke, Carmarthen, Radnor, Brecon and Hereford.

The Great Eastern Steamship Company hope that as the tendency is to build vessels of a greatly increased tonnage, the time is not far distant when either profitable employment will be found for the Great Eastern or that an opportunity will present itself of disposing of her at a price approaching her value. At the recent meeting of the company the directors said that "in their opinion it only wanted a little outlay to make her the fastest, most economical, and safest vessel afloat." When talking of the Great Eastern it is perhaps desirable that what is meant by "a little" should be explained.

The ordinary meeting of the Manchester Geological Society was held on Tuesday, Mr. George Gilroy, president, in the chair. A short discussion took place on the Koepe system of winding for collieries; Mr. W. E. Teale also exhibited an apparatus now being adopted in the South Wales colliery district for ascertaining the presence of gas in crevices or amongst rubbish where the fireman would be unable to penetrate. A discussion on the safe lighting of mines which had brought together a large number of colliery engineers from the district was unavoidably deferred to a subsequent meeting.

Iron shutters have been condemned in America. During the examination of Mr. Esterbrook, Superintendent of Buildings, by the jury impanelled to fix the responsibility for the loss of life at the old New York *World* office fire, he said there ought not to be an iron shutter permitted on any building in the city. The effect of iron shutters was to confine a fire within a building, preventing the firemen from gaining access thereto until it became a raging furnace within, resulting in a fire that could not be controlled. He suggests that they might be of service in narrow streets in protecting a building from a fire raging on the opposite side of the street, but when employed for this purpose they should be left open habitually, and only closed when danger is imminent.

The annual report of General Dumont, the American Supervising Inspector-General of Steam Vessels, shows an encouraging decrease of 29 per cent. in the number of lives lost during the past five years compared with the preceding five, notwithstanding an increase of 59 per cent. in the number of passengers carried. The figures for the several years are as follows:—From 1872 to 1876 the total number of lives lost was 1802; passengers carried, 597,115,085; steamers inspected, 19,819. From 1877 to 1881 the total lives lost was 1053; carried, 932,500,537; and steamers inspected, 22,132. General Dumont recommends a large reduction in the tax upon licensed officers of steam vessels. He would have the inspector's fee for granting certificates reduced to 2s. It now averages 30s.

A new ocean steamship, invented by the captain of the Cunard steamer Batavia, is, says the *Colonies and India*, being built near New York by the American Quick Transit Steamship Company, of Boston. She is composed of wood, has a turtle back deck, no masts, and nothing on deck except a pilot-house, ventilators, and the smoke pipe. The length is 151½ft., the breadth of beam is 22ft., the depth of the hold 16½ft., the draught forward is 5½ft., and aft 10½ft. The capacity is 512 tons. She will have three screws; the main one of four blades and of such pitch as to be capable of a speed of 30 knots an hour. The others will be fitted in the stern, behind the plates, and will be used in case of accident, when the plates will be used to steer with. The engines are of new design, and the ship is to be named the Meteor.

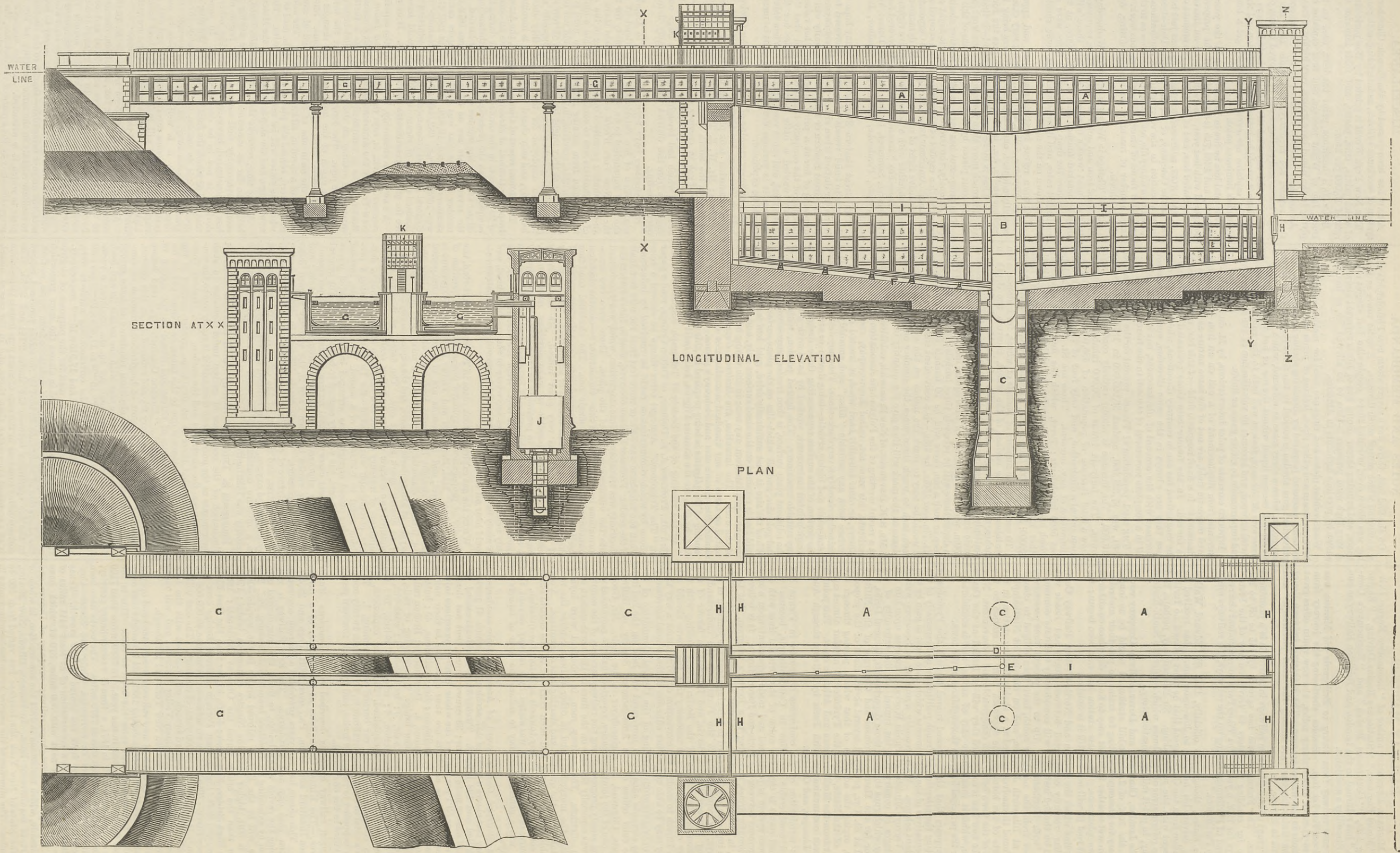
At one time, remarks the *American Machinist*, the safety of a boiler, so far as concerned any danger arising from low water, seemed reasonably well assured by the fusible plug. Experience has demonstrated, however, that this, like other so-called safety devices, is not to be depended upon. In some instances, the material of which the fusible portion of the plug is made seems to gradually lose its nature, or, more probably, the base of the metal gradually wastes away, its place being occupied by lime and other deposits until it is well-nigh impossible to melt it. In other instances it becomes covered with scale and dirt, making it highly improbable that it will melt until the heat becomes dangerously high. So uncertain is it at what temperature such plugs will melt, that as safety devices they are of little use.

A new telephone has been made by M. Bottelier, which consists of a cylindrical copper box, about 5in. diameter and 2in. high, in which the different pieces are placed and covered with a lid having a hole in the centre. To the right of this opening is fixed a mouthpiece in which to speak; the sounds emitted strike a vibrating plate screwed to the lid; the vibrations act on a magnet, suspended to the sides of a box by three steel wires, the tension of which can be regulated at will. It is easy to see how the system acts, the magnet being able—thanks to the elasticity of the wires—to oscillate slightly in the same direction as the vibrations of the plate to which it is attracted. As the magnetic action increases proportionately to the square of the distance, the amplitude of the oscillation increases until the tension of the wires, on the one hand, and the elasticity of the plate on the other, equilibrate the attraction.

HYDRAULIC ELEVATOR ON THE NEUFFOSSE CANAL AT FONTINETTE, ST. OMAR.

MESSRS. CLARK, STANDFIELD, AND CLERK, WESTMINSTER, ENGINEERS.

(*For description see page* 247.)



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J. C. J.—*You can obtain a patent for an invention in use abroad, but which has not been published in this realm. We cannot undertake to advise you as to the novelty here of the invention to which you refer, but we doubt very much that it has not been published here, if not anticipated.*

A Corn Miller.—*The scale to which you refer probably suits the spring which is most frequently used, namely,* 15-0-60 *lb., or it may fit some other spring. It is often put on indicators now, because with its aid one can tell almost at a glance what the initial cylinder pressure and vacuum are.*

THE ECONOMY OF THE ELECTRIC LIGHT.

(*To the Editor of The Engineer.*)

Sir,—In publishing my letter on the above subject last week there was an error in putting the dynamo machine at Messrs. Furlong's mill in the plural. There is only one Bürgin machine, which generates current for 50 Swan lamps, in two circuits of 25 each. J. H. Greenhill.
35, Mill-street, Belfast, April 4th.

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MEETINGS NEXT WEEK.

Society of Telegraph Engineers.—Thursday, April 13th, at 8 p.m.: "Description of a Form of Battery of Low Internal Resistance," by Mr. F. Higgins, Member. "Tests of Incandescent Lamps, with Special Reference to the Decrease in Resistance of the Carbon with an Increase of Electromotive Force," by Mr. Andrew Jamieson, Member.

THE ENGINEER.

APRIL 7, 1882.

THE COST OF THE ELECTRIC LIGHT.

In a recent impression we published the results of an experiment which we carried out at the Crystal Palace to obtain some information concerning the cost of the electric light. Certain statements have been since made which appear to render it necessary that our figures should be altered in certain respects. These statements refer, however, altogether to the cost of the plant supplied by Messrs. Hammond, and not at all to the working expenses. Messrs. Hammond, indeed, consider that we have allowed too much for depreciation and wear and tear; but it is well to err on the right side in this direction. We stated that a plant of thirty-two Brush lamps, engine, and two dynamos could probably be had for £1000. We find, however, from Messrs. Hammond's price list, that the dynamos cost as much as £400 each, and the lamps £16. In our estimate we allowed £300 for a 12-horse engine, £10 each for thirty-two lamps, £150 each for the dynamos, and £100 for wire and regulator, &c., all net cash; and we included nothing for engine shed or lamp-posts, because the cost of these things will vary with the wishes of the Town Council or other public body using the electric light. Messrs. Hammond's estimate would, however, be considerably higher than ours; but it by no means follows that we are wrong. We believe that there are numbers of firms who would be delighted to take up the manufacture of Brush 7A dynamos at £130 each. But it must be remarked that there are now heavy royalties to be paid to the patentees both for lamps and dynamos, and these cannot be charged legitimately to the light. In course of time the patents will expire. It is quite proper that the patentees should be remunerated for their skill and outlay, and no reasonable person can take exception to this. Yet, on the other hand, it is perfectly fair to the light to consider what the cost of its production will be when freed from the incumbrance of patentees' claims.

It happens that we are in a position to state exactly what Messrs. Hammond can do with the Brush system when they like to send in what may be termed a close tender; and we are pleased to find that a very near correspondence exists between our estimate and facts of which we knew nothing at the time our estimate was made. A preliminary report by Mr. W. Haywood, City Engineer, to the Streets Committee of the City on the contracts for electric lighting has just been published. Three contracts were made which all expired on the 31st ult. The electric lighting is divided into three districts, as follows:—District No. 1 includes Blackfriars Bridge, New Bridge-street, Ludgate-circus, Ludgate-hill, St. Paul's-churchyard—north side—and Cheapside, from its western end to King-street, the length of thoroughfare being about 1648 yards. District No. 2 includes Southwark Bridge, Queen Victoria-street, Queen-street between Queen Victoria-street and Upper Thames-street, and Queen-street-place, the total length of thoroughfare being about 1703 yards. District No. 3 includes London Bridge, Queen-street, between Queen Victoria-street and Cheapside, Cheapside between King-street and Poultry, King-street, Guildhall-yard, Poultry, Mansion House-street, the open space in front of the Royal Exchange, King William-street, and Adelaide place, the total length of thoroughfare being about 1521 yards.

The Anglo-American Light Company—Brush system—took its contract for £1410, the Electric and Magnetic Company—Jablochkoff system—for £2930, and Messrs. Siemens charged £3720. The second company we have named was unable to carry out the provisions of the contract, which was made over to the Electric Light and Power Generator Company, working the Lontin system, at the same price. It will be seen that there is a wide difference between the prices charged by the contractors, although the length of street lighted is nearly the same with all. As regards the actual cost, we have the following facts:—In district No. 1—lighted on the Brush system—the outlay for works has been £750. The cost of lighting for twelve months, from sunset to sunrise, £660. In district No. 2 — on the Lontin system—the cost of works was £1470, and the lighting £1460; while Messrs. Siemens, in district No. 3, charge £1450 for works, and no less than £2270 for light. In district No. 1 are 33 lamps, each of 2000 candles. In district No. 2 there are thirty-two lamps, each of 1000 to 1500 candles; while in district No. 3 there are six large lamps, each of 5000 candles, and twenty-eight small lamps, each of 300 candles; the total candle-power being, in the three cases respectively, 66,000, 45,000, and 38,400. Thus it will be seen that the Brush system has outstripped all its competitors by an enormous distance. Our estimate for the cost of thirty-two lamps working four hours a night was, in round numbers, £1000 per annum; but it appears that the Anglo-American Electric Light Company is actually ready to give the light of thirty-three lamps for much more than four hours a night for £660 per annum. We presume that this sum covers all expenses, and it is no doubt sufficient, provided the provision for maintenance of plant can be kept down to the very low estimate provided by Messrs. Hammond. There is not much wear and tear in a dynamo, yet 2 per cent. seems to be a very small allowance to meet its expense. Messrs. Siemens have written to the City Commissioners of Sewers, commenting on a statement publicly made by the chairman of the Commission that their system of electric lighting in the City was nearly four times the cost of gas. They pointed out in effect that much of the cost of the lighting had been entailed by the merely experimental and temporary nature of their contract necessitating the provision of expensive machinery; that it would have been cheaper if the contract had had more permanence, and if they were permitted to supply private houses in the same district with the electric light. They also stated that the comparisons as to the expense of gas and electric lighting to the disadvantage of the latter were always made under the supposition that the lights were of equal brilliancy, whereas the electric light was far more powerful than gas. But the new contract submitted by Messrs. Siemens, so far from being cheaper because the experiment continued, was £3600 instead of £2270, being nearly six times dearer than gas.

Coming now to the cost of gas, we find that, including cleaning, lighting, and repairing lamps, it would have amounted to £690, or about £30 more than that of the electric light in district No. 1. In district No. 2 it would have cost £700, and in district No. 3 £612; in the two latter cases being very much less than the cost of electricity. Rejecting districts 2 and 3, we may confine our attention to No. 1. In it there are 156 gas lamps supplanted by the electric light. The cost of maintaining them is almost precisely that of the cost of electric lighting; but the 156 lamps only give out 2500 candles, against 66,000 candles. We showed in our estimate that the cost of 500 gas lamps burning 5ft. each, and giving 10,000 candles, would be, if gas were 5s. per 1000 cubic feet, just equal to that of the electric light. In this estimate we allowed nothing for cleaning and lighting and repairs; but we find that in the City the outlay for these items is £350 per annum for 452 lamps, or nearly 15s. 6d. a lamp per annum. If we charged a similar sum against each of the 500 gas lamps in our estimate, the cost of gas would have greatly exceeded that of the electric light.

It is by no means to be supposed that the Brush system marks the greatest advance that can be made in the direction of cheapness. On the contrary, there is every reason to believe that, as more experience is gained, greater and greater reductions can be made in cost. We have shown that the charge for power is almost nominal, the fuel consumed not costing 10 per cent. of the whole expenses incurred; and for this reason it would appear that little or nothing is to be gained by improvements in dynamos which have for their object the attainment of greater efficiency for a given weight. Other things being equal, the more efficient a dynamo is the greater will be the power required to drive it. Put into other words, we may say that a large inefficient machine will require no more power to work it than a small highly efficient machine. Two great objects should be kept steadily in view; one is the reduction to the lowest possible point of the internal resistance of the machine, and the second the improvement of the commutators or collectors. These last constitute the weak point in the dynamo. Care should also be taken that the armatures are strong enough to resist centrifugal force. We have given a warning ere now concerning the fitting of small fly-wheels on dynamos to secure regular turning when gas engines are employed to drive them. The warning was not unnecessary. A few days since the armature of a dynamo flew to pieces at the Crystal Palace, but fortunately no one was hurt, and the lesson will prove valuable.

THE HISTORY AND TREATMENT OF RIVERS.

In the course of last session a Bill was introduced by Government to deal with the general question of the conservancy of rivers; but from causes not needing description, it failed to become law. This year the subject has been mentioned in the Queen's Speech; a Bill, under charge of Mr. Dodson, has actually been brought forward; and we have reason to believe that the Government are sincerely anxious to convert it into law. The subject, therefore, specially invites discussion by engineers, in order that the officials who will have charge of the working of the promised Act may have the fullest information as to the principles which will guide their practice. One very important branch of the subject, that relating to floods, has, in fact, been lately discussed at great length before the Institution of Civil Engineers. On this we may perhaps comment when the records are published; meanwhile we desire to call attention to a very able paper recently read by M. Cotard on another division of the question, before the sister society in France.

This paper, like French papers generally, takes wide ground, and deduces its conclusions from general principles. The author had developed, in a previous paper, a general theory as to the history of rivers, founded mainly on a study of their existing phenomena; and this theory he restates in the present communication. He considers that the history of a river may be divided into three main periods, which we may perhaps distinguish as those of youth, middle age, and old age. In youth a river consists of a chain of pools, each surrounded by a rocky margin, over a gap in which it discharges its waters by a rapid fall into the next pool below. The erosion of this gap gradually lowers the level of the pool. In middle age the pools, partly filled up by alluvium, partly emptied by the lowering of their levels, have become dry, and the river gradually cuts itself a sinuous course through the middle of the old lake bed, while at the same time it deepens the steep channels leading from one pool to another. The valley thus presents a series of flat basins, connected by narrow gorges, and each serving to some extent as a catchment basin, to receive and retain the water descending from the hills, and then pass it gradually into the river. In the third period, of old age, the whole bed of the river has been so far deepened, and the subterranean level of the waters so far reduced, that the basins have no longer any influence; the rain waters run off at once into the river, which, in consequence, takes the character of a torrent, now high in flood, now scarcely flowing; and the higher slopes of the hills are so quickly deprived of moisture that their springs fail, and in some cases they may even be reduced to desert.

For a proof of this theory M. Cotard points to the numerous rivers which are to be found in each one of the three conditions. On this point there need be no dispute. The division of a mountain stream into pools and shallows is one which is familiar to every fly-fisher; and the same holds true generally with larger rivers, though the effect is masked from view by the depth of the waters. Again, all mountaineers must have noticed the very frequent, if not universal, division of a mountain valley into a succession of basins or wide vales, connected by narrow gorges; which would correspond with the middle-age period of the river's history. As examples of this class, familiar to nearly everybody, we may point to the gorge of the Devil's Bridge in Wales, connecting the upper and lower valleys of the Rheidol; the gorge of a similar name in Switzerland, between the plain of Andermatt and the expanse above the Lake of Lucerne; the gorge of the Conway at Bettws-y-coed, with the rich dales of the Conway and Machno above, and the fertile vale of Llanrwst below; and many others. Perhaps the grandest in the world is cited by M. Cotard, namely, the gorge of Niagara, which divides the lake system of Canada from the lower course of the St. Lawrence; but there the dividing barrier of rock has not yet been cut away. The third period of old age, is not perhaps common in England, but is to be traced in the profound ravines and violent torrents of many parts of the Alps, and still more of the mountains of Asia and Africa; while it attains probably its grandest dimensions in the enormous "canons" of South America. Its effects have been notably augmented by human industry in draining meadows and swamps, felling forests, &c., not to speak of direct alterations in the river channels themselves.

But to admit that these three conditions exist, and even are common, in the case of rivers, is not to admit that they are stages through which every river must necessarily pass. In laying down his theory so broadly, M. Cotard appears to us to have forgotten the great variations in the circumstances of different regions and epochs. Thus, it

will probably strike everyone that it cannot apply to rivers flowing mainly through soft or alluvial soils. In such soils lakes are practically unknown, and in the rivers—generally deep and sluggish—which wander through them, the "pool and shallow" arrangement is absent. Again, if we confine ourselves to rocky districts, the theory rests on the assumption that the rivers have always had their own way undisturbed in channelling the valleys which contain them, and that all the features in their course have been carved by themselves alone. Now this is an assumption which no cautious geologist would endorse. There are at least two agencies, besides that of rivers, which may have acted, and probably have acted, to modify the features of every valley in Europe. These are, first, the action of the sea, covering the valley with silt when the country was deeply submerged, or excavating it by tidal currents and waves when it had been partially elevated and the valley formed a strait or estuary; and, secondly, the grinding and ploughing action of ice, either in the form of a glacier, or, less probably, of travelling icebergs. To trace the influence, in any given case, of these three agencies is one of the most fascinating problems presented to geologists; and it cannot be said to have been even approximately solved. But there is ample reason for holding that sea and ice have been, speaking generally, at least as potent in the carving of our mountain scenery as the more continuous but far gentler action of streams. If this be so, it is clear that the regular process described by M. Cotard will have been frequently interrupted, and that the streams, when, after the lapse of ages, they have returned to their channels, will often have found that a large amount of work has meantime been done, in some cases for them, but in others against them.

But, however we may dispute the fact of the history of any river having actually been as M. Cotard describes it, it is none the less true that this is the history which every river tends to create for itself, if it is allowed a quiet and uninterrupted career. Suppose a rocky surface to heave itself up out of the ocean. It will clearly be uneven, and will contain numerous depressions and hollows, which will fill with rain water until they overflow. If two such depressions are contiguous, it is obviously probable that the neck dividing them will be at a lower level than elsewhere, and therefore that the discharge from the upper of the two will pass over this neck into the lower. Here we have the beginning of the chain of pools. Suppose such a chain once formed, it is clear that the tendency of the current, running rapidly over the ledge which separates one pool from the next, will be to wear this ledge down, and thus to lower and finally empty the basin of the upper pool. How long the operation will take is a moot question. Our own belief is that mere running water has practically, or even absolutely, no effect in wearing away rock of tolerable hardness; but such water is charged, at least in times of flood, with a certain amount of gravel and sand, which, scraping along the bottom, does undoubtedly possess a considerable power of excavation. Moreover ocean currents will gradually produce a similar effect, and so will the grinding action of ice. Hence, from one cause or another, the valleys will be deepened substantially in the way M. Cotard describes; and the three periods he speaks of may be regarded as approximately correct, though the extent and duration of each will vary very greatly with different localities.

We may now go on to consider the application which M. Cotard makes of the theory to a question of the highest practical interest, namely, works of river improvement. The artificial treatment of rivers has always one of three objects in view—either to prevent the flooding of the adjacent lands, to hinder the erosion of the banks, or to facilitate navigation. Now, the further a river has advanced in the history here sketched out for it, the more violent and intermittent will it be in its character; hence the greater will be the danger both of flooding and erosion, and also the difficulties of navigation. From this it follows as a principle that the efforts of engineers should always be directed to retard, or certainly not to accelerate, the progress of a river in its career of decay. Unfortunately in many cases short-sighted views of immediate advantage have led to a complete reversal of this the natural and proper policy. A striking example is given in the case of the Nile. In ancient Egypt, between the cataracts and Khartoum, there are calculated to have been more than 20 million hectares of irrigable, and therefore fertile, land. Now, in consequence of works undertaken during the Roman period to improve the navigation of the ataracts, the upper level has fallen so far that the extent of irrigable land is two or three million hectares only. The same fault has often been committed in later times. There is a shallow in a river, over which it runs with a rapid and broken stream, and which forms more or less an impediment to navigation. By dredging out the bottom, or by confining the stream by dykes to increase the scour, it is sought to remove the obstacle, thus accelerating the downward progress of the river. A local success is thereby sometimes attained, but it is of brief duration. The bed continues to get deeper; the lowering of the bottom produces a lowering in the general surface level of the reach above; and by the time equilibrium is again established the depth at the shallow is not much greater than before the operations began, while it is decidedly reduced at the shallow next below, to which the same mistaken policy has next to be applied.

Such errors arise from a failure to appreciate what may be called the natural laws of equilibrium of a river, which are well set forth by M. Janicki, as follows:—In every stream, flowing naturally, there is a fixed and necessary relation among the following quantities:—Its slope, its velocity, its discharge, its section, the shape of its channel in plan and in profile, and the resistance to scour of the materials composing its bed. The influence of the latter fact may perhaps be questioned, but it is easily made apparent. Suppose from any cause the velocity of a river becomes greater than that which the resisting power of the material composing its bed will stand; the bed will then be worn away, and chiefly of course at the outside of the bends. The sinuosity of the river will thus be increased, and its length, for the same difference of level, will increase also. This means that the slope is diminished, and therefore the velocity will be less, and the resisting power of the bed will be sufficient to prevent further wear. The same principle of equilibrium will hold in other cases. It should therefore be a fundamental principle, in all partial river improvements, not to disturb the natural factors of equilibrium, as enumerated above; and this is at once sufficient to condemn all works undertaken with the idea of deepening a river at certain parts, either by artificial dredging or by increasing the force of the current. The works carried out on the Volga are a notable instance of this; the increased velocity produced by the building of dykes at certain shallows has simply ended in creating other shallows further down, and after an expenditure of millions the effective depth is actually lower than it was before the operations began. Such operations are worse than useless, unless the bottom is at the same time consolidated by some means, as has been done on the Oder and elsewhere in Germany; but this is, of course, a very costly process.

For the further applications of the principles thus indicated, both to the correction of erroneous and the discovery of proper measures for the treatment of rivers, we must for the present refer our readers to the paper itself.

LONG PASSENGER CARS.

The returns of American railway accidents for February, as recorded by the *Railroad Gazette*, have the usual characteristic excess of unexplained derailments. During the month there were sixty-nine derailments, and no fewer than twenty-eight, or no less than 40 per cent. of the whole were unexplainable. Of the remainder, fourteen were due to defects of road, seven to defects of equipment, ten to negligence in operating—which includes wrongly placed switches—eight to unforeseen obstructions, and two were maliciously caused. Out of the forty-one people killed and 153 injured by the accidents of the month, no less than fourteen were killed and 139 injured by these derailments. The *Railroad Gazette* remarks that "some of the unexplained derailments were, in all probability, due to defects of road; a few, perhaps, to defects of equipment; more of them, again, to faulty construction." We should, however, be inclined to ascribe these derailments to another cause, namely, to the inertia of these very long cars. This was suggested when speaking of the introduction of the long Pulman cars on the Brighton Railway. Our comparatively short cars are not sufficiently heavy to offer very great resistance to lateral movement, as when entering a curve or passing over points, and hence they rock and roll with movements of short range, all the chief movements of the running gear being transmitted to the carriage. In the case of the long carriage, however, the inertia is so great that only those movements and shocks which are of preponderating intensity and direction are transmitted to the car, the smaller movements and shocks being absorbed by the double spring and swing bogie gear. These cars have thus in general a much more steady rolling motion than our short carriages, but this it may be contended is fraught with some danger in entering curves, and at points and crossings, for the very heavy car tends to continue in its right line course with much greater persistence than a short carriage. The bogie or leading wheels make a sudden lurch transversely, but the inertia of the car causes its movement in that direction to be comparatively slow, and hence a strong tendency exists for the leading wheels to leave the rails, or for the car to leave or tip the bogie. If it does the latter, the wheels upon which the tipping takes place may drop inside the track, when the car begins too late to list over towards the curve, the inner wheels which had been lifted drop on to the rail or outside it, and the rest of the derailment follows. These derailments are so common in America, and so large a proportion unexplained, that it is worth considering whether or not the inertia of these long cars is not one of their chief causes.

THE NAVAL AND SUBMARINE EXHIBITION.

On Easter Monday the Naval and Submarine Exhibition will be opened. The work of getting in exhibits commenced on Wednesday, and a great deal will have to be accomplished in a short time; every available inch of space on the floor of the Agricultural Hall has been taken by exhibitors, and the galleries will be well filled. The exhibition promises to be a success in the fullest sense of the word, and it may be safely said that it is unique; for never before have been so many interesting exhibits connected with the sea, the engineer, and the sailor got together under one roof. The number of specially interesting exhibits is legion. We may mention Sir William Thomson's famous sounding log and compass. Messrs. Maudslay and Field will exhibit a fine collection of models of engines in motion. There will be many full-sized steam launches, some with their engines at work, steam being supplied by boilers outside the building. In the centre will be the great tank, in which Greek sponge divers, specially brought over from the Levant, will show their wonderful powers of endurance. In what is known as the "piggery;" life-saving apparatus, &c., will be tested that prizes may be awarded. The judges will be Admirals Hood and Boys and Sir Digby Murray, of the Board of Trade. Three rotary engines, one of 1000-horse power, will be shown in motion, steam for one of them, M. Brosard's, being supplied by two 16-horse power semi-portable boilers supplied by Messrs. Davey, Paxman and Co., Colchester. There will be besides lectures given daily. Among the lecturers we find Professor Osborne Reynolds; Mr. D. K. Clark; Capt. Orde Browne, R.A.; Mr. Robert Griffiths, on "Propellers;" Mr. Hall, on "Refrigerators;" Mr. D'Alton, on "Steel for Shipbuilding;" Mr. Terry, on "Ships' Pumps;" besides many others. On Monday evening Mr. Samson Barnett gave a preliminary dinner at the Criterion to the members of his staff and some others, to whom he explained the object of the Exhibition, and indicated what would be the nature of the contents of the Agricultural Hall. Mr. J. H. Raffety, managing director of the Hall, was also present. On the cordial co-operation of this gentleman a great deal depends. Mr. Raffety's skill and tact in the management of the Agricultural Hall is well known, and will no doubt do much to render the Naval and Submarine Exhibition a great success.

SECONDARY BATTERIES.

On Tuesday evening a display of the capabilities of the new accumulator battery of Sellon and Volckmar was given at the Crystal Palace. Subsequently Mr. Sellon delivered an address, in which he commented severely on certain statements made by the proprietors of the Faure patents. After alluding to the wonderful flourish of trumpets with which the Faure battery was introduced to the world, he went on: "I ask, do any of you know of one single working or workable installation of the Faure battery in any part of the world at the present time? Have any of you been able—and I know many have endeavoured—to purchase and thereby secure private possession of one single set of cells? Have any cells been submitted to the test of time in the hands of disinterested persons? The only opportunity which within my knowledge has been afforded to a section of the public to form any impartial judgment of the working of these cells was at the Paris Exhibition. There, under the management of a large staff, with the best facilities for work, and under the most favourable conditions to ensure any possible success, a certain number of cells were shown at work for a few months, and with what results as to power consumed, regularity in working, and wear and tear, I leave to the judgment of those who enjoyed the opportunity of observing them." We can say for ourselves that we have spared no trouble to obtain a Faure accumulator for the purpose of experiment, and we have been unsuccessful. Mr. Sellon concluded by saying:—"To recur for one moment to the natural forces. Dr. Sylvanus Thompson made a very remarkable statement in his last lecture in this place; it was that in the river Severn alone there was enough motive power to light all England, or to work all our machinery ten times over. Gentlemen, with such a statement before us, is it to be supposed that these and other analogous and enormous forces are in this age of progress to remain unutilised? Their utilisation on a small scale only will solve an immense problem of commercial economy, and open out a vista of benefit to mankind, towards which any practical means of storing electrical energy will contribute no inconsiderable quota."

METROPOLITAN BRIDGES.

It has been known for some time that Waterloo Bridge was in almost dangerous condition, and attempts have been made to protect the foundations of the piers from the scour of the river with some success. There is reason, however, to believe that a worse element of danger than scour is at work, as there are some indications that the pier next but one to the southern end of the bridge is sinking bodily. The Metropolitan Board of Works have entered into a contract with Mr. Webster, of St. Martin's-place, to carry out repairs and extensive works are in progress. A heavy coffer dam is being driven round the pier, the base of which is left dry at low water, and when this is complete it will be possible to make a thorough examination of the foundations. The first stone of Waterloo Bridge was laid on the 11th of October, 1811. The bridge was designed and built by Rennie, and it was one of the first bridges constructed within coffer dams instead of on caissons. The bridge is 1326ft. long, and consists of nine equal semi-elliptical arches of 120ft. span, with a versed sine of 32ft. and a rise above high water of 35ft. The piers are 30ft. wide at the base and 20ft. at the springing of the arch. The foundations are carried on piles driven deep in the clay, but London clay is well known to be a treacherous material, and the probability is that the failure of the bridge is due to this cause. Tenders have been received for the new arched stone bridge at Putney. That of Mr. J. Waddell for £240,434 has been accepted. This bridge will be built on wrought iron centreing, not less than 1500 tons of metal being required. This will get over the difficulty which would have been caused by the presence of timber centreing obstructing the steamers. The iron will be removed when the bridge is finished. The same system of construction was adopted by Mr. Webster in building the new stone bridge at Maidstone. The whole of the ironwork was supplied by Messrs. Handyside and Co., of Derby. It is probable that the construction of the new bridge at Battersea will not now be long delayed. The London Bridge scheme is slumbering.

LITERATURE.

The Steam Engine and its Inventors: A Historical Sketch. By Robert L. Galloway, Mining Engineer. London: Macmillan and Co. 1881.

The steam engine, according to an eminent authority with whom we are now and then forced to disagree, is on its last legs; but the early history of the machine still possesses an irresistible attraction for not a few eminently practical minds. There have been many books on the subject—some written for the purpose of supporting a preconceived theory, others to bolster up the claims of a particular inventor, not a few being mere picturesque compilations with the flimsiest basis of historical truth. Mr. Galloway claims in his preface to have followed a somewhat different plan from most of the treatises on the same subject. "No attempt," he says, "is made to give an account of all the machines in which steam has been employed. The sole object aimed at is to exhibit the successive steps in the development of the cylinder and piston engine, which is the great prime mover of modern times." The author has been entirely successful, and he has produced the very best book of the kind extant. It is not a "popular" work. It will not compete, for instance, with Mr. Smiles's productions, but is intended rather for the expert already familiar with the general nature of the various steps in the invention of the steam engine.

It does not contain much that is absolutely new, the chief characteristic of the book being that it brings together all, or nearly all, the authentic information on the subject which we possess. In every case Mr. Galloway has gone to the original authorities. He always gives chapter and verse for his statements, and his illustrations, so far as our memory serves, consist of careful reproductions of the originals. We have no "pot-lid" stories;* the impudent fabrication of Blasco de Garay's steamboat is not even mentioned, nor is anything said of the forged letter of Marion Delorme, describing her visit to the Bicêtre in the company of the Marquis of Worcester, where Solomon de Caus was confined as a madman for having invented a method of applying steam. We are half inclined to pick a quarrel with Mr. Galloway for his off-hand treatment of the Marquis of Worcester, whose claims he dismisses in a very brief note. Perhaps he errs as greatly in one direction as Mr. Dircks does in the opposite one; but it must be admitted that the evidence in favour of the Marquis's claim to the actual construction of a steam engine is not of a very satisfactory description.

The book opens with an account of the true nature of the vacuum and of the experiments which were made in the latter part of the seventeenth century in connection with the weight and pressure of the atmosphere. It describes the various schemes propounded by Sir Samuel

* The "pot-lid" story is much older than generally supposed, for it is referred to by Bacon in his "Advancement of Learning," first published in 1605. Speaking of accidental discoveries, he says: "So as it should seem that hitherto men are rather beholden to . . . or to the pot-lid that flew open for artillery, or generally to chance, or anything else than to logic, for the invention of arts and sciences."

Morland, Huyghens, Papin, and Hautefeuille, in some of which gunpowder was used for obtaining a vacuum. The credit of the "first *motive engine*, consisting of cylinder and piston," is assigned to Huyghens. Having traced the progress of the atmospheric engine—the parent of the modern steam engine—in the hands of philosophers, the author turns his attention to the efforts of the workers in brass and iron—the artisans and mechanics. Notwithstanding the great industry and patient research which Mr. Galloway has expended, he fails to fill up the gap in the history of the steam engine between Savery's machine and that of Newcomen. He has, indeed, fully established the very important fact that Newcomen's engine was brought out under the protection of Savery's patent. But before dealing with this point it will be well to state the sources of our information as to the dates and construction of the two machines.

Savery's engine, which is too well-known to need any description, was patented in 1698. At that period patents were granted without any condition requiring the filing of a specification, so that we are entirely dependent upon informal "contemporaneous expositions." It is true that the "title" of a patent is, in some cases, so full as to amount to a brief abstract of the invention, and now and then we get a sufficient indication of the inventor's scheme from that source. We happen most fortunately to be in full possession of Savery's plan (1) from a paper in the "Philosophical Transactions" for 1699, he having exhibited a model before the Royal Society in that year, and (2) from the description contained in his pamphlet, the "Miner's Friend," which he published in 1702. That pamphlet is illustrated with a well executed copper-plate, which leaves nothing to be desired. Richard Bradley, in "New Improvements of Planting and Gardening," published in 1718, gives a drawing of an engine erected by Savery at Campden House, or "Camden" as he calls it. "about six years ago," which would be in 1712. This engine is much simpler in construction than the one shown in Savery's tract above alluded to, and it has only one receiver.

So much for Savery's individual efforts. Now in the very same year—1712—we hear of a "steam engine near Dudley Castle, invented by Captain Savery and Mr. Newcomen, erected by ye later, 1712," which displays an extraordinary advance, consisting as it does of a well-designed "pumping engine," with a beam, arc-heads and chains, and self-acting gear. Two copies of the print representing this engine are in existence, and, so far as our extensive inquiries go, only two—one being in the Salt Library at Stafford, and the other in the possession of Mr. Samuel Timmins, F.S.A., of Birmingham. By the courtesy of the owner we were enabled to reproduce the latter in *fac simile* in The Engineer for Nov. 28th, 1879. We gave a brief description of it at the time, and its significance as bearing upon the generally-received notions of the invention of the self-acting gear was fully discussed in an article upon the Loan Collection of Scientific Instruments at South Kensington in 1876, where the print was exhibited—see Engineer, May 26th, 1876.

As regards the alleged partnership between Savery and Newcomen, it is asserted by Switzer—who appears to have been intimately acquainted with the latter—that "Newcomen was as early in his invention as Savery was in his, only the latter being nearer the court had obtained his patent before the other knew of it; on which account Mr. Newcomen was glad to come in as a partner to it." This statement has been received with a certain amount of reserve, on account of the great dissimilarity between the two machines, and also because Newcomen is regarded as belonging to a somewhat later period. In consequence of the lax practice of those early days there was nothing in the "title" of Savery's patent to exclude such an invention as that of Newcomen, and as specifications were not obligatory, the ground covered by a patent was as wide as the inventor liked. Mr. Galloway maintains that Newcomen's engine suffered much prejudice by being brought before the world as an improvement or modification of Savery's, and he is probably right. It must, however, not be forgotten that we have not the slightest evidence as to what Newcomen's original invention really was. We refer to his engine as it existed in the year 1698, when Savery took out his patent, and when, according to Switzer, Newcomen was already in the field. The proofs of a partnership between Savery and Newcomen consist of the print above referred to, and also, as Mr. Galloway acutely points out, of a clause in a deed for the erection of a pumping engine at Edmonstone Colliery, in the county of Midlothian. The parties to the deed are "the committee in London, appointed and authorised by the proprietors of the invention for raising water by fire" on the one part, and Andrew Wauchope, of Edmonstone, colliery proprietor, on the other part. The deed bears date 1725, and provides that certain royalties are to be paid until 1733, the very year in which Savery's patent—prolonged by special Act of Parliament for thirty-five years from 1698—came to an end. Although the deed contains no mention of either Savery or Newcomen, there can be hardly any doubt that "the committee in London" consisted of the representatives of these two individuals. Savery was in all probability dead at the time. That there was about the time some such body in existence claiming to grant licenses for the use of the new engines is clear from an advertisement which appeared in the *London Gazette* for August 11th—14th, 1716, and which, we believe, is now brought to light for the first time. It is as follows:—

"Whereas the invention of raising water by the impellent force of fire, authorised by Parliament, is lately brought to the greatest perfection, and all sorts of mines, &c., may be thereby drained, and water raised to any height with more ease and less charge than by the other methods hitherto used, as is sufficiently demonstrated by diverse engines of this invention, now at work in the several counties of Stafford, Warwick, Cornwall, and Flint. I have now therefore to give notice that if any person shall be desirous to treat with the proprietors for such engines, attendance will be given for that purpose every Wednesday, at the Sword Blade Coffee-house, in Birchin-lane, London, from three to five o'clock; and if any letters be directed thither to be left for Mr. Eliot, the parties shall receive all fitting satisfaction and dispatch."

We should much like to know who the "proprietors" mentioned in this advertisement were, and what was the precise nature of the engine which they professed themselves ready to erect. With the exception of the old print alluded to, our information is very scanty, and we were at one time inclined to doubt the genuineness even of that; but there seems no reason to do so. Since we last wrote upon the subject it has been pointed out that the Stafford copy has the imprint—"Birmingham: Printed and sold by H. Butler, in New-street." No date is attached, the engraver's date (1719) being probably regarded as sufficient. A curious evidence of the authenticity of this date has been elicited by Mr. Timmins, who shows that the first Birmingham book was published in the year 1719, and that it bore the imprint "Birmingham: Printed by H. B., in New-street." Assuming the print to be genuine, it may still be held to represent the machine, not in its original condition as erected in 1712, but as it actually existed in 1719, the date when the print was issued.

Desaguliers' account of the labours of Savery and Newcomen, as given in his "Experimental Philosophy," must be received with a great deal of caution. He was himself an inventor in the same line, and he wrote many years after the events which he professes to describe. His account of the invention of the self-acting gear is flatly contradicted by the print of the Dudley Castle engine; and as Mr. Galloway points out, the usual statement that the cocks were at first turned by boys may have arisen from a confusion between Savery's fire engine and Newcomen's, or from the fact that Newcomen employed a "buoy" floating upon the surface of the water in the boiler to open the injection cock.

A chapter is devoted to the period which intervened between Newcomen and Watt, and the author then proceeds to sketch the progress and results of the grand discovery of separate condensation, and the subsequent invention of the single-acting, and afterwards of the double-acting engine. Without in the least detracting from Watt's merits, it must be said that his specification of 1769, which included the separate condenser, is not a model of clearness. It was no doubt purposely drawn in a vague manner, and it was not until the patent was extended by Act of Parliament that a specification "particularly describing and ascertaining the said invention" was given to the world.

As regards the application of the crank to the steam engine, Mr. Galloway repeats the story that Watt was fraudulently anticipated by Pickard, but there is some ground for supposing that Pickard was a *bonâ fide* inventor, not, indeed, that there was any great merit in the mere application of a mechanism which had been well-known for centuries. Pickard's patent was dated 1780, but it is certain that he was at work upon the subject early in 1779, in which year he applied for a Scotch patent for a contrivance of this kind. The patent was abandoned at an early stage, so that no details of the mechanism are extant. It appears from a deed dated April, 1779, that Pickard, Wasbrough—a Bristol engineer, who had a patent substitute for the crank—Sampson Freeth—a Birmingham merchant—and William Chapman, of Newcastle-on-Tyne—a well-known engineer—were associated together for the purpose of introducing a certain contrivance to be applied to steam engines for producing rotary motion. The deed is in the possession of Wasbrough's descendants, and it is not impossible that the contrivance alluded to in the above document may, after all, have been a simple crank. Such are the bare facts of a story that has never yet been fully told. But, in any case, the application of the crank to the steam engine is included in John Barber's patent of 1766, besides being suggested by Menzies in a patent granted in 1761, so that neither Watt nor Pickard are entitled to priority in the matter.

As regards the application of the steam engine to the propulsion of ships, Mr. Galloway seems inclined to make too little of Miller's early experiments, and a great deal too much of Fulton's efforts. The chief merit of the latter consisted in his power of adapting and absorbing other people's ideas. We think, too, that Mr. Galloway ought to have known that Miller's original engine—largely restored, it is true—is now at South Kensington. At all events it was there a few months ago, and it was never in the Andersonian University at Glasgow as stated by Mr. Galloway.

The origin of the locomotive is described with sufficient fulness, each step being carefully noted, but the author leaves the machine as it appeared at the Rainhill competition. His drawing of the "Rocket" is, however, a mere sketch. For a more correct representation we may refer him to The Engineer for September 17th, 1880.

In case another edition should be called for, we point out that the great philosopher Hooke wrote his name with a final "e," which Mr. Galloway unjustly deprives him of. A good deal of information might be got together by a diligent perusal of the old patents relating to the steam engine, and as regards the history of the Cornish pumping engine, there is a mine of valuable references in Boase's "Bibliotheca Cornubiensis," the third and concluding volume of which was published last year. We should also be glad to be informed of the dates and places of death of Savery, Newcomen, and Cawley. A judicious offer of rewards ought to stimulate the efforts of parish clerks to search their respective registers. If inventors were in the least affected by such considerations, the present race might feel somewhat discouraged by the thought that so little is known of the history of those who did so much for the world and so little for themselves.

Durham Colliers.—The claim of the Durham colliers for a heavy advance in wages, and their decision to strike if they do not get it, is, perhaps, also affecting the manufactured iron trade. If any such strike should actually take place, it will lay off many of the mills and forges, and so make a scarcity of bars, angles, and plates.

HOW THE ELECTRIC LIGHT IS PRODUCED.

No. II.

In our last impression we explained, in the simplest and shortest manner possible, how electricity is obtained by the aid of a dynamo-electric machine. This article is intended to explain how the electricity obtained is made to give light. It is, perhaps, hardly necessary, but it may be useful, to add that neither this nor the preceding article is intended for the perusal of electricians. They have been written for the express benefit of that numerous class who, while wishful to obtain information concerning the principles involved in electric lighting, have no time to read books, which, however elementary, contain much more than is actually necessary to satisfy the reader's purpose.

(27) There are two systems of electric lighting, represented by the "arc" light and the "incandescent" light. The former is used by Jablochkoff, Brush, Crompton, Siemens, André, and many others; the latter by Edison Swan, and Lane-Fox.

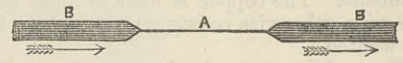
(28) When a current of electricity is caused to pass through a wire or other conductor, no matter how good the conductor may be, it meets with a certain amount of resistance to its passage, just as water meets with resistance in passing through a pipe.

(29) The effect of resistance is to raise the temperature of the conductor—no one knows why.

(30) If the resistance be great the temperature will rise so high that the conductor will become white hot, and may even be melted.

(31) If in a length of wire, called "a circuit," through which a current of electricity can be passed, we introduce a piece of very thin wire—as, for example, at A in Fig. 10, which shows two portions of a circuit—a resistance

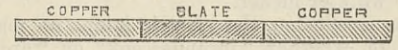
FIG. 10



will be set up, and a current which would not sensibly elevate the temperature of B B will make A brilliantly white hot. If A were of very infusible material, as platinum, it could be heated sufficiently without melting to give out a brilliant light; but the platinum wire cannot in practice be used for this purpose, because, when it is fully heated, the smallest augmentation in the strength of the current will melt it. In other words, in order that it may give out light enough, it must always be on the point of melting.

(32) If into a circuit—see (31)—we introduce a length of any material which is a bad conductor, that material will cause resistance and become highly heated. Thus, if in the bit of circuit, Fig. 11, were introduced a very short length

FIG II



of a non-conductor, such as slate, it would be heated and broken up.

(33) Carbon is a very imperfect conductor, and when made to take its place in a circuit it is highly heated, because of the resistance it causes—see (31).

(34) Carbon is found in three principal forms—diamond, graphite, and charcoal; anthracite coal and coke may be regarded as very nearly pure carbon.

(35) None of these three forms can be used to produce electric light instead of the platinum resistance piece A in Fig. 10, unless special precautions are taken to prevent them from burning away. The use of the diamond is, of course, out of the question, because of its cost and scarcity. Nearly every other form of carbon has been tried.

(36) If a stick or small rod of carbon were used in the place of A, Fig. 10, the light produced would be very feeble, unless the carbon were very small, in which case it would be rapidly consumed, unless the air were excluded. In the Swan and Edison lamps a very small filament of carbon is put inside a little glass globe, and from this globe all the air is exhausted. The little filament of carbon cannot burn away, because there is no oxygen in the globe to combine with it. In Fig. 12 we have at A the filament, the current of electricity passing in at one side and out at the other, in the direction of the arrows. To give an idea of the tenuity of the filament, we may say here that Edison made his original carbons of bits of sewing cotton, put between the two halves of a clamp like the flat ends of a pair of tongs. The clamp was heated red-hot, and the little charcoal filament taken out in the shape of a horseshoe. Such a filament may offer a resistance equal to 1000 times that of the copper wire W W, and, in consequence, it becomes whitehot, or "incandescent," and gives light.

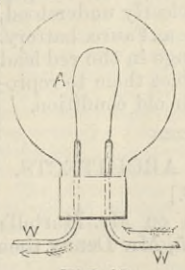


FIG. 12

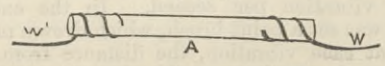
(37) The carbon does *not burn;* it is only intensely hot. If the globe were to break the carbon would be burned up quicker than the eye can wink by coming in contact with the air.

(38) The incandescent system is only applicable to small lights, for reasons which we cannot explain here.

(39) When large and powerful lights are required recourse must be had to the arc system.

(40) If we make a break in a circuit the current will jump across the break if it is not too wide, but as the break offers great resistance to the passage of the current, intense heat is produced.

FIG. 13

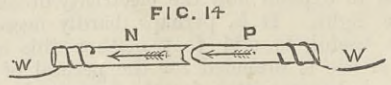


(41) If we put into a circuit a piece of carbon A, Fig. 13, by coiling the ends of the wires W W firmly round it, no heat will be generated in the carbon. Its large cross

section as compared with the wires make up for its want of conductivity.

(42) If we break the carbon in two and draw the ends about one-tenth of an inch apart, the electric current will jump from one to the other, and the carbons will soon assume the form shown roughly in Fig. 14. P is called

FIG. 14



the positive and N the negative carbon, and the light is produced, first, by the extremely high temperatures of the points of the carbons; secondly, the electrical current in jumping across carries like dust before a storm a multitude of minute particles of carbon torn off P and flings them on N. These particles are in the condition of most vivid combustion it is perhaps possible to imagine, and they give out the greater portion of the light.

(43) The carbons N and P do not take fire and burn, because carbon, when very hard and solid, can only be burned with extreme difficulty. In the incandescent lamp the carbon may be said to be in a state of extreme subdivision. The carbons used in arc lamps are, on the contrary, of considerable size, and excessively dense and hard.

(44) Carbons for arc lamps are nearly all made in France. The process is kept a secret as to details by the most eminent makers. Generally speaking, it may be said that carbons are made by grinding very good and clean coke to a fine powder and mixing it into a plastic mass with treacle or syrup. This mass is then made into rolls, each of which is placed in a strong iron mould and subjected to a pressure of many tons by hydraulic presses. The rolls are then packed in seggars or fire-clay boxes, which protect them from the air, and they are then baked at a red heat for several weeks. They are subsequently electro-plated with copper outside. The copper is used to make good contact with the wire, otherwise resistance would be set up where it is not wanted.

(45) The carbons waste slowly away, the positive fastest. The rate of waste depends on various conditions. In good lamps a $\frac{3}{8}$in. carbon will waste at the rate of about 1in. per hour. The points of the carbons tend to get further apart, and at last they would be so far removed from each other that the light would go out. To prevent this, all arc lamps are fitted with an automatic device by which the carbons are adjusted to each other. These devices are legion in number. They all depend on the same principle for their action. As the carbons get further and further apart the resistance increases, and at last a point is reached when a portion of the current is shunted into the coils of a small electro-magnet, which acts on the mechanism of the lamp, sets it in motion, and readjusts the carbons to each other. It is this act of readjustment which cause the "flicker" or wink to be seen every now and then with most arc lamps. The better the adjusting gear the less often will the lamp wink or flicker.

(46) In conclusion, the electric lamp, no matter what its form, or whether "incandescent" or "arc," depends for its action on the fact that when a portion of a circuit offers a resistance to the passage of an electric current, the resisting portion becomes intensely heated.

(47) We have alluded to batteries as a means of generating electric light, and more especially to the storage battery. We cannot say much about these batteries in such an article as this, for their mode of action is hardly yet fully understood by electricians or chemists. It must suffice to say that into a box containing water acidulated with a few drops of sulphuric acid are put a number of bags containing red lead with a lead plate in each. A current of electricity from a dynamo is sent for many hours through the water; at the end of that time it is found that a portion of the red lead has been converted into metallic lead. The battery can then be put away for an indefinite time. If now two wires be fixed to it so as to make a circuit, the metallic lead will begin to resort to its original condition of red lead, and a current of electricity will flow out of the battery nearly equal in strength to that which was passed through it to "charge" it. Why this takes place no one knows with certainty. We have only given a very rough explanation of what goes on, because we assume that those who read these articles have either no knowledge at all of chemistry, or a competent knowledge of that science. If the former is the case the reader would not understand a fuller explanation than we have given. If the latter, he will be able to fill up for himself the gap which we have left open. It must be clearly understood, however, that no electricity is stored in a Faure battery. The electricity sent in only effects a change in the red lead and metallic lead in the cell which enables them to reproduce electricity when they resort to their old condition.

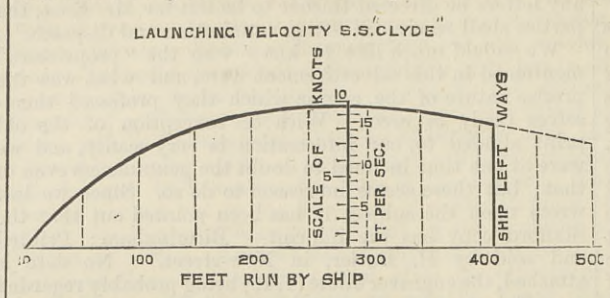
THE INSTITUTION OF NAVAL ARCHITECTS.

[*Continued from page* 245.]

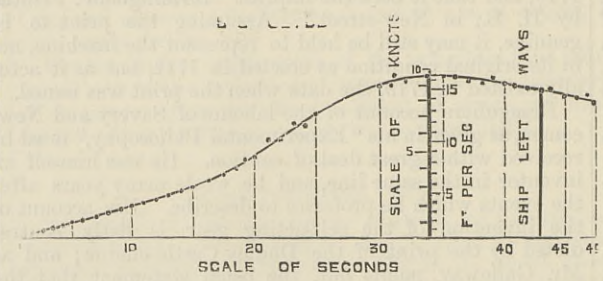
On the conclusion of the discussion on Mr. Martell's paper, which will be found on page 245, Mr. Denny then read his paper,

On Launching Velocities.

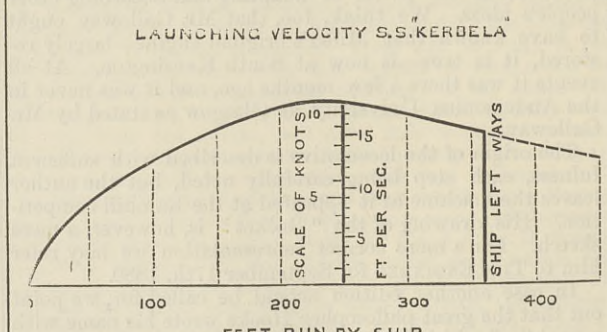
For a long time Mr. Denny's firm observed by chronograph, in the case of each steamer, the number of seconds taken from the release of the launch until the sliding ways left the standing ways. The information obtained was far from sufficient for the purpose of explaining the difference between the launches of different vessels. More accurate observations were then made by a method introduced by Messrs. Robert Napier and Sons. This consisted in attaching a strong cord to the bow of the steamer, which unrolled itself from a large reel as the vessel left the ways. Over this cord was hung a heavy lead pendulum, designed to make one vibration per second. In the end of this pendulum was set a paint brush, which drew a mark across the cord at each vibration, the distance from centre to centre of each of these marks denoting the distance travelled by the ship in one second of time. After the launch the cord was measured off throughout its length, and all the distances set up upon a scale of seconds. It was found in practice that not only were the markings



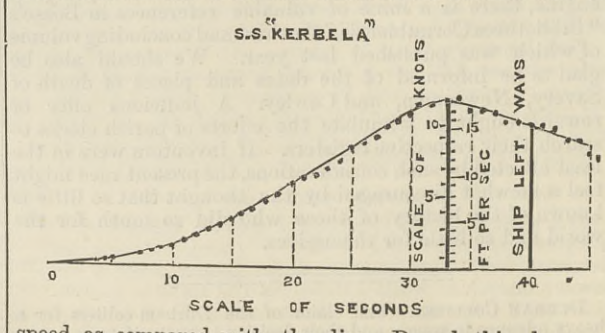
very indefinite, especially when the cord was travelling quickly, but that the paint brush gradually lost its paint, and the pendulum, from the friction of the brush across



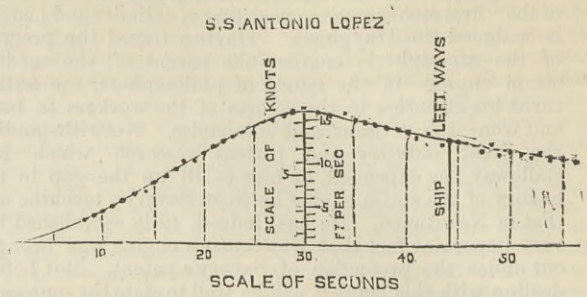
the cord, was by no means certain in its movements. This method was therefore abandoned and another adopted. The same arrangement of cord and reel was employed, only instead of passing the cord under a paint-brush pendulum, they took a turn of it round a disc of a known diameter. As the launch proceeded, the cord, in following the ship,



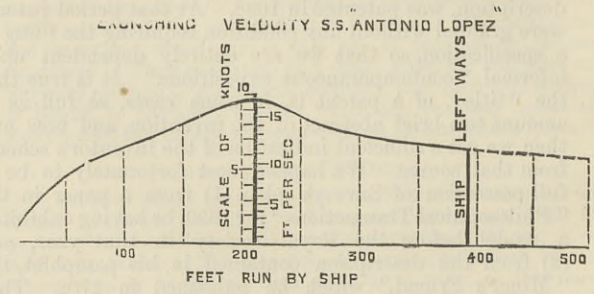
turned the disc in unrolling itself from the reel; a shaft through the centre of the disc by means of gearing communicated motion to a drum which had a definite rate of



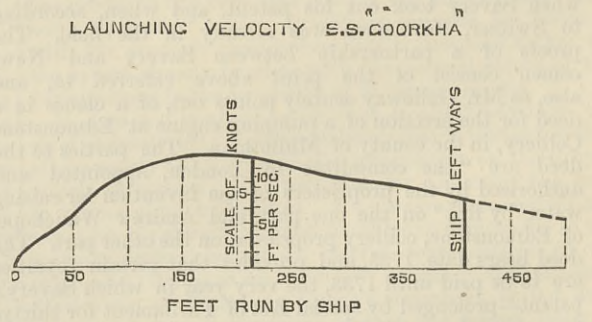
speed as compared with the disc. Round this drum a sheet of paper was firmly fixed, and upon it worked one of Mr. Froude's small pens filled with aniline dye, and actuated by an electric clock so as to make one jerk every half-second, with the loss of a half-second every seven and



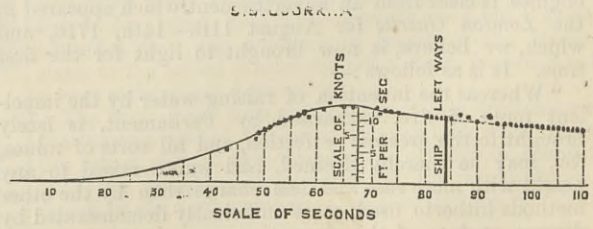
a-half seconds. By this means the time element was marked, and as the drum had a constant ratio of travel to



the revolving disc, and therefore to the speed of the launch, it was very easy to obtain from the diagram taken off it an exact measure of the speed of the launch at every half-second of its progress down the ways. All later observations have been made in this way, but some of the curves given were produced by the older method. In



addition to these observations, a check is obtained upon them by making five marks along the length of the sliding ways at known distances, the aftermost of these marks corresponding with a similar mark upon the standing ways. An observer with four chronographs, set in a case, so that all their stops can be started together by a small wooden

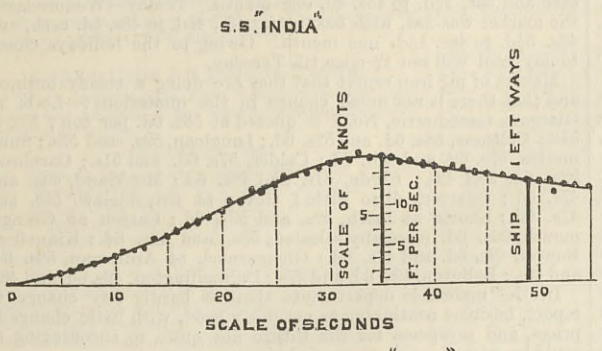


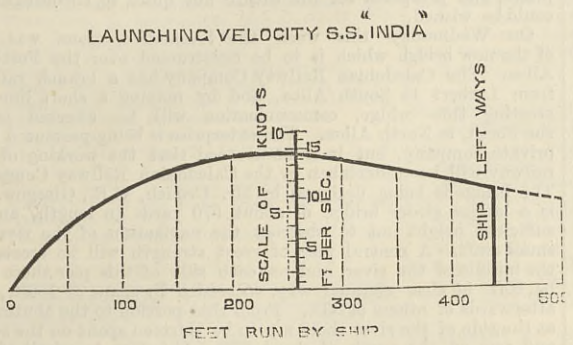
slide, is placed at the stern of the vessel, so that he can observe the time at which each of the marks on the sliding ways passes over the mark on the standing ways. When the first mark begins to move from the mark on the stand-

Table of Launching Data.

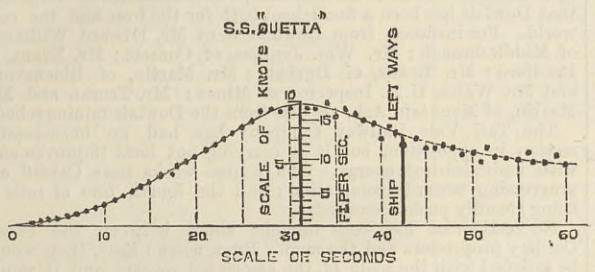
Name of steamer	Bancoora.	Diana.	Kerbela.	Quetta.	Clyde.	India.	Antonio Lopez.	Mahinapua.	Bucarest	Goorkha
Date of launch	1880 19 Nov.	1880 3 Sep.	1880 6 Oct.	1881 1 March	1881 15 June	1881 27 Aug.	1881 8 Nov.	1881 31 Dec.	1881 20 Dec.	1882 7 March
Temperature of air	—	—	—	—	60°	56°	52°	37·5°	40°	56°
Declivity of ways in sixteenths	8 to 12	8 to 12	7 to 15	8 to 16	7 to 13	7 to 12	9 to 11	8 to 17	6 to 12	8 to 12
Water on end of ways	5′ 2″	4′ 10″	4′ 9″	6′ 6″	4′ 8″	5′ 6″	6′ 6″	4′ 2″	4′ 9″	7′ 7″
Draught of ship forward	6′ 10½″	2′ 1¼″	7′ 8″	8′ 7½″	8′ 9″	7′ 8″	8′ 2″	3′ 4″	5′ 10¾″	7′ 11½″
Draught of ship aft	8′ 7″	3′ 2″	8′ 11″	10′ 7½″	12′ 3″	10′ 5″	10′ 10½″	5′ 0″	8′ 10½″	10′ 6″
Draught of ship mean	7′ 8¾″	2′ 7⅝″	8′ 3½″	9′ 7½″	10′ 6″	9′ 0½″	9′ 6¼″	4′ 2″	7′ 4½″	9′ 2¾″
Displacement in tons	1560	162	1245	2075	2510	2125	1944	266	1108	2187
Length of standing ways	343′	—	366′	409′	414′	433′	392′	251′	268′	406′
Length of sliding ways	246′	114′	209′	288′	300′	298′	268′	112′	186′	300′
Breadth of sliding ways	23″	15″	23″	23″	23″	23″	23″	15″	16″	23″
Area, in square feet, of sliding ways	943	285	801	1104	1150	1142	1027	280	496	1150
Tons displacement per square foot of sliding ways	1·65	·56	1·55	1·87	2·19	1·86	1·89	·95	2·2	1·9
Dip of stern to general surface of water	12′ 6″	—	16′	19′	20′ 6″	17′	15′ 6″	—	13′ 9″	15′ 6″
Distance run when maximum velocity occurred	183′	170′	247′	235′	280′	260′	210′	170′	140″	220
Total fall in length of standing ways	18·2	—	20·5	24·7	19·9	20·8	19·5	14·7	12·1	19·4
Total fall at point of maximum velocity	8·8	10·9	12·6	13·2	12·4	10·9	10·	8·4	6·1	12·1
Total time of leaving ways	40″	30″	40″	43″	43″	49″	44″	43″	48″	84″
Time of maximum velocity	28″	27″	33″	30″	34″	35″	30″	36″	38″	67″
Maximum velocity (in feet per second)	15·3	13·7	17·7	16·45	16·4	14·7	16·6	13·7	14·4	12
Maximum velocity (in knots per hour)	9·06	8·11	10·5	9·74	9·71	8·70	9·80	8·11	8·53	7·15
Feet per second. Mean velocity to end of standing ways	8·58	—	9·15	9·51	9·63	8·84	8·91	5·84	5·54	4·83
Velocity on leaving standing ways	12·9	12·45	15·8	12·05	15·	12·6	12·9	—	11·9	10·
Mean velocity up to maximum	6·54	6·30	7·48	7·83	8·23	7·43	7·00	4·72	3·68	3·05
Velocity due to an unretarded fall equal to fall of standing ways between start and point of maximum velocity	23·7	26·4	28·4	29·1	28·2	26·4	25·3	23·2	19·7	27·8

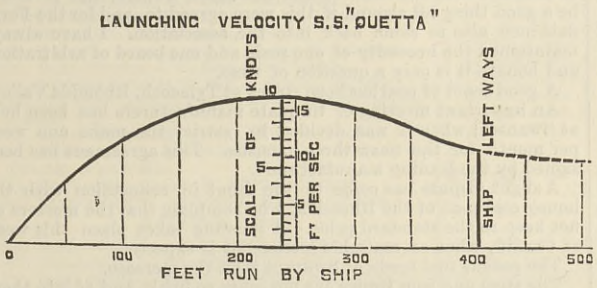
ing ways, he starts the chronographs, and he stops each chronograph successively as the other marks on the sliding ways pass over it. There is a slight difficulty in carrying out this arrangement, as the movement of the ship at first is so slow that the beginning of observations made by the persons at the stern and at the bow of the vessel may not coincide. To avoid this, telegraphic communication was made at the last launch between the observer at the bow



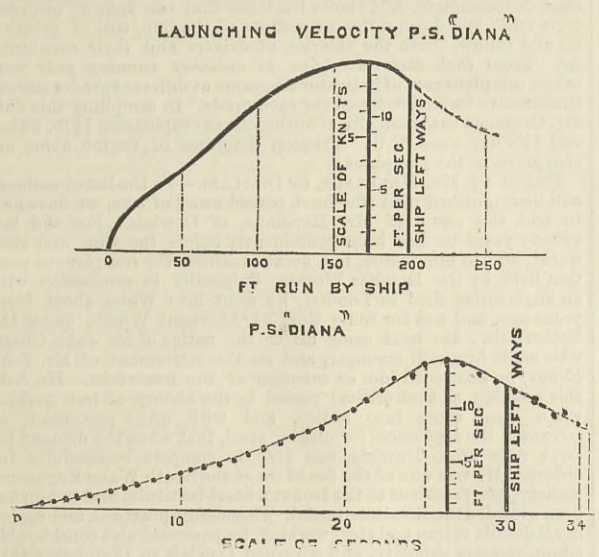


and the observer at the stern, so that they might start observations simultaneously. In addition to these observations, one of the staff was told off in a boat, sufficiently clear of the launch to be out of the way of the vessel, but near enough to be able to observe the dip of the stern. The diagrams show the data obtained from the launches of ten steamers, nine of these built by Messrs Denny, and one, the Bucharest, by Messrs. A. McMillan and Son. This firm,

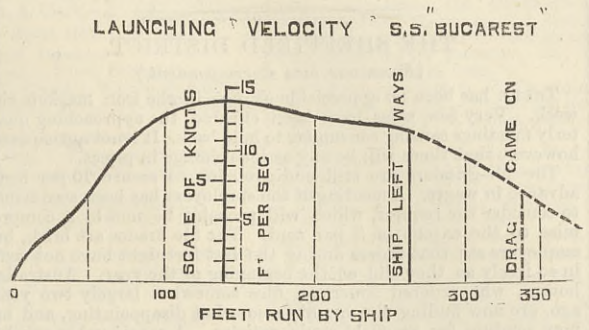


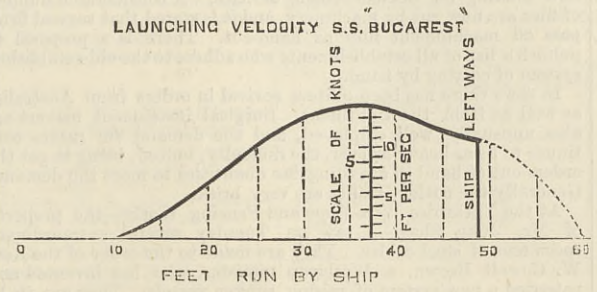


having to launch most of their steamers diagonally across the Leven, are obliged to make use of chain and anchor drags for bringing them up, and the Bucarest was checked in this way. Her curves are therefore of peculiar interest as compared with those of the vessels launched by Messrs. Denny, who launch right up river, as showing the difference between the velocities of a steamer launched with drags, and the velocities of other steamers launched without such checks. The Clyde, Quetta, India, and Goorkha

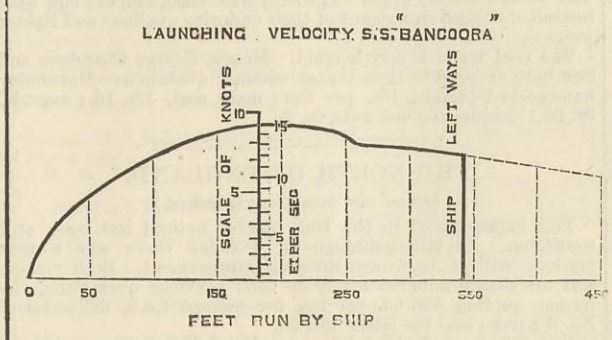


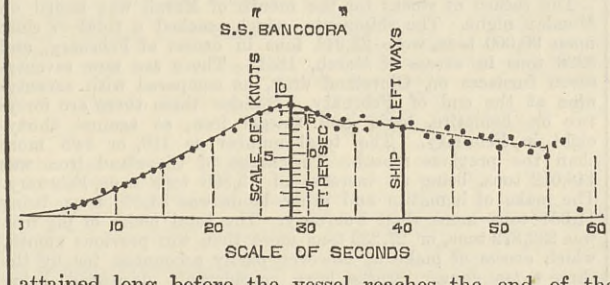
are vessels upwards of 4000 tons gross ; one, the Antonio Lopez, is of 3600 tons gross ; the Bancoora is of 2880 tons gross ; the Kerbela of 1937 ; the Mahinapua is of 426 tons gross ; and the Diana is a paddle steamer of small size. The weights or displacements of the steamers vary from 2500 tons in the Clyde down to 266 tons in the Mahinapua, and 162 tons in the Diana. The maximum velocity obtained in the launching of these different steamers does not seem to depend upon their size. The curves are set off in two ways, first by curves produced directly from the results of the observations taken on the drum. In these the abscissæ represent seconds and the ordinates the speed in feet per second. In some of the curves there is a considerable oscillation of the observation spots, due very much to the occasional sagging of the cord, not, it is thought, in any case due to differences of velocity. In the time curves the speed of the vessel per second at each distance along the standing ways is produced. Almost all of them show a hollow rise upon the face, and that if the rise of the speed is quick to the





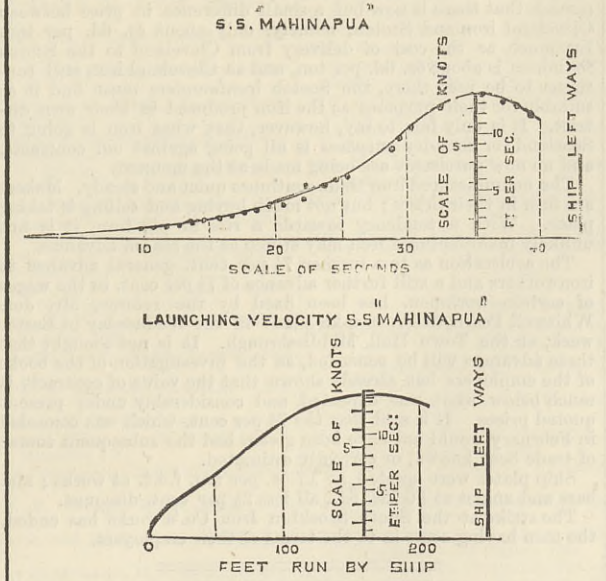
maximum, there is almost invariably a quick fall upon the other side, which, however, settles down to a steady diminution of velocity. In the case of the Bucarest the effect of the drags was felt before they began to move, a fact due to the weight of the attachments between the ship and the drags, and to the work done in straightening them up before the actual movement of the drags took place. In all cases the point of maximum velocity is





attained long before the vessel reaches the end of the standing ways, due, no doubt, to the resistance of the water acting upon the stern. It may also be due, to some small extent, to the black soap and tallow lubricant being squeezed out by the movement of the ways.

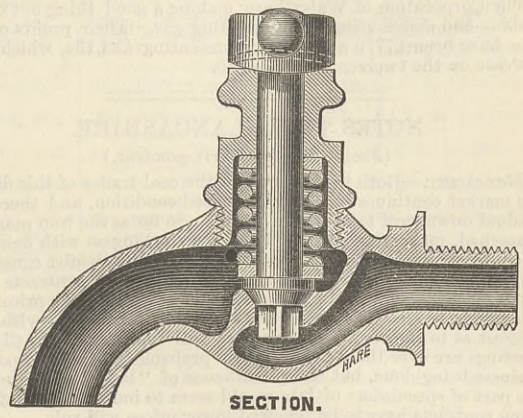
In the discussion upon Mr. Denny's paper Mr. Hamilton said that with extended observations of the kind a coefficient of friction might be obtained. Much greater decli-



vities for the ways are used, he said, in France. Mr. Scott gave an instance of the effect of the use of best hard tallow, which a manager, anxious to secure a successful launch, had obtained. The result was that the ship moved the whole way at only about 1·5ft. per minute. Mr Biles gave some figures obtained from launches by Messrs. Thomson, Glasgow, which gave a mean speed of 12·6ft. per second, with inclination of standing ways of $\frac{3}{8}$ to $\frac{5}{8}$ at lower end. Mr. Watt handed in the results of observations on the launch of the Agamemnon, Polyphemus, and Constance. In reply to the discussion, Mr. Denny referred to the importance of the proper selection of way lubricant.

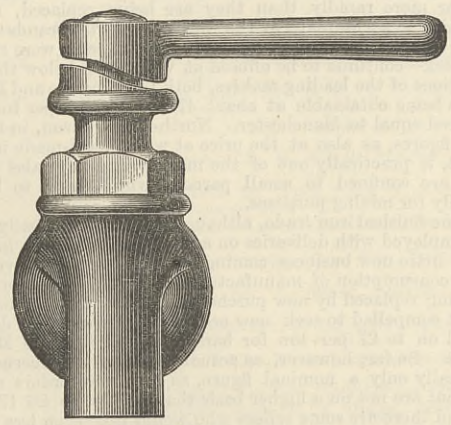
SAFETY VALVE TAP.

The accompanying engravings illustrate the safety valve tap of Field and Cotton's patent, made by Messrs. Dale and Co., Bear-lane, London, S.E., as described in our account last week of the Building Exhibition. It combines in one instrument a tight



SECTION.

kitchen boiler tap and a safety valve, which cannot become set fast by corrosion or furring, like the dead weight or lever safety valves. The lever is so constructed that about one-third of a



FRONT ELEVATION

turn is given before the valve rises, thus rendering it tight. The tap being in daily use for drawing off water from the boiler is not likely to stick, the safety valve being lifted each time the handle is turned.

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

(*From our own Correspondent.*)

On Saturday, Mr. E. Fisher Smith, as agent of the Earl of Dudley, issued his spring circular, announcing a drop in the price of coal. By virtue of the terms of the sliding scale this reduction in coal would bring about a reduction also in colliers' wages in the proportion of 4d. per day in the thick coal seams, and 2d. per day in the thin coal seams. At one or two of the collieries the men struck on Saturday immediately upon hearing of the circular. On Monday men refused to go down at several pits, and there was a meeting at which some 3000 colliers attended. The men protested against the drop. The determination come to was not merely not to accept the drop, but also to demand a rise of 6d. per day, for which some informal notices had been given a fortnight before. These proceedings were repeated on Tuesday, and the men paraded in force through the Dudley district, joined on the way by other colliers who had left off work at neighbouring pits. On the same day there was a meeting in Wolverhampton of delegates of the Miners' Federated Association for the Midland Counties, representing the districts of North and South Staffordshire, East Worcestershire, Cannock Chase, and Salop. The position was discussed, and a resolution was passed expressing deep regret at it, and resolving to seek an interview, which Mr. Fisher-Smith conceded, in the hope of bringing about an amicable arrangement. The delegates requested the withdrawal of the circular announcing the drop. Such a step was, of course, declined, but Mr. Smith consented to call a meeting of the trade to confer with the men's delegates for the following Thursday at the Queen's Hotel, Birmingham. By the decision of that meeting he was quite willing to abide. The offer was accepted, and the deputation consented to induce the men who had already struck to meanwhile return to work.

There was not much done on 'Change in Wolverhampton on Wednesday. Prices were firmer.

Common bars were £6 15s. upwards; marked sorts, £7 10s. Common bars of North Staffordshire make were plentiful at from £6 17s. 6d. to £7 12s. 6d., delivered in Liverpool.

Rods were in improved demand.

Plates, by the majority of the makers, were quoted thus: Ship, £8 to £8 15s.; girder, £8 10s. to £9 15s.; boiler, £8 10s. to £9 15s.; and tank, £8 10s. to £9 15s. These quotations are "at works," delivery in London is 15s. extra, and in Liverpool 11s.

Sheets were more plentiful than for some time past.

Earl Dudley's rivet iron was in fair request at the following rates:—£10 10s. for single best, £12 for double best, and £13 for treble best; angle iron, £8 12s. 6d., £10, £11 10s., and £13 10s. respectively; T-iron, £9 2s. 6d., £10 10s., £12, and £14 per ton; strips and hoops from 14 to 19 w.g. were £9 2s. 6d., £10 10s., £12, and £14, according to quality.

The prices ruling in Melbourne at date of mail were set down as: Galvanised corrugated roofing sheets of 26 w.g., £21, £22, and £23, according to brand; bar and rod iron in request at £10 to £11, and sheet iron firm, with assortments of Nos. 8 to 18 quoted at £11 10s. to £12, while for Nos. 20 to 26 £13 10s. was required; plates dull at £11 to £12; hoop iron for trade purposes, £10; drawn fencing wire in good request at, for Nos. 6, 7, and 8, £13 10s., £14, and £14 10s.

The stopping of the collieries has checked the make of pigs, and has tightened prices. All-mine pigs were quoted on 'Change £3 7s. 6d. to £3 10s.; part-mine, £2 10s. to £3; and cinder sorts from £2 10s. down to £2 2s. 6d., according to the proportion of cinder.

A goodly number of Staffordshire manufacturers engaged in the metal trades are signing a petition promoted by the Mexican bondholders for an early adjustment of diplomatic and commercial relations with Mexico.

A committee of the Wolverhampton Chamber of Commerce is to report upon the proposed Anglo-Spanish Treaty, of which a draft copy has been sent to the Chamber by Earl Granville.

The attention of Mr. Collett, director of Admiralty contracts, was drawn last week by the Wolverhampton Chamber of Commerce to what it was contended were excessive railway freightage rates between South Staffordshire and the chief Admiralty depôts.

Mr. Collett has now communicated with the Chamber asking for details, that he may bring them forward in the evidence which he is collecting for the Select Committee on Railway Rates.

The bill of Mr. Burt, M.P., for increasing the powers of the Employers' Liability Act is receiving the aid of the operatives of Birmingham, represented by the Trades Council of that town, who on Monday passed a resolution requesting the borough members to give the bill their support.

The Corporation of Walsall are making a good thing out of the making and distributing of illuminating gas. Their profits on the year have been £7770 upon sales representing £24,134, which is an ncrease on the twelvemonth of £715.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—Both in the iron and the coal trades of this district the market continues in a very depressed condition, and there is a gradual downward tendency in prices. So far as the iron market is concerned, makers on the one hand are working on with deliveries in contracts, and giving way as little as possible, whilst consumers and dealers on the other hand are running off their contracts without replacing them, in the expectation of breaking down prices, and the quarterly meetings next week are looked forward to with some interest as to the course which prices will then take. Until these meetings are over there is not much probability of any important business being done, but the prominence of "bear" operations on the part of speculators of late would seem to indicate a belief that when contracts have to be renewed lower prices will rule.

Lancashire makers of pig iron are now quoting about 48s. per ton, less 2½, for forge and foundry qualities delivered equal to Manchester; but at this figure they are only securing new orders for comparatively small quantities, and with old contracts running out far more rapidly than they are being replaced, stocks are beginning to accumulate at the works. District brands—although I have not heard of quite such low figures as sales were reported at last week—continue to be offered at very much below the nominal quotations of the leading makers, both Lincolnshire and Derbyshire brands being obtainable at about 47s. to 47s. 6d. per ton, less 2½, delivered equal to Manchester. North-country iron, in the face of these figures, as also at the price at which local-made iron can be bought, is practically out of the market, and any sales which are made are confined to small parcels, which have to be bought specially for mixing purposes.

In the finished iron trade, although makers are mostly still kept well employed with deliveries on account of orders in hand, there is very little new business coming in. There is, however, a large actual consumption of manufactured iron still going on, which is not being replaced by new purchases, and the leading makers who are not compelled to seek new orders at present seem determined to hold on to £7 per ton for bars delivered into the Manchester district. So far, however, as actual business is concerned, this is practically only a nominal figure, as any new orders now being given out are not on a higher basis than £6 15s. to £6 17s. 6d. per ton, and there are some sellers who would take even less than this. For hoop iron the demand has only been very limited, and £7 per ton may be taken as about an average price.

Although the new work actually in prospect in the engineering branches of the trade is comparatively only limited in quantity, the leading firms throughout the district continue well employed, and orders as they run out seem to be gradually replaced, the chief complaint being that prices have to be cut exceedingly fine. Amongst boilermakers, locomotive builders, and marine engineers, there is plenty of work stirring, and in these branches of trade the orders in hand are likely to keep them busy for some time to come.

The coal trade is extremely quiet all through, and with most of the pits not working more than about half time, there are heavy stocks at nearly all the collieries throughout Lancashire. Although any actually announced reduction of list rates has only been made this month in a few exceptional cases, there is a gradual levelling down of prices to meet the market, and with so much stock being pressed for sale, prices are regulated more by what buyers are prepared to offer than by list rates. Best coal at the pit mouth averages 8s. 6d. to 9s.; seconds, 6s. to 7s.; common, 5s. to 5s. 6d.; burgy, 4s. 6d. to 5s.; good slack, 3s. 9d. to 4s. 3d.; and common, 2s. 9d. to 3s. 3d. per ton.

On Friday last I was present at a private trial made with a fire-extinguishing apparatus, at the works of the Chemical Fire Engine Co., Bolton. The apparatus, which is known as Forster's patent, consists of a handy and portable arrangement of a couple of cylinders and a chemical chamber contained within a tank of water. One cylinder acts as a pump up to a pressure of 95 lb. to the square inch, to force the water through the chemical chamber into the second cylinder, where the water, having become thoroughly chemicalised, is ejected impregnated with carbonic acid gas. The apparatus was put to a number of severe tests upon a built-up fire composed of rough timber and shavings, saturated with petroleum, but with a small ¾in. jet the fire was got completely under control in a few seconds. Trials on a larger scale are to be made before the local authorities at Ashton in the course of a few weeks.

The question of weekly or fortnightly pays at the collieries in the West Lancashire district seems likely to come again into prominence. A short time back weekly pays were introduced into the district to meet the wishes of the men, but there is now a strong disposition on the part of some of the colliery proprietors to revert back to the old system of fortnightly pays. At one colliery this has been put in force, with the result that the men have struck against the change, and I understand that this is to some extent a test case which will be followed if practicable by other collieries.

On Saturday last the students of the Wigan and Warrington Mining and Mechanical schools paid a visit to Messrs. Pearson and Knowles' Moss pits and to the works of the Wigan Coal and Iron Company. At the Moss pits the students were shown the modern winding engines for raising coals from the various mines down to a depth of 711 yards, at which the Arley mine is got. The engines at this pit are the most powerful of their kind in the country, with 40in. cylinders, 7ft. stroke, working up to 1500-horse power, with winding drums 25ft. in diameter. The visit to Wigan Coal and Iron Company's works was also full of interest, although the time at disposal did not allow of anything like a thorough inspection of the modern blast furnace plant which has been put down. One important feature of the works, however, which attracted considerable attention was the utilisation of the waste gases from the furnaces in the ovens for heating the blast, and in the boilers for generating the steam.

Barrow.—Business in the hematite pig iron market does not show any signs of an early activity. Sales during the week have not increased, and demand is still quiet. It is expected that prices have touched their lowest point, and makers are considering the advisability of limiting the production. I should not be surprised if prices did look up slightly; but anything like the activity which was noticeable in the iron trade a few months ago cannot be expected yet awhile. Stocks are not accumulating, as large deliveries are being made, principally on home account. Traffic receipts on local railways show a decided increase during the past week or so, and this, no doubt, is attributable to the heavy tonnage of metal which is being transmitted. Shipping is only quiet, but very large shipments will be made during the season. No. 1 Bessemer is quoted 57s. 6d. per ton; No. 3 forge 56s. net, f.o.b., three months' deliveries. These prices are practically unremunerative, and the attempt on the part of makers to restrict the output may perhaps bring a better feeling. Steel workers are busy, and a very fair demand is experienced. Iron ore in fair request at from 13s. 6d. to 15s. per ton at the mines. Iron shipbuilders are in receipt of a few orders which will keep them in work a short time; no new contracts have been booked. Minor industries steadily employed.

The trade of Maryport has received a considerable and welcome addition to it during the past week in the shape of the re-starting of the Ellen Rolling Mills, owned by Messrs. Kirk Brothers and Company. These works have been idle for a long period, and the re-commencement of operations would appear to indicate a sanguine future for the finished bar iron trade so far as the Maryport district is concerned. A number of men are already employed, and it is expected in a short time, when the works are in full swing, that employment will be found for a large staff of workmen.

A resolution has been passed at a meeting of the West Cumberland ironmasters that for the future, instead of applying to ore proprietors for ore, the latter shall make an offer of their ore and fix the price, which the buyers can choose as to accepting or not.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

There has been no appreciable change in the iron markets this week. Very few sales have been effected, the approaching quarterly meetings causing consumers to hold back. It is not anticipated, however, that there will be any serious change in prices.

The file-grinders are still endeavouring to secure 10 per cent. advance in wages. A meeting of the employers has been summoned to consider the request, which will probably be met by a compromise to the extent of 5 per cent. The file trades are brisk, but employers say that orders during the last fortnight have not come in so freely as they did at the beginning of the year. Australian houses, who ordered American files somewhat largely two years ago, are now finding the quality somewhat disappointing, and are now sending for Sheffield-made articles. A considerable number of files are now cut by machinery, and it is stated that several firms pass off machine-cut files as hand-cut. There is a proposal to publish a list of all establishments who adhere to the old-established system of cutting by hand.

In saws there has been quite a revival in orders from Australia, as well as from the Continent. Surgical instrument makers are also unusually well employed, and the demand for razors continues to be as heavy as ever, the difficulty, indeed, being to get the orders out of hand in anything like quantities to meet the demand. Generally the cutlery trades are very brisk.

At the Yorkshire Wire Rope and Fencing Works—the property of Mr. John Shaw—I saw on Tuesday several extraordinary specimens of steel cables. They are made to the order of the Rev. W. Cowell Brown, a Wesleyan minister, who has invented and patented a new system of raising sunken vessels. They are to be attached to two barges which have been built for him by Messrs. Samuda, at Millwall. The cables are estimated to lift a weight of 250 tons each. They are five wires in a strand, twenty-five strands to a rope, and these ropes are twisted into the cable, which thus contains 150 wires. Two of these cables are 40ft. long, and weigh 4½ cwt. each; two of 72ft. long, which weigh 8 cwt. each. They are 9¼in. in circumference, and are altogether the biggest things of the kind ever made in Sheffield. Mr. Shaw has about forty miles of his patent wire fencing on order—a large portion for South Africa. A speciality for that colony are wire bullock traces, which weigh only 9 lb. each, and are now used instead of chains, on account of their enduring qualities and lighter weights.

The coal trade is very languid. Messrs. George Chambers and Son have dropped to their lowest summer quotations—Mortomley hand-picked brands, 15s. per ton; main coal, 12s. 1d.; seconds, 9s. 2d.; double-screened nuts, 9s. 2d.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

The improvement in the iron market noticed last week still continues. At Middlesbrough on Tuesday there was a firm market, with a tendency towards improvement. Both makers and merchants adhered firmly to their previous quotations, the former quoting 43s. 6d. per ton for prompt f.o.b. deliveries of No. 3 g.m.b., and the latter 43s. 3d.

The return of stocks for the month of March was issued on Monday night. The shipments, which reached a total of close upon 90,000 tons, were 22,944 tons in excess of February, and 8228 tons in excess of March, 1881. There are now seventy-seven furnaces on Cleveland iron, as compared with seventy-nine at the end of February. Besides these there are forty-two on hematite, basic, and spiegel iron, as against thirty-eight in February. The total number is 119, or two more than the previous month. The make of Cleveland iron was 148,012 tons, being an increase of 15,866 tons over February. The make of hematite and other kinds was 84,860 tons, being 11,364 tons more than February. The total make of pig iron was 232,872 tons, or 27,230 tons more than the previous month, which excess of make is, however, partly accounted for by the three extra days. Stocks have considerably decreased, being 29,970 tons below the stock at the end of February. The stock now amounts to 334,850 tons, against 364,820 a month ago. In the first three quarters of 1881 they increased by about 100,000 tons; but in the last quarter of that year and the first in the present year, owing to the operation of the restrictive policy, they have decreased to about an equal extent. The announcement of these figures tends, of course, to stiffen prices, as it is clear that consumption is considerably in excess of production.

There is a decided scarcity of pig iron for prompt delivery, and the possession of warrants is eagerly sought for. It is worthy of remark that there is now but a small difference in price between Cleveland iron and Scotch, namely, only about 4s. 6d. per ton. Inasmuch as the cost of delivery from Cleveland to the Scotch foundries is about 6s. 6d. per ton, and as Cleveland iron still continues to be used there, the Scotch ironfounders must find it as suitable for their purposes as the iron produced in their own district. It is only fair to say, however, that what iron is going to Scotland for foundry purposes is all going against old contracts, and no new purchases are being made at the moment.

The manufactured iron trade continues quiet and steady. Makers are firm in their prices; but not much buying and selling is taking place. With a tendency towards a rise in pig iron, it is not unlikely manufactured iron may stiffen as the season advances.

The arbitration as to a further 7½ per cent. general advance to ironworkers and a still further advance of 7½ per cent. in the wages of certain workmen, has been fixed by the referee, Mr. Jos. Whitwell Pease, M.P., to take place on the Wednesday in Easter week, at the Town Hall, Middlesbrough. It is not thought that these advances will be conceded, as the investigation of the books of the employers has already shown that the value of contracts is much below what was expected, and considerably under present quoted prices. It is said that the 7½ per cent. which was conceded in February would not have been given, had the subsequent course of trade been known, or correctly estimated.

Ship plates were quoted at £7 5s. per ton, f.o.t. at works; and bars and angles at £6 12s. 6d., all less 2½ per cent. discount.

The strike at the South Stockton Iron Co.'s works has ended, the men having come in to the terms of their employers.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

A good steady business continues to be done in the Scotch iron trade, there being a large consumption of raw iron at the manufacturing works. The shipments have not been quite so large during the past week; but, considering the heavy consignments that have been made during the preceding weeks, this is not considered as at all remarkable. The warrant market has lacked animation, there being considerably less doing than of late, and prices at the close of last week, and during the early part of the present week, have showed rather a decline. The private advices from America are not very encouraging, and the demand for pig iron on the part of the Continent lacks the activity which was experienced during last month. Now that the shipments have become smaller it is probable that stocks will increase both in the public stores and in the makers' yards.

Business was done in the warrant market on Friday morning at from 48s. 1d. to 48s. 4d., and back to 48s. cash, and from 48s. 5d. to 48s. 1½d. one month; in the afternoon quotations were 48s. to 47s. 10½d. cash, and 48s. 1½d. to 48s. one month. On Monday forenoon business was done at 47s. 8d. to 47s. 10d. cash, and 47s. 10½d. to 47s. 11d. one month. The tone was quiet in the afternoon with small business, 47s. 10d. cash and 47s. 10½d. fourteen days. Business was done on Tuesday at 47s. 11½d. to 48s. 2d. cash and 48s. 1½d. to 48s. 4d. one month. To-day—Wednesday—the market was flat, with business at 48s. 4½d. to 48s. ½d. cash, and 48s. 5½d. to 48s. 1½d. one month. Owing to the holidays closed to-day, and will not re-open till Tuesday.

Makers of pig iron report that they are doing a steady business and that there is not much change in the quotations:—f.o.b. at Glasgow, Gartsherrie, No. 1 is quoted at 58s. 6d. per ton; No. 3, 51s.; Coltness, 58s. 6d. and 52s. 6d.; Langloan, 59s. and 53s.; Summerlee, 57s. 6d. and 49s. 6d.; Calder, 57s. 6d. and 51s.; Carnbroe, 52s. 6d. and 49s.; Clyde, 51s. and 48s. 6d.; Monkland, 49s. and 47s. 6d.; Quarter, ditto ditto; Govan at Broomielaw, 50s. and 47s. 6d.; Shotts at Leith, 59s. and 53s. 6d.; Carron at Grangemouth, 50s. 6d. (specially selected, 53s.) and 49s. 6d.; Kinneil at Boness, 48s. 6d. and 47s. 6d.; Glengarnock at Ardrossan, 52s. 6d. and 49s.; Eglinton, 49s. 6d. and 47s.; Dalmellington, 49s. 6d. and 48s.

In the malleable departments there is hardly any change to report, business continuing as yet fairly good, with little change in prices, and prospects for the future not quite so encouraging as could be wished.

On Wednesday this week the foundation stone was laid of the new bridge which is to be constructed over the Forth at Alloa. The Caledonian Railway Company has a branch railway from Larbert to South Alloa, and by making a short line and erecting this bridge, communication will be effected across the Forth, to North Alloa. The enterprise is being promoted by a private company, but it is understood that the working of the railway will be undertaken by the Caledonian Railway Company. The bridge is being designed by Mr. Crouch, C.E., Glasgow. It is a lattice girder bridge of about 570 yards in length, and of sufficient height not to obstruct the navigation of the river by small craft. A central pier of great strength will be erected in the middle of the river, and on each side of this pier there is to be 60ft. of clear channel way, succeeded by spans of 100ft., and afterwards of others of 80ft. From that portion to the abutments at the side of the river there are to be thirteen spans on the south and two on the north of about 67ft. In order to admit of the passage of large vessels, there is to be a swing bridge about the centre of the structure. The contractors are Messrs. Watt and Wilson, Glasgow, and the ironwork of the bridge is to be supplied by Messrs. P. and W. McLellan, of the same city.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

I regret to announce the death of Mr. Menelaus, of Dowlais. Speculation is rife as to his successor, but it must not be forgotten that Dowlais has been a fine school both for the iron and the coal world. For instance, from Dowlais went Mr. Edward Williams, of Middlesbrough; Mr. Wm. Jenkins, of Consett; Mr. Evans, of Bradford; Mr. Evans, of Durham; Mr. Martin, of Blaenavon; and Mr. Wales, H.M. Inspector of Mines; Mr. Truran and Mr. Martin, of Mountain Ash, are also from the Dowlais mining school.

The Taff Vale Railway Company has had an unsuccessful session in opposition, but it is carrying out local improvements with undiminished energy. The engine works near Cardiff are progressing towards completion; and the fourth line of rails is being steadily pushed onwards.

No settlement has been brought about between the Ocean Colliery proprietors and the men. From what I hear, they would be satisfied with the scale of the associated owners, and it would be a good thing all around if this were agreed to, and for the Ferndale men also to come back into the association. I have always maintained the necessity of one scale and one board of arbitration, and believe it is only a question of time.

A good seam of coal has been struck at Tylacoch, Rhondda Valley.

An important meeting of tin-plate manufacturers has been held at Swansea, when it was decided to restrict the make one week per month for the next three months. This agreement has been signed by the leading manufacturers.

A slight dispute has come to the front in connection with the house coal men of the Rhondda, who complain that the masters do not keep to the standard price. A meeting takes place this week at Cardiff, when an amicable settlement is expected.

The patent fuel trade of Swansea is on the increase.

The steel and iron trades are not quite so brisk, and of late there has been a falling off in the demand from America.

Extensions and improvements on a large scale are being carried on at Tredegar, and another blast furnace will soon be in action. Treforest is also brisk, and if American orders fail, home railways are expected to give a good impetus as the spring advances.

Russian Railway Practice.—We have received from Mr. Urquhart, of Borisoglebsk, South Russia, a pamphlet in Russian, entitled "Running Rules of the Grazi-Tsaritsin Railway, Russia." The pamphlet contains particulars concerning the fuel for each class of locomotive, and shows the loads they can take at ordinary time-table speeds on different sections of the line, cost of grease—oil and tallow—with the salaries of drivers and their assistants, &c. From each class of engine in ordinary running gear were taken complete sets of indicator diagrams at different grades shown, the tractive force developed for each grade. In compiling this data Mr. Urquhart has taken 1 lb. of anthracite as evaporating 7½ lb. water, and 1 lb. dry wood 3¼ lb. Friction diagrams of engine alone are also given in the pamphlet.

Death of Mr. Menelaus, of Dowlais.—To the list of eminent and distinguished men who have passed away of late, we have now to add the name of Mr. Menelaus, of Dowlais. For the last twenty years he has been prominently before the iron and steel world, and to him is due, in a great measure, the conspicuous position held by the Dowlais Works. Originally in connection with an engineering firm in London, he went into Wales about forty years ago, and was for some time at Abernant Works, under the Fothergills. He next came under the notice of Sir John Guest, who made him mill manager, and on the retirement of Mr. John Evans, he succeeded him as manager of the ironworks. He held this position at that critical period in the history of iron making when steel came into notice, and with great perception so advanced the appliances for making steel, that when the demand for steel rails arose Dowlais was able to compete successfully for orders. He was one of the founders of the South Wales Engineers' Society, past president of the Iron and Steel Institute, and to him has been awarded the Bessemer medal. Thoroughly practical, and versed in all details of iron and steel working, he possessed also considerable administrative capacity, and governed Dowlais so thoroughly that of late years the workmen were noted for their avoidance of all those impulsive and antagonistic movements which in kindred industries have marred so much the industrial progress of South Wales. To him is due the prosperous condition of the works in adverse times. He laid it down as a maxim that the old rule of simply making rails, which had characterised the efforts of Welsh ironmasters, should be abandoned, and that the ironmaster should be open to meet any requirements in the scope of his industry. For, he was wont to say, "if rails are not wanted, bars may, and if not bars, then tin-plate, wire, or tires." By his indomitable energy and prescience he was able to keep Dowlais fully employed when semi-stagnation marked the neighbouring works of South Wales, and thus may be regarded as one who has rendered substantial service even to the poorest of his ten thousand *employés*.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

28*th March*, 1882.

1479. SOAP, L. Varicas.—(*H. Heckel, Cincinatti, U.S.*)
1480. WITHDRAWING AIR, W. Teague, Cornwall.
1481. HEATING WATER, A. J. Billing, London.
1482. WASHING CLOTHES, R. E. Wearden, Manchester.
1483. COILING MACHINE, C. L. Clarke and J. Leigh, Manchester.
1484. TIN-PLATES, C. S. B. Gardner, Glamorgan.
1485. LIGHTING by GAS, F. H. Wenham, London.
1486. BOTTLES, D. Rylands, Barnsley.
1487. CUTTING METALS, W. W. Hulse, Manchester.
1488. LOOMS, J. and J. Hodgkinson, Blackburn.
1489. FIRE-ARMS, L. Loewenthal and D. de R. Willoughby, London.
1490. ENGINES, A. Morton, Glasgow.
1491. SADDLE BARS, J. Oldmeadow, Cheltenham.
1492. BEDS, J. Rycroft.—(*E. S. Griffith, Toledo, U.S.*)
1493. LEAD PIPES, D. Walker and W. Simpson, London.
1494. TREATING GASES, P. Spence, Manchester.
1495. FASTENINGS, J. W. Saunders, Stourbridge.
1496. DYNAMO MACHINES, T. J. Handford.—(*T. A. Edison, Menlo Park, U.S.*)
1497. HOT-AIR BATHS, T. Maccall, Derby.
1498. METALLIC SHINGLES, W. R. Lake.—(*C. Comstock, New Canaan, U.S.*)
1499. FIRE-ENGINE HOSE, W. R. Lake.—(*T. S. Nowell, Boston, U.S.*)
1500. TOBACCO-PIPES, E. Lorge, London.
1501. SIZING WARPS, A. Boult.—(*P. Letellier, France.*)
1502. SEWING KNIT GOODS, J. H. Johnson.—(*S. Borton, Philadelphia, and C. H. Wilcox, New York, U.S.*)

29*th March*, 1882.

1503. CLEANING COTTON, A. M. Clark.—(*A. A. Goldsmith, Charleston, U.S.*)
1504. FISHING RODS, W. H. Brookes, Birkenhead.
1505. PAPER FILES, A. Ellis, Lewes.
1506. MAKING ICE, J. J. Coleman, Glasgow.
1507. FURNACES, T. Bowen and E. Jenkins, Glamorgan.
1508. HARROWS, R., J., and H. Wilder, Wallingford.
1509. UMBRELLAS, J. Hickisson, London.
1510. DISINTEGRATORS, F. Wirth.—(*F. Westmeyer, Germany.*)
1511. SMALL-ARMS, T. W. Webley, Birmingham.
1512. LADDERS, T. Jones, Sedgley.
1513. TAPS, F. Robinson, Huddersfield.
1514. ENGINES, G. Tidcombe, jun., Watford.
1515. STEAM MOTORS, W. R. Rowan, London.
1516. ELECTRICAL INSULATION, J. Imray.—(*La Société Anonyme des Cables Electriques, Paris.*)
1517. LAMPS, B. C. Simpson, London.
1518. PROJECTILES, W. Naylor, Penistone.
1519. RAIL CHAIR, W. J. Boaler, London.
1520. LOOMS, J. C. Rouse, Halifax.
1521. BRIDLE BITS, J. C. Mewburn.—(*P. H. Goulet, France.*)
1522. FLUSHING SEWERS, J. B. Denton and G. Butler, London.
1523. LOOMS, R. Hindle and G. Greenwood, Blackburn.
1524. BUOYS, J. Jaques, London.
1525. DRYING GRAIN, I. Fisher, Manchester.
1526. TRANSMITTING APPARATUS, W. R. Lake.—(*A. F. and F. B. Johnson, Brooklyn, U.S.*)
1527. RAILWAY SIGNALLING, H. Morris, Manchester.
1528. BAND TWINES, J. G. Hey, Cleckheaton.
1529. NON-CONDUCTORS, T. and J. Brooke, Sheffield.
1530. FUSIBLE PLUGS, J. Burton and R. Byrnes, Staleybridge.
1531. GLOVE FASTENERS, J. W. Pritchett, London.
1532. FURNACES, A. J. Boult.—(*M. Gros-Desormeaux, Vaucliu, West Indies.*
1533. EXTRACTING GASES, R. Aitken, Glasgow.
1534. SAFETY LAMPS, J. Cunliffe, Bolton-le-Moors.

30*th March*, 1882.

1535. STAMP-BOX CHARM, J. Hirst, London.
1536. BEDSTEADS, J. Reynolds, Worcester.
1537. INDICATORS, J. and A. Lawrence, Birmingham.
1538. LOOMS, G. Hodgson and J. Broadley, Bradford.
1539. STEAM ENGINES, G. R. Mather, Wellingborough.
1540. CLIPS F. W. T. C. Cordua.—(*C. Kortum, Berlin.*)
1541. TREATING COAL GAS, J. A. Kendall, London.
1542. CURING FISH, J. Ross, jun., Muchalls, N.B.
1543. CAPSULES, C. Cheswright, London.
1544. CURTAIN SUSPENDERS, B. F. Grimmett and J. Cook, Birmingham.
1545. LAMPS, C. D. Aria and J. Davies, London.
1546. MINCING MACHINE, J. Hood, jun., Edinburgh.
1547. EXCAVATING NARROW CHANNELS, T. Abbott, Newark-upon-Trent, and G. S. Moore, Sunderland.
1548. BATTERIES, W. B. Brain, Gloucester.
1549. STEELYARDS, A. J. Boult.—(*P. Arnaud and L. Gaytté, France.*)
1550. FILTERING APPARATUS, A. W. L. Reddie.—(*L. A. M. Hélie and C. M. M. de la Vieuville, Paris.*)
1551. STEADYING AIR ENGINES, J. S., T. A , and E. R. Walker, Wigan.
1552. SCREWS, W. R. Lake.—(*American Screw Company (Incorporated), Providence, Rhode Island, U.S.*)
1553. LOCKS, G. H. Wildes, London.
1554. TREATING GRAIN, E. Beanes, London.
1555. TELEPHONES, J. H. Johnson.—(*C. G. Rodrigues-Peresre, Paris.*)
1556. GENERATING ELECTRICITY, J. S. Williams, London.
1557. BRUSHES, A. Marsden and F. Cross, Huddersfield.

31*st March*, 1882.

1558. GOVERNORS, E. Truman, Grantham.
1559. DRIVING ROPES, J. Rowbottom, Charlesworth.
1560. FASTENERS, E. Horsepool, London.
1561. PURIFYING GAS, J. Walker, Leeds.
1562. CHECKING APPARATUS, H. Lyon, London.
1563. THRASHING, A. W. Mantle, London.
1564. DRINKING VESSELS, J. Tams, Longton.
1565. ORNAMENTING ARTICLES, J. B. Dubois, Maule.
1566. LOOMS for WEAVING, J. Wade, Wortley.
1567. CONCENTRATED MILK, E. Kunkler, London.
1568. BRICKS, &c., F. Render, Manchester.
1569. STOPPERS, C. W. von Schlieffen, Schlieffenberg.
1570. ELECTRIC LAMPS, W. Jeffery, North Woolwich.
1571. BUTTONS, E. A. Brydges.—(*B. Fischer, Stuttgart.*)
1572. BOOTS, J. and G. J. Taylor, London.
1573. HAND SCREENS, M. O. Hund, London.
1574. ELECTRIC CURRENTS, W. Lake.—(*J. Moser, Berlin.*)
1575. SHINGLES, W. R. Lake.—(*R. Seaman, U.S.*)
1576. TIN, &c., W. A. Barlow.—(*L. Bourau, Paris.*)
1577. COPPER TUBES, S. Walker, Birmingham.
1578. ADMINISTERING ANÆSTHETICS, W. R. Lake.—(*S. Cooper and E. Dennis, U.S.*)
1579. LOCKS, &c., D. Summerfield, Aston.
1580. ELECTRIC LAMPS, D. Salomons, Tunbridge Wells.
1581. SADDLES, J. Jenner, London.
1582. PRODUCING COPIES, M. Farmer, Chelsea.

1*st April*, 1882.

1583. ELECTRIC BELL, H. Binko.—(*M. I. Siegel, Austria.*)
1584. FIREPLACES, G. L. Shorland, Manchester.
1585. COAL GAS, J. F. Allan and W. Adamson, Glasgow.
1586. BLEACHING JUTE, T. G. Young, Kelly, N.B.
1587. SECONDARY BATTERIES, A. Tribe, London.
1588. GUIDES, H. J. Haddan.—(*C. Calloch, France.*)
1589. PAINTING, M. Mende and H. Krause, Berlin.
1590. GAS MOTOR ENGINES, R. Skene, London.
1591. STARCH, H. Lake.—(*E. Wilhelm, Buffalo, U.S.*)
1592. PROJECTILES, J. Vavasseur, London.
1593. GLOVES, H. Urwick, Wandsworth.
1594. FURNACES, Sir W. W. Hughes, Bayswater.
1595. FIRE-ESCAPES, W. P. Thompson, London.
1596. DOOR LATCHES, W. Johnson, Liverpool.
1597. BOTTLE STOPPERS, H. J. West, London.
1598. GRINDING, G. Ryder and M. Fielding, Bolton.
1599. METALLIC BRUSHES, W. F. Bateman, Yorkshire.
1600. ELECTRICAL APPARATUS, G. W. von Nawrocki.—(*F. Bahr, Russia.*)
1601. AIR ECONOMISER, W. Teague, jun., Cornwall.
1602. SPINNING FRAMES, A. Clark.—(*J. Rolland, Paris.*)

3*rd April*, 1882.

1603. PIANOS, W. Fischer, Dresden.
1604. VAPORISING FLUIDS, C. Scott, Belfast.
1605. WASHERS, E. I. H. E. and J. Whitehouse, Tipton.
1606. BLOCK SYSTEM on RAILWAYS, H. J. Haddan.—(*A. Flamache, Brussels.*)
1607. DOOR LOCKS, J. Mathison, Norway.
1608. WEIGHING MACHINES, C. Reuter, Germany.
1609. PARQUET FLOORING, F. H. F. Engel.—(*F. H. Schmidt, Altona, Prussia.*)
1610. FEEDING WOOL, W. Cliffe, Huddersfield.
1611. REGULATING APPARATUS, W. R. Lake.—(*E. Weston, New Jersey, U.S.*)
1612. CRAVATS, W. R. Lake.—(*E. Demonchaux, France.*)
1613. TAPS and COCKS, F. G. Fleury, London.
1614. DYNAMO-ELECTRIC MACHINES, W. R. Lake.—(*E. Weston, New Jersey, U.S.*)
1615. UTILISING TIDES, &c., E. Davies, London.
1616. ELECTRIC CURRENTS, W. B. Brain, Gloucester.
1617. CUTTING BLOCKS, F. Wirth.—(*G. Sebold, Germany.*)
1618. ELECTRIC LAMPS, J. B. Rogers, London.
1619. CARBON CONDUCTORS, W. R. Lake.—(*H. S. Maxim, Brooklyn, U.S.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

1479. MAKING SOAP, L. Varicas, Montague-place, Russell-square, London.—A communication from H. Heckel, Cincinnatti, U.S.—28*th March*, 1882.
1499. DISCHARGE APPARATUS, W. R. Lake, Southampton-buildings, London.—A communication from T. S. Nowell, Boston, U.S.—28*th March*, 1882.
1552. SCREWS, &c., W. R. Lake, Southampton-buildings, London.—A communication from The American Screw Company (Incorporated), Providence, U.S.—30*th March*, 1882.

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

1245. EXHIBITING APPARATUS, J. H. Pepper, Tunbridge Wells, and J. J. Walker, London.—28*th March*, 1879.
1270. GAS-MOTOR ENGINES, F. W. Turner, St. Albans.—29*th March*, 1879.
1234. CORONETS, DOMES, &c., S. Spencer, London.—28*th March*, 1879.
1261. ORDNANCE, A. Longsdon, London.—29*th March*, 1879.
1412. SECURING CORKS, &c., of BOTTLES, J. Shanks, Dublin.—9*th April*, 1879.
1253. MAINTAINING a PLATFORM, &c., in a HORIZONTAL POSITION, F. Gardner, Bayswater.—29*th March*, 1879.
1315. IRON and STEEL WIRE, J. C. Ramsden, Redgate.—2*nd April*, 1879.
1317. MACHINE GUNS, H. H. Lake, London.—2*nd April*, 1879.
1282. GLYCERINE, C. Thomas, W. J. Fuller, and S. A. King, Bristol.—31*st March*, 1879.
1329. ANIMAL FIBRES, H. H. Lake, London.—3*rd April*, 1879.
1332. ROLLING MILLS, A. Mechwart, Buda Pesth.—3*rd April*, 1879.
1340. DISCHARGING, &c., GRAIN, F. E. Duckham, Millwall.—4*th April*, 1879.
1358. PRINTING MACHINES, T. Nelson, W. Inglis, and J. T. Gray, Edinburgh.—5*th April*, 1879.
1359. SULPHO-CYANIDES, &c., H. E. Newton, London.—5*th April*, 1879.
1396. HARROWS, G. W. Murray, Banff, and J. and A. Macdonald, Portsoy.—8*th April*, 1879.
1419. LEAD and CRAYON HOLDERS, J. H. Johnson, London.—9*th April*, 1879.
1847. SPRING BUFFERS, J. C. Taite and T. W. Carlton, London.—9*th May*, 1879.
1313. BESSEMER STEEL, S. G. Thomas, Battersea.—2*nd April*, 1879.

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

1204. TRAMWAY, &c., TRACTION, A. S. Hallidie, London.—2*nd April*, 1875.
1144. HYDRO EXTRACTORS, T. Broadbent, Huddersfield.—30*th March*, 1875.
1198. RAILWAYS, J. L. Haddan, Clapham.—2*nd April*, 1875.
2302. SEWING MACHINE, F. Simmons, London.—8*th June*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 21*st April*, 1882.

5173. ENGINES, W. A. Barlow, London.—Com. from J. Ritz and A. Nebele.—26*th November*, 1881.
5174. WASHING, &c., FABRICS, L. Webster, Dewsbury.—26*th November*, 1881.
5175. RECORDING APPARATUS, D. Young, London.—26*th November*, 1881.
5195. GAS REGULATORS, &c., J. Ungar, London.—28*th November*, 1881.
5204. STOPCOCKS, C. Stuart, Fenny Stratford.—29*th November*, 1881.
5205. DRILLING APPARATUS, C. Stuart, Fenny Stratford.—29*th November*, 1881.
5211. SEWING MACHINES, J. Hunt and J. S. Fairfax, London.—29*th November*, 1881.
5217. CRANES, &c., W. Clarke, Gateshead-on-Tyne.—29*th November*, 1881.
5228. DAMS, J. Thomas, Bangor.—30*th November*, 1881.
5232. HEATING APPARATUS, W. Hutchinson, Clapton Park.—30*th November*, 1881.
5241. FEEDING PAPER, J. H. R. Dinsmore and F. Hoyer, Liverpool.—30*th November*, 1881.
5245. SHIPS' PROPELLERS, C. D. Abel, London.—Com from J. A. Andrée.—30*th November*, 1881.
5272. ELECTRIC LAMPS, W. F. King and A. B. Brown, Edinburgh.—2*nd December*, 1881.
5281. CULTIVATING LAND, G. P. Blake, Exeter.—2*nd December*, 1881.
5282. FANCY YARNS, E. Horsfall, Bradford.—2*nd December*, 1881.
5289. STEAM GENERATORS, W. L. Wise, London.—Com. from G. H. Babcock, S. Wilcox, N. W. Pratt, and E. H. Bennett.—3*rd December*, 1881.
5298. CRANES, W. D. Priestman, Kingston-upon-Hull. 3*rd December*, 1881.
5375. ROUNDABOUTS, F. Savage, King's Lynn.—8*th December*, 1881.
5399. GAS, J. Laycock and T. Clapham, Keighley.—9*th December*, 1881.
5422. SUBSTITUTE for CARDBOARD, H. J. Haddan, London.—Com. from D. P. et Roux.—12*th December*, 1881.
5551. ARMATURES, J. H. Johnson, London.—A communication from W. W. Griscom.—19*th December*, 1881.
5563. FURNACES, &c., W. L. Wise, London.—A communication from G. E. Palmer, A. Worthington, and G. A. Rowell.—20*th December*, 1881.
5664. CUTTING METALS, W. W. Hulse, Manchester.—24*th December*, 1881.
170. CABS, &c., J. Abbott, Bideford.—12*th January*, 1882.
389. FIRE-ARMS, W. R. Lake, London.—A communication from W. Trabue.—26*th January*, 1882.
495. SAWING WOOD, J. Smith, Rochdale.—1*st February*, 1882.
554. CONCENTRATING MILK, F. Springmuhl, London.—4*th February*, 1882.
555. CONDENSED GRAPE JUICE, F. Springmuhl, London.—4*th February*, 1882.
711. SUSTAINING COMBUSTION in LAMPS, W. J. J. Robinson, Limerick.—14*th February*, 1882.
800. CANDLESTICKS, J. H. Johnson, London.—Com. from J. Engelson.—18*th February*, 1882.
1023. ELECTRICAL GENERATORS, T. J. Handford, London.—Com. from T. A. Edison.—3*rd March*, 1882.
1089. STEEL, J. Gjers, Middlesbrough-on-Tees.—7*th March*, 1882.
1094. SOCKETS or HOLDERS, E. H. Johnson, London.—7*th March*, 1882.
1139. DYNAMO, &c., MACHINES, T. J. Handford, London.—Com. from T. A. Edison.—9*th March*, 1882.
1142. REGULATING the GENERATIVE CAPACITY of DYNAMO, &c., MACHINES, T. J. Handford, London.—Com. from T. A. Edison.—9*th March*, 1882.
1166. SURFACES for PRINTING, &c., J. J. Sachs, Sunbury.—10*th March*, 1882.
1167. PURIFYING GAS, G. C. Trewby, Beckton.—Com. from O. A. L. Pihl.—10*th March*, 1882.
1169. FIRE-ARMS, P. T. Godsal, Windsor.—10*th March*, 1882.
1191. DYNAMO, &c., MACHINES, T. J. Handford, London.—Com. from T. A. Edison.—11*th March*, 1882.
1328. ELECTRIC SIGNALLING APPARATUS, L. J. Crossley, Halifax, J. F. Harrison, Bradford, and W. Emmott, Halifax.—18*th March*, 1882.
1479. SOAP, L. Varicas, London.—A communication from H. Heckel.—28*th March*, 1882.

Last day for filing opposition, 25*th April*, 1882.

5142. WARMING, &c., APPARATUS, L. A. Groth, London.—Com. from C. Ostlund.—24*th November*, 1881.
5212. ANIMAL CHARCOAL, T. Hadfield, Liverpool.—Com. from R. Reddish.—29*th November*, 1881.
5227. RINGS, HOOKS, &c., J. V. Hope, Wednesbury.—30*th November*, 1881.
5243. LAMP BURNERS, W. Foxcroft, Birmingham, and J. Titley, Wolverhampton.—30*th November*, 1881.
5247. POLISHING KNIVES, &c., J. F. Walters, Bayswater.—30*th November*, 1881.
5259. ENGINES, J. Rhodes, Newton Heath.—1*st December*, 1881.
5260. FRICTION COUPLINGS, &c., J. C. Eckardt, Stuttgardt.—1*st December*, 1881.
5261. SECONDARY BATTERIES, H. E. Newton, London.—Com. from E. Volckmar.—1*st December*, 1881.
5273. CAPSULES, J. Imray, London.—A communication from C. Cheswright.—2*nd December*, 1881.
5280. FUSIBLE PLUGS, H. J. Harman, Manchester.—2*nd December*, 1881.
5287. VELOCIPEDES, C. Beger, London.—3*rd December*, 1881.
5292. SPINNING COTTON, &c., J. Leyland, Bolton.—3*rd December*, 1881.
5295. ELECTRIC LAMPS, H. E. Newton, London.—Com. from A. I. Gravier.—3*rd December*, 1881.
5320. HATS, &c., R. Wallwork, Manchester.—6*th December*, 1881.
5386. ROLLER MILLS, W. P. Thompson, London.—Com. from W. D. Gray.—9*th December*, 1881.
5423. LOOMS, G. Geissler, Kirkburton.—12*th December*, 1881.
5446. GAS FITTINGS, &c., J. J. Royle, Manchester.—13*th December*, 1881.
5542. GALVANIC BATTERY, W. R. Lake, London.—A communication from La Société Universelle d'Electricité Tommasi.—17*th December*, 1881.
5571. FLOOR COVERINGS, A. M. Clark, London.—Com. from T. and V. E. Meyer.—20*th December*, 1881.
5597. CALORIC ENGINE, A. M. Clark, London.—A communication from J. Schweizer.—21*st December*, 1881.
5708. ANCHORS, J. Nock, Hasskeni.—29*th December*, 1881.
93. ROLLING METAL, F. Wirth, Frankfort-on-the-Maine.—Com. from. L. Röhr.—7*th January*, 1882.
235. SCREW PROPELLERS, R. Griffiths, Bayswater.—17*th January*, 1882.
297. GALVANIC BATTERIES, J. and A. J. Higgin, Manchester.—20*th January*, 1882.
387. PURIFYING COAL GAS, J. Walker, Leeds.—26*th January*, 1882.
392. OBTAINING LIGHT by ELECTRICITY, W. P. Thompson, London.—Com. from the Union Electric Manufacturing Co., Incorporated.—26*th January*, 1882.
629. SIGNALLING APPARATUS, J. W. Webster, Littleborough, J. Hill, Rochdale, and F. T. and T. Greenwood, Smithy Bridge.—9*th February*, 1882.
700. ELECTRICITY, J. S. Williams, London.—13*th February*, 1882.
702. BLOWING APPARATUS, H. Wilson, Stockton-on-Tees.—13*th February*, 1882.
755. WATER-CLOSETS, R. Weaver, London.—16*th February*, 1882.
766. ELECTRICITY, J. S. Williams, London.—16*th February*, 1882.
856. ELECTRICITY, J. S. Williams, London.—16*th February*, 1882.
877. ALARUM BELLS, H. Lees, Ashton-under-Lyne.—23*rd February*, 1882.
878. SCREW PROPELLERS, T. Heppell, Birtley—23*rd February*, 1882.
996. SEWING MACHINES, R. H. Brandon, Paris.—A communication from the Morley Sewing Machine Company.—1*st March*, 1882.
1003. FISH-JOINTS, A. Davy, Sheffield.—2*nd March*, 1882.
1012. LABELLING MACHINE, G. J. Hutchings, Newcross.—2*nd March*, 1882.
1083. FLOATING LIGHTS, J. Imray, London.—A communication from J. Pintsch.—6*th March*, 1882.
1149. VALVES, &c., A. W. Harrison, Abergavenny.—9*th March*, 1882.
1183. CORKSCREWS, G. W. von Nawrocki, Berlin.—A communication from R. Hessel.—11*th March*, 1882.
1266. ARTIFICIAL INDIGO, J. H. Johnson, London.—A communication from the Badische Aniline and Soda Fabric.—16*th March*, 1882.
1309. MEASURING DISTANCES, J. P. Nolan, Ballinderry.—17*th March*, 1882.
1318. GAS MOTOR ENGINES, C. G. Beechey, Liverpool.—21*st March*, 1882.
1360. GAS MOTOR ENGINES, H. Sumner, Manchester.—21*st March*, 1882.
1499. DISCHARGE APPARATUS, W. R. Lake, London.—Com. from T. S. Nowell.—28*th March*, 1882.
1552. SCREWS, &c., W. R. Lake, London.—Com. from the American Screw Company.—30*th March*, 1882.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the* 31*st March*, 1882.)

3956. PLATES, BARS, &c., J. Larue, Paris.—13*th September*, 1881.
4250. SEPARATING GASES, E. P. Alexander, London.—1*st October*, 1881.
4253. FEEDING FUEL to FURNACES, &c., J. McMillan, Glasgow.—1*st October*, 1881.
4269. SEWING MACHINES, F. Cutlan, Cardiff.—1*st October*, 1881.
4282. LOZENGES, J. L. Collier, Rochdale.—3*rd October*, 1881.
4288. GAS ENGINES, R. Simon and F. Wertenbruch, Nottingham.—3*rd October*, 1881.
4300. PIPES, F. D. Vœux, London.—4*th October*, 1881.
4303. PAPER-FOLDING MACHINES, R. Cundall, Thornton.—4*th October*, 1881.
4306. FURNACES and KILNS, G. Eyre, Codnor.—4*th October*, 1881.
4309. GALVANIC, &c., BATTERIES, F. Wirth, Frankfort-on-the-Maine.—4*th October*, 1881.
4310. SECONDARY BATTERIES, A. P. Laurie, Duddingstone.—4*th October*, 1881.
4313. SURVEYING APPARATUS, G. H. Stephens and H. Wilmer, London.—4*th October*, 1881.
4315. FIXED CONVERTERS, J. Lloyd, Prior's Lee Hall, near Shifnal.—4*th October*, 1881.
4331. FRENCH CLOISONNES, W. H. Beck, London.—5*th October*, 1881.
4388. EXTRACTING CALORIC, C. Tellier, Paris.—8*th October*, 1881.
4418. CALCINING SULPHIDE ORES, R. Mackenzie, Huelva.—11*th October*, 1881.
4432. LOOMS, J. Barbour, Belfast.—11*th October*, 1881.
4457. BLEACHING JUTE, T. G. Young, Penicuik.—13*th October*, 1881.
4702. SULPHATE of LIME, J. Young, Kelly.—27*th October*, 1881.
5409. INDICATORS, C. I. and F. Edmondson, Manchester.—10*th December*, 1881.
5430. TELEPHONES, A. W. Rose, London.—12*th December*, 1881.
5440. WARPING, &c., MACHINES, J. Sewell, E. Hulton, and J. Bethel, Manchester.—13*th December*, 1881.
5550. ODOMETERS and REGISTERS, W. P. Thompson, London.—19*th December*, 1881.
5651. ELECTRIC CURRENT METERS, St. G. L. Fox, London.—24*th December*, 1881.
5697. ARTIFICIAL HUMAN MILK, P. T. J. Voltmer, Birmingham.—28*th December*, 1881.
44. CURING NEURALGIA, &c., H. F. Mills, London.—4*th January*, 1882.
200. MULTIPLYING APPARATUS, H. E. Tyler, Edmonton.—14*th January*, 1882.
268. INTERCEPTING and EXTRACTING APPARATUS, P. Lowe, Darwen.—19*th January*, 1882.
345. WIND INSTRUMENTS, L. Varicas, London.—24*th January*, 1882.
507. CLOCKS, H. H. Lake, London.—1*st February*, 1882.

(*List of Letters Patent which passed the Great Seal on the* 4*th April*, 1882.)

4343. EXTINGUISHING FIRE, J. Dutton, London.—6*th October*, 1881.
4346. CHECKING, &c., APPLIANCES, J. T. R. Proctor, Dundee.—6*th October*, 1881.
4347. FIRE-BOXES, J. Shepherd, Manchester.—6*th October*, 1881.
4348. LOOMS, G. Kirk, Huddersfield.—6*th October*, 1881.
4353. PREPARING WOOL, &c., J. Tatham, Rochdale.—6*th October*, 1881.
4362. BORING, &c., APPARATUS, A. Upward, London.—7*th October*, 1881.
4372. CUTTING SHIVES, E. J. Heal, London.—7*th October*, 1881.
4382. PERAMBULATORS, C. H. Brassington, Manchester.—8*th October*, 1881.
4389. PREPARING COMPOUNDS, R. H. C. Nevile, Lincoln.—8*th October*, 1881.
4397. MAGNESIA, T. Twynam, London.—10*th October*, 1881.
4403. FIRE-LIGHTERS, A. G. Elliott, London.—10*th October*, 1881.
4411. FALSE BOTTOM for MASH TUNS, G. G. Cave, Bristol.—11*th October*, 1881.
4415. COLLIERY, &c., WAGONS, R. Hadfield, London.—11*th October*, 1881.
4452. FRICTIONAL COUPLINGS, W. L. Wise, London.—12*th October*, 1881.
4461. METAL KEGS, &c., J. Storer, Glasgow.—13*th October*, 1881.
4462. PUMPING MACHINERY, J. Gill, Edinburgh.—13*th October*, 1881.
4474. MOTORS, W. L. Wise, Westminster.—13*th October*, 1881.
4491. SODA, J. Imray, London.—14*th October*, 1881.
4495. LOOMS for WEAVING, W. E. Gedge, London.—15*th October*, 1881.
4497. WRINGING MACHINES, H. J. Haddan, London.—15*th October*, 1881.
4519. CARRIAGE AXLE-CLIPS, G. Wearing, Staffordshire.—17*th October*, 1881.
4530. BEDSTEAD VALANCES, M. A. Dearden, Doncaster.—18*th October*, 1881.
4558. REGISTERING DYNAMOMETERS, W. P. Thompson, London.—19*th October*, 1881.
4641. TARGETS, W. R. Lake, London.—22*nd October*, 1881.
4642. VACUUM BRAKE APPARATUS, J. Gresham, Salford.—24*th October*, 1881.
4747. WIGS, &c., J. H. Johnson, London.—29*th October*, 1881.
4767. FURNACES, W. P. Thompson, London.—1*st November*, 1881.
4798. TUBULAR STEAM BOILERS, G. Kamensky, London.—2*nd November*, 1881.
4899. COLOURING MATTERS, J. Imray, London.—9*th November*, 1881.
5040. STOVES, J. B. Petter, Yeovil.—17*th November*, 1881.
5111. WATER FITTINGS, J. R. Hargreaves, Lancaster.—23*rd November*, 1881.
5345. CUTTING-OUT CLOTH, &c., J. Gracey, Belfast.—7*th December*, 1881.
5419. LOCKS, G. H. Chubb, London, and H. W. Chubb, Chiselhurst.—10*th December*, 1881.
5599. INSULATED CONDUCTORS, W. Smith, London.—21*st December*, 1881.
5674. TRANSMITTING APPARATUS, S. Pitt, Sutton.—27*th December*, 1881.
16. HORSESHOES, J. Buckham and G. Jackson, Lanchester.—2*nd January*, 1882.
129. ELECTRICALLY LIGHTING TRAINS, W. H. Preece, Wimbledon, and J. James, London.—10*th January*, 1882.
180. GAS-BURNERS, F. Siemens, London.—12*th January*, 1882.
249. CLEANING BOOTS, G. H. Ellis, London.—18*th January*, 1882.
277. STEAM PUMPING ENGINES, W. D. Hooker, St. Louis, U.S.—19*th January*, 1882.
281. SELF-ACTING GRABS, J. H. Johnson, London.—19*th January*, 1882.
333. ELECTRIC CABLES, T. J. Handford, London.—23*rd January*, 1882.
361. ELECTRICAL CONDUCTORS, W. R. Lake, London.—24*th January*, 1882.
366. POWER LOOMS, S. C. Lister and J. Reixach, Yorkshire.—24*th January*, 1882.
373. SHUTTLES, J. R. Richards, Preston.—25*th January*, 1882.
388. TRANSFERRING DESIGNS, J. M. Moss, Patricroft.—26*th January*, 1882.
416. BLAST FURNACES, J. Cliff, Frodingham, and J. H. Dawes, Messingham.—27*th January*, 1882.
482. LATCHES, E. R. Wethered, Woolwich.—31*st January*, 1882.
488. PACKING for PISTON RODS, W. R. Lake, London.—31*st January*, 1882.
490. SPRING MOTOR APPARATUS, W. R. Lake, London.—31*st January*, 1882.

List of Specifications published during the week ending April 1st, 1882.

2260, 2d.; 3431, 6d.; 3465, 4d.; 3473, 6d.; 3478, 6d.; 3491, 6d.; 3528, 10d.; 3533, 6d.; 3536, 8d.; 3537, 6d.; 3538, 6d.; 3539, 8d.; 3551, 8d.; 3556, 4d.; 3564, 8d.; 3569, 6d.; 3572, 6d. 3578, 10d.; 3595, 6d.; 3598, 6d.;; 3606, 6d.; 3610, 6d.; 3617, 2d.; 3619, 6d.; 3621, 6d.; 3622, 8d.; 3636, 6d.; 3648, 6d.; 3649, 6d.; 3667, 6d.; 3668, 6d.; 3670, 8d.; 3674, 8d.; 3676, 4d.; 3677, 6d.; 3678, 4d.; 3694, 6d.; 3696, 6d.; 3698, 6d.; 3703, 6d.; 3704, 6d.; 3706, 2d.; 3709, 4d.; 3716, 6d.; 3723, 1s. 6d.; 3726, 8d.; 3729, 4d.; 3737, 6d.; 3740, 4d.; 3742, 2d.; 3743, 2d.; 3747, 6d.; 3748, 4d.; 3749, 4d.; 3750, 2d.; 3753, 2d.; 3755, 2d.; 3756, 2d.; 3757, 2d.; 3759, 2d.; 3761, 2d.; 3762, 4d.; 3763, 2d.; 3764, 2d.; 3765, 2d.; 3766, 6d.; 3769, 2d.; 3799, 2d.; 3781, 2d.; 3784, 2d.; 3785, 6d.; 3787, 2d.; 3788, 2d.; 3794, 2d.; 3800, 2d.; 3802, 2d.; 3803 4d.; 3804, 4d.; 3806, 2d.; 3810, 2d.; 3814, 2d.; 3816, 2d.; 3818, 2d.; 3819, 2d.; 3822, 2d.; 3823, 2d.; 3825, 2d.; 3830, 2d.; 3832, 6d.; 3835, 2d.; 3836, 2d.; 3837, 2d.; 3838, 4d.; 3840, 2d.; 3841, 6d.; 3843, 2d.; 3844, 6d.; 3846, 2d.; 3847, 2d.; 3849, 2d.; 3850, 2d.; 3851, 2d.; 3853, 2d.; 3855, 2d.; 3857, 2d.; 4032, 6d.; 4046, 4d; 5463, 6d.; 5569, 2d.; 5670, 6d.; 5695, 6d.; 24, 2d.

*** Specifications will be forwarded by post from the Patent-office on receipt of the amount of price and postage. Sums exceeding 1s. must be remitted by Post-office order, made payable at the Post-office, 5, High Holborn, to Mr. H. Reader Lack, her Majesty's Patent-office, Southampton-buildings, Chancery-lane, London

ABSTRACTS OF SPECIFICATIONS.

Prepared by ourselves expressly for The Engineer *at the office of Her Majesty's Commissioners of Patents.*

2260. Metallic Alloy, *W. L. Wise, Westminster.*—24*th May*, 1881.—(*A communication from K. H. Kühne, near Dresden.*) 2*d.*

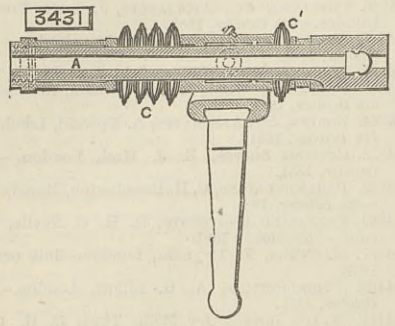
This relates to a new alloy composed of 83¼ per cent. copper, 7 per cent. tin, 9 per cent. lead, and ¾ per cent. phosphorus.

2935. Supporting and Protecting Persons Outside Buildings for Window Cleaning, &c., *S. Krakauer, administrator of J. Louis, Minories.*—5*th July*, 1881. 6*d.*

This consists of a frame adjustable in height so as to fit against the inside of the window frame, and having on each side bar a sliding clamp, through which passes a horizontal bar also made adjustable, and carrying hinged to its outer end a platform surrounded by a railing capable of folding up so as to occupy less space when not in use.

3431. Mounting Ordnance, *A. Longsdon, London.*—8*th August*, 1881.—(*A communication from A. Krupp, Essen, Germany.*) 6*d.*

This relates to the application of springs to pieces of ordnance. When the gun is discharged the forward springs C counteract or take up the recoil, thus partly



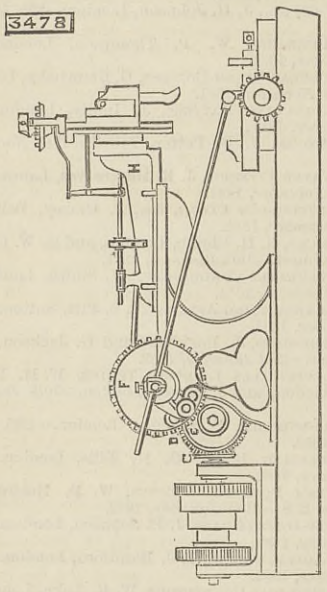
or wholly relieving the gun carriage and other parts from the shock; on the other hand, when the reaction takes place and the gun A returns to its original position, the rear springs C¹ take up the forward thrust and thus prevent the concussion that would otherwise take place.

3465. Graters, *J. G. Thresher, London.*—10*th August*, 1881.—(*A communication from M. V. Bligh, Boulogne.*) 4*d.*

This consists of a receptacle open at one end and having a perforated grating surface on one or both sides. The substance to be grated is placed in a holder containing a spring to force the same outwards, and which is made to slide in grooves formed in the edges of the grater.

3478. Turning. Shaping, Planing, and Slotting Metal, &c., *R. A. Lee, Westminster.*—11*th August*, 1881. 6*d.*

The object is to enable an ordinary lathe to be used also for shaping, planing, or slotting, and it consists in screwing on the nose of the mandril a mitre wheel C gearing with wheel D, on whose spindle is a third wheel E gearing with wheel F, which is slotted to



receive a stud connected by a rod to a slide H travelling in guides. The end of the slide terminates in a circular plate at right angles to the slide, and to it is bolted the top half of a slide rest, the cutting tool being held in a swinging tool box, the work to be operated on being fixed to the lower half of slide rest fixed on the bed of lathe.

3491. Flat-headed Tacks, Nails, Drawing-pins, &c., *G. Klug, Glasgow.*—12*th August*, 1881.—(*A communication from C. Meier, Berlin.*) 6*d.*

This consists in forming the tack, nail, or pin with the stem and head in one piece, by stamping out from the head a piece of the required form for the stem without separating it from the head, and then bending such piece downwards.

3528. Fog Signal Apparatus, &c., *F. H. Holmes, West Brompton.*—13*th August*, 1881. 10*d.*

This relates to a siren to produce consecutively a high and one or more low notes each differing in pitch and in any desired order, and it consists in the use of two or more brakes or governors arranged so that one brake when adjusted will produce a definite high note by regulating the speed of the screw, but when a second brake is made to act together with the first the friction is increased, causing the siren to revolve with less velocity, and consequently produce a lower note.

3533. Crinolines, *C. S. Schneider, Chelsea.*—15*th August*, 1881. 6*d.*

This relates to means for rendering crinolines comparatively invisible and indeformable, and to allow the train of the dress to be extended or drawn in at pleasure. The crinoline consists of a horsehair fabric united down the front by tape springs, and at its back steel stiffeners are arranged. In the lower part an opening is left, the edges of which may be brought closer together or separated at will.

3536. Refrigerating Machines, &c., *L. Sterne, D. Clerk, and J. B. Handyside, Glasgow.*—15*th August*, 1881. 8*d.*

This relates to machines in which air is compressed, cooled, and re-expanded in a manner to return part of the power employed for compressing it, and it consists in an arrangement of parts to compress the air in two or more successive stages with or without cooling between the stages, the air being cooled by passing in a single stream or small number of streams through an elongated course in contact with metallic surfaces cooled by water passing in the opposite direction.

3537. Moulding or Vulcanising Flasks for Dental Purposes, &c., *J. S. Campbell, New York.*—15*th August*, 1881. 6*d.*

This consists in provisions for closing a dental flask obliquely, and in oblique guides for that purpose secured to one part of the flask and operating against the opposite part as the two portions approach each other in closing; and it consists further in a combined oblique or inclined and perpendicular guides, which oblique guides consist preferably of movable studs or pins with a head and a partially screwed and partially plane neck terminating in a point, the end of which is out of the axial line of the stud.

3551. Automatic Weighing Machines, *C. Reuther, Germany.*—16*th August*, 1881. 8*d.*

This relates to automatic weighing machines for granular or pulverous substances or liquids, which at the same time register the quantities weighed, such apparatus consisting mainly of a double-armed lever or beam having at one end a receptacle for receiving the substance and at the other end either a constant weight or scale to receive varying weights; Secondly, of a feed mechanism to allow exactly as much material to flow into the receptacle as corresponds to the weight, and then cut off the supply, and after removal of the charge open it again; lastly, a mechanism to discharge the receptacle when filled.

3556. Breakwaters and Harbours, *E. C. G. Thomas, Madras.*—16*th August*, 1881. 4*d.*

The object is to prevent the action of the waves injuring shipping and harbour works, by placing in the course of the current or wave a row of obstructions, meeting the current with a sharp point, like the apex of a triangle or the bows of a vessel, and with vertical sides at such an angle or curve in plan as to divert the cleft water right and left.

3564. Lamps for Railway Carriages, &c., *J. F. Shallis and T. C. J. Thomas, Minories.*—16*th August*, 1881. 8*d.*

The oil is contained in an annular reservoir surrounding a reflecting chamber, above which is a combustion chamber with a diaphragm below it to exclude draught, holes being provided to admit air for combustion. The combustion chamber has also a chimney, and the reflecting chamber below the diaphragm has holes to allow the escape of heat. The reflecting chamber may be in the form of a truncated cone with its axis vertical, or it may be of parabolic or other shape in vertical section, and of polygonal or other shape in cross section. The light is produced at burners arranged in a horizontal or inclined position over the reflecting chamber.

3569. Registering the Number of Fares or Amount of Monies Received in Tram-cars, &c., *A. J. T. Wild, Nunhead.*—17*th August*, 1881. 6*d.*

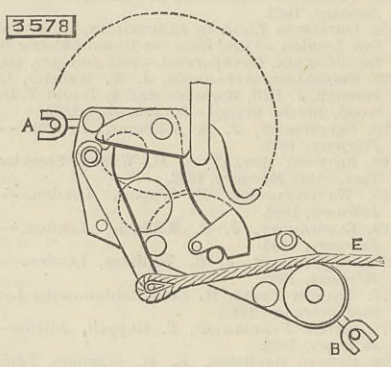
This consists in the use of a train of wheels numbered from 0 to 9, and forming a suitable number register actuated by the fares received, which are placed on a hinged platform, and in falling actuate the unit wheel of the register; at the same time a ticket is presented to be given to the passenger, and a bell is sounded.

3572. Velocipedes, *G. Richards, Manchester, and B. C. Tilghman, London.*—17*th August*, 1881. 6*d.*

This consists principally in the application of a small wheel in front of the main driving wheel of a bicycle, such additional wheel being carried by a frame pivotted to the frame which carries the rear wheel, and serving to prevent the rider being thrown over the handle of the machine.

3578. Boat Disengaging Gear, *M. H. Robinson, Hampton Wick.*—17*th August*, 1881. 10*d.*

This relates to improvements on boat disengaging gear already in use, the object being to render it more compact, so that it occupies less depth and may be adapted to boats at present hung by slings. The



disengaging gear is attached to the stem or stern-post by chain A, and to the keel by chain B. To each apparatus is connected the rope E divided in the middle by a purchase, and as long as such rope is held taut the gear is locked, but on releasing the rope the hooks become disengaged.

3595. Pianofortes, *C. Collard, London.*—18*th August*, 1881. 6*d.*

This relates to mechanism for obtaining at pleasure in horizontal pianofortes a soft tone without the use of a shifting keyboard, and it consists of a lever arrangement actuated by a pedal and serving to introduce a strip of cloth or other soft fabric between the hammers and the strings.

3598. Looms for Weaving, *E. Smith, Houley, Yorks.*—18*th August*, 1881. 6*d.*

This relates to the weaving of "dhootas," that is fabrics with a central plain or figured portion, and a border of coloured warps, and also of coloured wefts for that portion only, and it consists in actuating the warp threads by a jacquard motion, dobbies, or tappet motions, so that a shed is formed for the passing of the ordinary shuttle through the central portions of the yarn alternately with sheds formed in the borders for the passing of special shuttles through them, such shuttles carrying yarn of the desired colour.

3606. Metallic Structures for Barracks, Hospitals, &c., *C. D. Abel, London.*—19*th August*, 1881.—(*A communication from La Société Nouvelle de Constructions—Système Tollet—Paris.*) 6*d.*

This relates to a system of constructing buildings patented A.D. 1878, No. 1877, and consisting in the use of framing for the structure of metal ribs of Gothic or ogival form, connected at their base by cross ties or girders forming part of the buildings, and the present invention consists in forming the structures with two concentric ribs with a space between, the sides of which are to be filled in with brickwork, so as to form a continuous air space throughout the building.

3610. Circular Ribbed Fabrics, &c., *H. M. Mellor, Nottingham.*—19*th August*, 1881. 6*d.*

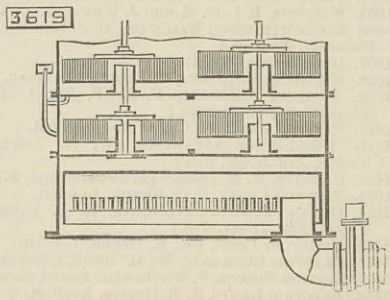
The object is to produce circular ribbed fabrics with various patterns of rib or rib and plain fabric in the same piece, and also to form a welt around one end of the piece, and it consists in the employment of a cylinder having latch needles in a vertical position carried by needle slides with projections on their outer edges of various lengths. These slides are actuated by cams that can be moved into or out of action so as to act upon the projections on the slides or not. An upper or ribbing cylinder is employed and has horizontal latch needles carried by levers, turning on centres, and to these cylinders is attached a welting apparatus of ordinary construction to be worked either automatically or by hand. An extra thread guide is used in connection with cams for the purpose of making extra stitches upon such needles as are intended to be put out of work when changing from one kind of rib to another.

3617. Advertising, *C. B. S. Webb, Colchester.*—19*th August*, 1881.—(*Provisional protection not allowed.*) 2*d.*

This relates to a timepiece inserted in a glazed frame, the remainder of which is filled in with advertisements.

3619. Apparatus for the Purification of Coal Gas, *C. C. Walker, Lilleshall, Salop, and W. T. Walker, Highgate.*—19*th August*, 1881. 6*d.*

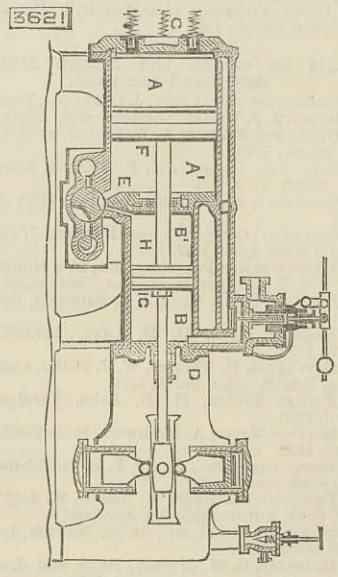
This relates to improvements on patent No. 1478, dated 10th April, 1880. The drawing represents a vertical section of a portion of a scrubbing apparatus constructed according to the former patent, with the present invention applied to the lowermost tank of the said apparatus. The present invention consists



in the employment in or for the purification of coal gas of washing apparatus, constructed with inverted troughs having slotted or perforated sides, partially submerged in purifying liquid.

3621. Automatic Air Compression Machines, *V. C. Haurie, London.*—19*th August*, 1881.—(*Partly a communication from F. Windhausen, Berlin.*) 6*d.*

The machine consists of two cylinders A A¹ and B B¹ of different diameters connected to one another centrally and closed by two covers C and D; these cylinders and spaces are separated from one another by the intermediary piece E. In each of them moves



a closing piston F and G, which are connected by the piston-rod H which passes through the intermediary piece E and through the cover D. The rooms or chambers A¹ and B¹ serve to receive the acting steam, whilst the chambers A and B are destined to serve as a receiver for the compressing air. Other improvements are described.

3622. Hot Air, Steam, and Compressed Air Machines, *V. C. Haurié, London.*—25*th August*, 1881.—(*Partly a communication from F. Windhausen, Berlin.*) 8*d.*

This relates to a machine consisting of two centrally joined unequal cylinders with a condenser joined to them, and in which hot gases and steam expanding in two stages operate on two unequal pistons for the purpose of compressing air and producing mechanical effect. The condenser in which the steam is condensed and the hot gases are cooled is arranged so as to produce a space of diluted air, by aid of which the machine can work as well with closed oven and high pressure of air as also with opened oven at an atmospheric pressure of the hot gases and steam. A heating apparatus is provided with an evaporator and water reservoir, for supplying the steam to the machine and heating the air.

3636. Silk Reels or Apparatus for Dressing Flour, Middlings, &c., *C. W. Maconchy, Dublin.*—20*th August*, 1881. 6*d.*

The object is to prevent the coarser materials being blown back by the draught in the bolting chest on to the flour, thereby making it dirty, and it consists in providing a circular flexible stop joint or division between every two compartments of the bolting chest to prevent intercommunication and consequent draught.

3648. Heating Apparatus, &c., *W. H. Stephenson, Blackburn.*—22*nd August*, 1881. 6*d.*

This relates to apparatus for heating greenhouses, &c., and consists, First, in the use of U-shaped water-heating pipes, so as to increase their heating surface; and Secondly, in the use of apparatus to control and regulate the temperature of the place to be heated. The controlling apparatus consists of a device compressing an air-tight cylinder connected by pipes with one leg of a syphon containing mercury, a gas supply being connected to the after leg, so that as the heat increases the air in the cylinder expands and forces the mercury down in one leg and up in the other, thereby partially closing the gas supply opening.

3649. Jigging, Sifting, Separating, and Cleaning Grass and other Seeds or Grain, &c., *S. Bruce, Dublin.*—22*nd August*, 1881. 6*d.*

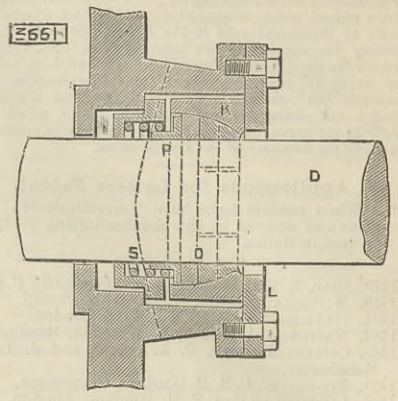
Inside a frame an inclined box containing one or more inclined sieves is held in position by four guide wheels, admitting of its being jigged or moved in a perpendicular or somewhat inclined or diagonal direction, such motion being obtained through cranks and connecting rods.

3664. Photographic Pictures and Apparatus for Exhibiting same, *P. M. Justice, London.*—23*rd August*, 1881.—(*A communication from J. Dewé, Ottawa, Canada.*) 6*d.*

The object is to give to photographic pictures tints colour or hues, in order to enhance the perspective and scenic effects, by means of reflected light and an interposed coloured medium.

3661. Valve Stem Supports and Valve Stems or Piston Rod Packing for Steam Engines, &c., *W. Morgan-Brown, London.*—23*rd August*, 1881.—(*A communication from G. H. Richards, Boston, U.S.*)—(*Complete.*) 8*d.*

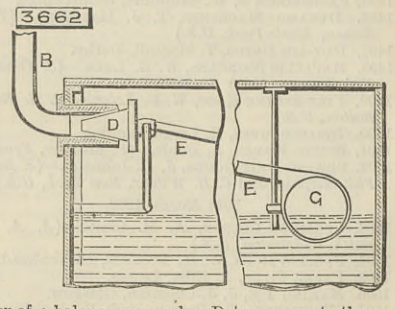
This relates to valve stem supports and valve stem or piston rod packing, and one of its objects is to relieve the stuffing-boxes of the weight of the valve stem, and so prevent wear, and it consists in inserting springs between the yoke of the valve stem and the valve. The packing consists of a receptacle K connected to the cylinder head by a coupling L, so as to be free to move laterally to compensate for vibration or change in position of the valve rod D. The receptacle K has an internally-curved socket to receive



externally correspondingly shaped packing rings O, which are shaped internally to fit the rod, and are acted upon by the follower P and spring S to press them into their socket.

3662. Controlling the Admission of Feed-water to Steam Generators, *M. Benson, London.*—23*rd August*, 1881.—(*A communication from S. C. Salisbury, New York.*)—(*Complete.*) 6*d.*

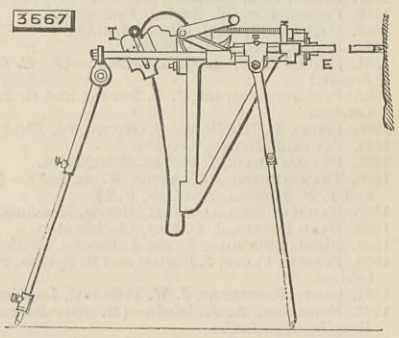
This consists in the combination with a steam gene-



rator of a balance cone valve D transverse to the port of the steam pipe B, whereby steam passes to operate the feed pump and a controlling lever E, fulcrum and float G, governed by the height of water in the generator.

3667. Drilling or Perforating Rocks, *W. R. Lake, London.*—23*rd August*, 1881.—(*A communication from L. W. Tracy, Philadelphia, U.S.*) 6*d.*

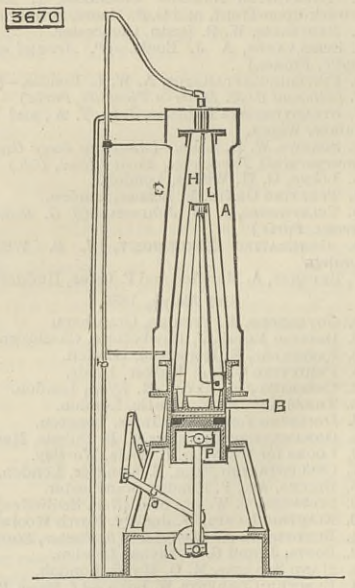
This consists of a hand-power rock drilling machine composed of a spring acting hammer I, a drill holder E, and a hand operating device for pressing back the hammer carried by a body adapted to slide on a fixed



frame in combination with an automatic feed device connecting the body to the frame actuated by the drill holder to feed the body and operating parts forward as fast as the drill enters the rock.

3670. Cooling and Compressing Air, &c., *W. R. Lake, London.*—23*rd August*, 1881.—(*A communication from J. P. and O. G. Burnham, Chicago, U.S.*) 8*d.*

This relates to single chambered machines for cooling air and similar fluids by the method of successive compression and expansion thereof, and it consists, First, of mechanical means to simultaneously compress the air and abstract its heat; and Secondly, to expand the air in contact with other surfaces than those through which the cooling agent operates while it is



being compressed. H is the single chamber within which the compression and expansion are effected, and it is enclosed in a shell A closed at top by a cap with an inwardly opening check valve. The shell is surrounded by a water tank C. The compression and expansion are effected by the pistons L and P, the expanded air escaping at B.

3671. Printing Machines, *J. H. Young and R. Paterson, Glasgow.*—23*rd August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to double-cylinder perfecting printing machines, in which the sheets are printed on one side by the forme of type under the first cylinder, and have the other side printed by the forme under the second cylinder when the sheet is reversed, and the objects are, First, to prevent the "set-off" or impression made on the second cylinder by the letter-press on each wet printed sheet passing under it being

transferred from the cylinder to the next sheet in succession; and Secondly, to secure the delivery of the printed sheets by mechanical means instead of by manual labour.

3672. Fuses for Blasting, *A. and J. Hunter, Glasgow.*—*23rd August*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in the use of a fuse consisting of a short tube of waterproof paper filled with fine powder, and inserted only a few inches in the hole left by the needle or wire, and leading to the pricked cartridge.

3673. Singeing Fabrics, *J. Walton, Lancaster.*—*23rd August*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to singe the fabric on both sides at one operation, and consists in causing the fabric to pass over one and under a second revolving cylinder, both of which are heated in any suitable manner.

3674. Locomotives, &c., *C. D. Abel, London.*—*23rd August*, 1881.—(*A communication from A. Estrade, France.*) 8*d.*

The object is to improve the construction of locomotives, tenders, and rolling stock of railways in such a manner as, First, to impart thereto greater stability and safety against running off the rails by lowering the centre of gravity thereof: Secondly, to obtain increased speed by the use of wheels of much larger diameter than at present; and Thirdly, to obtain easier motion and decreased wear and tear by a system of double suspension of the body of the carriage or locomotive.

3676. Valves, *J. Smith, jun., and S. A. Johnson, Millwall.*—*23rd August*, 1881. 4*d.*

This relates to valves applicable to air and circulating pumps and valves of all descriptions of marine and other engines, and for other purposes, and it consists of a metal valve packed on the face and on the back with canvass, tucks, packing, or other substance held in dovetailed recesses in the valve. The packing projects outside the valve face, and when in action forms a tight joint around the grating. The back packing, when the valve opens, comes in contact with a metal washer placed on the stud in the grating, and so checks the valve.

3677. Registering Fares paid in Omnibuses, &c., *J. N. Maskelyne, Picadilly.*—*23rd August*, 1881. 6*d.*

The object is to provide a simple compact apparatus to register the amounts of different fares paid by passengers in public vehicles, and to punch the tickets with the amount paid as they are issued, and it consists of a pair of toothed wheels mounted a short distance apart on the same axle, and actuated by pinions driven by turning a handle. The front wheel carries a dial marked with various fares, and is arranged so as to present the particular fare to be paid when the same has been registered and the ticket punched. The rear wheel has on its face pins, which actuate striking hammers, so as to sound the amount of the fare to be paid, and at the same time actuates the punches which mark the fare on the ticket. Suitable registering mechanism is also provided.

3678. Polishing Spoons, Forks, &c., *E. W. Lay and S. Martin, Hampstead.*—*23rd August*, 1881. 4*d.*

A spindle covered with vulcanised india-rubber is caused to revolve at a high speed by means of pulleys and band actuated by a treadle, one part of the india-rubber being plain so as to serve for polishing flat surfaces, whilst the other is provided with both concaved and convexed surfaces to suit the curved parts of the forks or spoons. A brush is also mounted on the spindle to remove the dust from the articles when polished.

3680. Joint for Bracelets, Armlets, Scarf Slides, &c., *J. E. Beaver and T. Terry, Birmingham.*—*24th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to bracelets, &c., of the shape known as "the Belcher," which consists of a band curved in cross section and formed in two or more parts jointed together, and it consists in cutting out the requisite parts for a hinge from the band and turning them round into a tubular form and securing them by a pin, so that the joint is sunk below the outer curved surface of the band.

3681. Carbonic Acid Gas, &c., *T. Hogben, London.*—*24th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to apparatus for generating carbonic acid gas, mixing it with liquids, and refrigerating the same, and it consists of two vessels placed one over the other and connected, so that the top one can be easily removed. The gas is generated in the lower vessel, and passing to the upper vessel saturates the liquid it contains, causing it to be aërated. The liquid is then conducted to a refrigerator.

3684. Driving Gear for Velocipedes, *W. G. Hammon, Coventry.*—*24th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to means for varying the speed, and consists in mounting the driving wheel loose on its spindle and attaching to it a ratchet wheel, with which a pawl secured to the spindle engages. A clutch box encloses a helical spring attached to the spindle and having a slot on its circumference to receive an upright tooth formed on the pawl. A chain is coiled on the barrel, and is adjustable as to its leverage on a pivotted treadle.

3685. Buttons, *G. Phillips, Hereford.*—*24th August*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in forming the button in two parts, the head being made to screw on to the stem of the bottom of the button, such stem being passed through a hole formed in the garment.

3686. Ornamenting Surfaces of Sheet Metal and Articles made from Sheet Metal, *A. N. Hopkins, Birmingham, and G. Hatton, Kidderminster.*—*24th August*, 1881.—(*Not proceeded with.*) 2*d.*

The design is formed in wax on the surface to be ornamented, and then by means of acid the remainder of such surface is countersunk, leaving the design in relief. The countersunk portion is then filled up with a permanent japan, lacquer, or enamel.

3689. Bolts for Fastening Doors, *A. H. Windsor, Brentwood.*—*24th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to means for indicating outside the door when the apartment is occupied and the bolt shot.

3690. Drying Machines, *W. A. Gibbs, Chingford.*—*24th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to means for drying hay stacked in a green state, and it consists in building the stack with a central hollow and inserting a shaft therein, the top of which projects beyond the stack, so as to create an upward current of air, and thereby prevent the stack over heating.

3692. Cleansing, Restoring, or Polishing Jewellery, &c., *E. Jesty, Yeovil.*—*24th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to a composition for cleaning jewellery, and consisting of 1 grain best rouge, 240 grains prepared washed whiting, 120 grains strong ammonia, and 599 grains of water.

3695. Basting Meat, *J. Lacy, Surrey.*—*24th August*, 1881.—(*Not proceeded with.*) 2*d.*

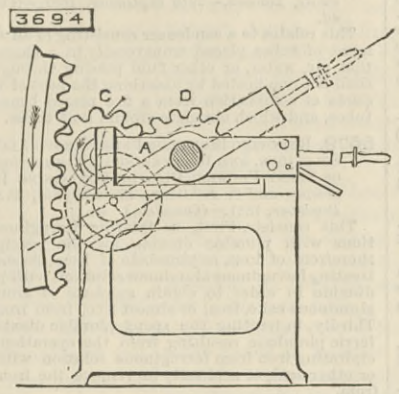
This relates to the use of an endless chain of buckets actuated by suitable spring mechanism to raise the fat from the dripping pan and pour it over the joint of meat.

3697. Bicycle Lamp, *G. R. Godsall and J. C. C. Read, Birmingham.*—*25th August*, 1881. 6*d.*

To the frame of an ordinary bicycle lamp a hinged barrel is applied to suspend it on the axis, one part of the barrel being securely connected to the top part of the lamp body, while to the under part of the other half of the barrel a plate is fixed and forms a hasp to snap over a projecting spring catch on the top part of the front of the lamp.

3694. Safety Gear for Starting Engines, *J. Musgrave and A. Walsh, Bolton.*—*24th August*, 1881. 6*d.*

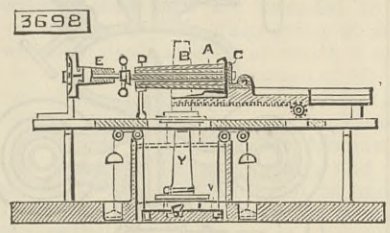
This consists of a small pinion C gearing into the cogs of the driving wheel of the large engine, the said pinion being fitted on a radial arm or lever A pivotted on a shaft; the arm or lever has a handle by which the pinion can be moved into gear with the driving wheel; on the shaft on which the arm or lever is pivotted is another pinion D gearing into the small



pinion and driven by a worm and worm wheel—or other gear—actuated either by a small starting engine or by hand to start the large engine; when the engine has been started and has attained sufficient speed to become the driver instead of the driven, it will throw the small pinion out of gear.

3698. Manufacture of Tuyeres, *C. J. Brock, London.*—*25th August*, 1881.—(*A communication from H. Walker, Pittsburgh, U.S.*) 6*d.*

This relates especially to tuyeres such as are used in Bessemer converters, and which consist of a mass of fire-clay of a somewhat tapering long cylindrical form with numerous small holes extending longitudinally through the tuyere, and the machine for manufacturing the same consists of a tapering mould B, with a perforated piston D at its small end, and a screw press E to force the piston against the plastic material, and so compress it around and between the core rods in the mould, which are secured to a head G, capable of



moving on ways so as to introduce and withdraw the core bars A to and from the mould by means of a rack and pinion. The mould can be turned on trunnions into a vertical position when required to remove the tuyere Y, which is deposited on the platform V, capable of being raised and lowered by suitable weights and cords.

3702. Carts, *O. C. Alty, Blackburn.*—*25th August*, 1881.—(*Not proceeded with.*) 2*d.*

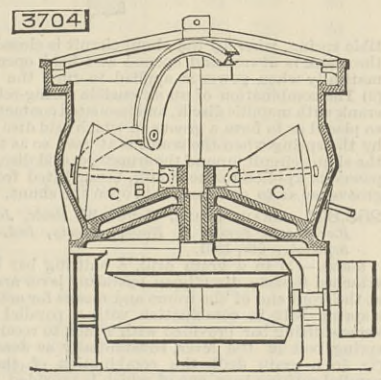
This relates to means for taking the weight of the load off the shafts of the cart, and consists in applying two light wheels in front of the ordinary wheels of the cart, such wheels working on a swivel like a pair of jury wheels, and being so arranged that the cart will tip over like an ordinary cart.

3703. Securing Rails in Chairs, *T. Matthews, Stoke Newington.*—*25th August*, 1881. 6*d.*

The inner face of one jaw of the chair fits the side of the rail, and between the other jaw and the opposite side of the rail a space is left to receive an excentric block jointed to the upper part of this jaw by a horizontal joint, and which, when turned, bears against the side and under part of the head of the rail so as to hold it securely in position.

3704. Crushing Gold Ore, &c., *J. M. Stuart, London.*—*25th August*, 1881. 6*d.*

The apparatus is formed of an outer case, within which is a false bottom B, formed by preference of chilled steel, and affixed to a revolving axis supported in suitable bearings. Around this axis is also applied another, a hollow axis with arms forming axes which are inclined to receive a series of conical rollers C. The



axis carrying the false bottom and that surrounding it, and carrying the conical rollers, have pinions applied to them, the teeth of which are taken into by the teeth of another wheel, by which, or by other suitable means, the two main axes are caused to revolve in opposite directions.

3705. Extracting, Refining, and Hardening Paraffine Wax, *O. Herrlich, London.*—*25th August*, 1881.—(*A communication from H. Ujhely, Vienna.*) 2*d.*

The crude material is placed in a vessel and mixed with alcohol, petroleum, and ether. The alcohol absorbs the oil and carries it with it through a filter, leaving the paraffine behind, the latter being then purified by the addition of a powder, which is a waste product from the manufacture of ferrocyanide of potassium. The alcohol and oil is placed in a steam-heated still, when the spirit separates from it, and is conducted back to the container ready for re-use.

3706. Compensating Chain Barrel or Sheave for Steam or Hand Steering Apparatus, *J. Lynn, Sunderland.*—*25th August*, 1881.—(*Void.*) 2*d.*

Upon the main shaft of any steering gear, instead of the ordinary chain barrel is fixed a chain barrel or sheave having its centre excentric to that of the main shaft, in such a position that when the rudder is in its middle (or fore and aft) position, the chain barrel or sheave shall be standing in a neutral position, such that any movement in either direction will cause its excentricity to take effect. The chains attached to the tiller on rudder head and leading to port and starboard sides of ship respectively are carried along the deck in the usual manner and secured to shackles fixed in the excentric chain barrel or sheaves, each chain working in its own groove, or as may be, in some case, each chain having its own sheave fixed excentrically on the main shaft.

3708. Floors or Surfaces for Skating Upon, *A. C. McLeod, Shrewsbury.*—*25th August*, 1881. 2*d.*

This relates to the preparation of a surface to be skated upon with ordinary ice skates, and consists in covering the ground evenly with lac, resin, bitumen, or other fusible substance, and then melting the same and allowing it to cool.

3709. Flyers for Spinning and Doubling Fibres, *T. A. Duncan, Otley.*—*25th August*, 1881. 6*d.*

This consists in constructing flyers with an extra eye or curl in the leg or legs midway or at other desired position underneath the shoulder and between it and the bottom curl.

3710. Joining Boards, Planks, &c., *E. E. Lemmon, Stratford.* –*25th August*, 1881. — (*Not proceeded with.*) 2*d.*

This consists in making narrow grooves, preferably saw cuts, along the edges to be joined, and then inserting strips of hoop iron in such grooves.

3711. Improvements in Electric Lamps, *F. H. F. Engel, Hamburg.*—*25th August*, 1881.—(*A communication from C. H. F. Müller, Hamburg.*)—(*Not proceeded with.*) 2*d.*

This consists in the use of sheet platinum in strips of about ⅛in. wide, to connect the conductors with the carbons in incandescent lamps, instead of the wires hitherto employed, the sheet strips being more easily fixed into the glass globes.

3712. Ammonia, *C. D. Abel, London.*—*25th August*, 1881.—(*A communication from F. Twinch, Paris.*) 4*d.*

This consists in the manufacture of ammonia by causing nitrogen, liberated from atmospheric air by the action thereon of the lower nitrogen oxides, to combine at the moment of its liberation with nascent hydrogen liberated from aqueous vapour or alkaline hydrates, or from both by the action of metals thereon in the presence of heat.

3716. Pitch Chains for the Transmission of Motive Power, *J. I. Warman, Coventry.* — *25th August*, 1881. 6*d.*

This relates to the construction and arrangement of a driving chain with links having bosses, and the wheel to suit the same.

3718. Sizing, Mordanting, Dyeing, Printing, and Finishing Textile and other Materials, &c., *J. Wolff, Manchester.*—*25th August*, 1881. 4*d.*

This consists in applying to the material to be sized a solution which is rendered insoluble by the action of light, such as chrome gelatine, and the parts to form the design are exposed to light, the remainder being afterwards removed by water. Suitable colours and mordants may be added to the sensitive size employed, and the ground of the fabric may be subsequently dyed any desired colour.

3722. Tree Pots, Flower Pots, and Seed Pan, *I. Glazebrook, Birmingham.*—*25th August*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in forming a trough at the bottom of the pot to receive water, which passes through holes in the bottom of the pot, and is absorbed by the soil.

3723. Knitting Machines, *F. Caldwell, Loughborough.*—*26th August*, 1881. 1*s.* 6*d.*

This relates, First, to machinery and apparatus for operating the frame and machine needle bits and needles; Secondly, to the production of a fast top or welt on ribbed looped fabrics made on circular machines in continuous lengths, producing two and one, three and two, five and three, or other number of ribs except one and one rib; Thirdly, to the production of a fast top or welt on plain looped fabrics in continuous lengths made on circular machines, employing latch or tumbler needles, by operating upon every other needle; Fourthly, to the production of a fast top or welt on fabrics made on a plain circular loop wheel frame.

3726. Combing Machines, *E. de Pass, London.*—*26th August*, 1881.—(*A communication from J. Imbs, Paris.*) 8*d.*

This relates, First, to a double reciprocating movement, consisting of combined rising and rotation imparted to an independent head finishing comb; Secondly, to the backward or return movement of the head nipper, interrupted or very much slackened during the penetration of the finishing comb, so as to insure the proper working of the comb; Thirdly, to the alternately quickened and slackened rotary motion of the cleaning brush; Fourthly, to the arrangement by which the pressure upon the seizing nipper is applied much lower down and without straining the rods; Fifthly, to the slow movement of alternate approach and withdrawal of a doffing comb in combination with an oscillating rotary movement of a doffer for detaching the fleece from the doffer.

3727. Fare and Passenger Register for Tramcars, &c., *A. Horne and T. Sigley, Liverpool.*—*26th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the use of a turnstile actuated by the passengers entering the vehicle, and serving to register the number of passengers or the fares paid.

3729. Range Finders, *F. Charteris (Lord Elcho), London.*—*26th August*, 1881. 4*d.*

This consists in a stair-shaped arrangement of lines and figures, and the combination of two symmetrically arranged systems of lines on the same disc, one for indicating the apparent height of infantry, and the other the apparent height of cavalry at various distances.

3730. Spinning or Twisting Coarse Yarns, *J. Barbour and A. Coombe, Belfast.*—*26th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to rope yarn spinners, and consists in the employment of conductors composed of two travelling endless leather bands, placed between the drawing rollers or gills, which contain the sliver to be twisted, and the flyers.

3731. Improvements in Apparatus for Transmitting and Receiving Audible Signals by Means of Electricity, *A. F. St. George, London.*—*26th August*, 1881.—(*Not proceeded with.*) 4*d.*

This invention relates to apparatus used for the purpose of acoustical telegraphy or telephony, and a cheap and new method of constructing such apparatus, and consists in two coils of iron or steel wire, through one of which a constant current from a battery is flowing, and the other of which is connected with a vibrating diaphragm.

3735. Spinning Machinery, *F. Ripley and T. H. Brigg, Bradford.*—*26th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to arrangements for driving and lubricating flyer spindles so as to render them capable of being driven at a high speed, and it consists in the use of an inverted flyer, the legs of which are connected to prevent undue expansion, and the flyer driven by an independent wharve and band. The spindle is driven by a separate wharve, and the collar supporting it is cupped to contain oil and fibre.

3737. Ramming Apparatus for Asphalte, Pavement, &c., *H. Knoblauch, Berlin.*—*27th August*, 1881.—(*A communication from Professor E. Dietrich, Berlin.*) 6*d.*

This relates to arranging the hammers in such a manner that when the apparatus is moved forward in performing the operation of ramming, the surfaces covered by the blows slightly overlap one another in order to obtain an equal amount of ramming for the whole surface.

3740. Tanning of Hides or Skins, *G. L. Loversidge, Rochdale.*—*27th August*, 1881. 4*d.*

This consists in the tanning of hides or skins by the employment of valonia, oak bark, or other equivalent tanning materials in conjunction with either borax or boracic acid, or in conjunction with borax and boracic acid, or in conjunction with borax and citric acid, or in conjunction with boracic acid and citric acid.

3742. Feeding Steam Boilers, *E. Fromentin, Paris.*—*27th August*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in the use of a feed bottle, to which is attached a condenser.

3743. Looms for Weaving, &c., *J. Northrop, Embsay, Yorkshire.*—*27th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates, First, to opening the ends of the warps to allow the shuttle to go through and to allow them to remain opened for any number of picks, the healds remaining stationary when lifted; Secondly, to self-acting apparatus for stopping the loom when the weft breaks.

3745. Etching Glass, *J. Fahdt, Dresden.*—*27th August*, 1881. 2*d.*

This consists in the process of etching glass, enamel, porcelain, and similar substances by the use of fluoride in a dry state in combination with a suitable gluten.

3747. Ring Spinning Machines or Frames, *W. R. Lake, London.*—*27th August*, 1881.—(*A communication from S. A. Jenks, Rhode Island, U.S.*)—(*Complete.*) 6*d.*

Instead of having a belt pulley to each set of rolls and an additional pulley for driving a portion of the rolls in both sets or equivalent trains of high-speed gearing, the inventor employs two belt pulleys and connecting gearing for driving a portion of the rolls in both sets, and one belt for communicating motion from the main shaft to both of the said pulleys coupled with the desired capacity for effecting the graduated rotation of a certain roll or rolls in each set of rolls.

3748. Hydrate of Strontia, *C. F. Claus, London.*—*27th August*, 1881. 4*d.*

This consists in the production of hydrate of strontia by the action of an alkaline solution of oxide of zinc upon a solution of sulphide of strontium.

3749. Barrows, *B. Green, Mitcham.*—*27th August*, 1881. 4*d.*

This consists of a barrow pivotted so as to be able to tip up.

3750. Combined Bookcase, Bed, and Wardrobe, *C. Pratt, Clapham.*—*29th August*, 1881.—(*Not proceeded with.*) 2*d.*

The whole is combined in one, and may come into three parts.

3751. Paints or Compositions for Coating Ships' Bottoms, &c., *A. B. Rodyk, London.*—*29th August*, 1881.—(*A communication from N. B. Dennys, Singapore.*) 4*d.*

The paint is made by suspending zinc in a semi-saturated solution of crystals of sulphate of copper, in the proportion of 1 cwt. of zinc to 1½ cwt. of sulphate of copper. The resulting deposit is collected and dried, and reduced to a powder, to which the juice of the tree known as "eloeococcus vernica" is added in sufficient quantity to make a fair working paint.

3753. Converting Reciprocating into Rotary Motion, *J. Kellet, Bradford.*—*29th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to a mechanical arrangement by which velocipedes and other machines in which cranks are commonly employed may be driven without the aid of such cranks.

3755. Cutting Leather, *I. Hepworth, Littletown, Yorkshire.*—*29th August*, 1881.—(*Not proceeded with.*) 2*d.*

The machine consists of two fluted rollers mounted in suitable framework, and capable of adjustment according to the thickness of the leather. Between the rollers is fixed a knife at an angle which may be varied so as to produce a long or short splice.

3756. Clasp or Fastening for Memorandum Books, &c., *G. W. Newbury and J. F. Bennet, London.*—*29th August*, 1881.—(*Not proceeded with.*) 2*d.*

One way is to make the clasp or fastening of wire bent spirally and fixing to one end thereof one of the plates that are attached to the book, the other end being so formed as to clasp the other cover of the book, thus forming an expanding clasp.

3757. Opening and Closing the Doors of Hansom Cabs, &c., *H. Benest, Bow.*—*29th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the employment of springs and a chain or rod within reach of the driver.

3759. Ships' Berths, *W. R. Lake, London.*—*29th August*, 1881.—(*A communication from A. M. Crosby, U.S.*)—(*Not proceeded with.*) 2*d.*

This relates to a self-levelling berth or other structure for ships.

3761. Fittings for Excluding Draught, *R. W. Newlands, Hammersmith.*—*29th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the employment of india-rubber fitted in a suitable manner.

3762. Autographic Transfer for Lithographic and Zincographic Ppinting, *A. M. Clark, London.*—*29th August*, 1881.—(*A communication from J. J. Magne, Paris.*) 4*d.*

This consists essentially in writing and drawing on an unprepared surface with a crayon having the property of retaining fatty ink; then moistening the paper so written or drawn upon with a liquid having a repellent action for such fatty ink, and consequently a protective action for the blank portions of the paper; and finally inking up the writing or drawing, which is then transferred to stone or zinc.

3763. Driving Velocipedes, *J. K. Starley, Coventry.*—*30th August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to means for decreasing the speed and obtaining greater propelling power when mounting hills, and it consists in mounting loosely on the wheel axle a chain wheel carrying a double toothed pinion, the upper teeth gearing with a bevel wheel on the hub of the driving wheel, and the lower teeth capable of being geared at will with a smaller bevel wheel mounted on a spindle and sliding on a feather moved by a clutch and lever.

3764. Velocipedes, *J. K. Starley, Coventry.*—*30th August*, 1881.—(*Not proceeded with.*) 2*d.*

This consists, First, in forming a chain wheel of two discs with rollers mounted between them, so as to form the teeth; Secondly, to means for shifting the saddle by a lever; and Thirdly, to differential or hill-climbing gear, and which consists in forming an internal toothed wheel on the driving wheel hub; and on the chain wheel, which is loose on the spindle, is fixed a pinion gearing with the internal wheel and with another wheel fastened on the spindle, so that it may be brought into gear with a pinion on an upright shaft.

3765. Preserving and Treating Cotton Seed, *F. R. Lanier, Memphis, U.S.*—*30th August*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in packing the cotton seed in oil-tight packages, and filling up the spaces between the seeds with cotton-seed oil, and also in subjecting the mass preserved as described to hydraulic pressure, and usually with heat to extract the oil and obtain a sweet and wholesome oil and feeding cake.

3766. Preventing the Waste of Water, *W. H. Cutler and J. Chapman, Exton.*)—*30th August*, 1881. 6*d.*

A cistern is formed with a partition so as to provide an inner chamber, and in it is a valve opening inwards. An air compressor or bellows is actuated by the ordinary pull and forces air into the inner chamber, which air, acting on the water therein, forces it through a syphon tube, and so to the place to be flushed.

3769. Propelling Velocipedes, *E. A. Smyth, London.*—*30th August*, 1881.—(*Not proceeded with.*) 2*d.*

A straight rack with a pedal is moved by foot and acts upon a wheel concentric with the driving-wheel, which it actuates through a ratchet and pawl.

3779. Apparatus for the Conversion of Animal Energy and Gravitation into Rotary Motion, *A. B. Joy, Ilkley, Yorks.*—*30th August*, 1881.—(*Not proceeded with.*) 2*d.*

On the shaft to be driven are mounted two pinions,

having sliding catch boxes at each side, which are kept in gear by springs. With each pinion gears a sliding rack, on to the ends of which the weight of the driver is alternately brought to bear.

3781. Compounds for Hardening, Softening, Tempering, and Improving the Quality of Steel, &c., *C. D. Abel, London.*—30*th August*, 1881.—(*A communication from F. Hanswirth and Kupfer, Zurich.*)—(*Not proceeded with.*) 2*d.*

This relates to various compounds for treating steel, that to be employed for imparting to steel great toughness and to improve its quality, consisting of 200 parts resin, 120 parts liver oil, 60 parts sheep's tallow, 30 parts paraffine, 40 parts colophonium, 20 parts yellow prussiate of potash, 10 parts chromate of potash, 10 parts refined borax, 15 parts powdered ox's hoof, 15 parts tartaric acid, 10 parts alum, 10 parts soft soap, 20 parts charcoal powder from lime tree wood, 15 parts burnt ivory, 5 parts dry cooking salt, 10 parts gum arabic, 5 parts aloe powder, and 5 parts gentian powder, the whole being mixed and boiled together for an hour.

3784. Shedding Apparatus for Looms, *E. Grube, Bury.*—31*st August*, 1881.—(*Not proceeded with.*) 2*d.*

To actuate a heald a jack or lever is acted upon by a bowl, carried by a vibrating lever, the bowl acting on inclines or curves on the jacks and on a switch, which is shifted by means of a pattern chain or wheel.

3785. Obtaining Products from Blast Furnace and other Combustible Gases, &c., *J. Alexander and A. K. McCosh, Lanark.*—31*st August*, 1881. 6*d.*

This relates to improvements on patents No. 4117, A.D. 1879, and 1433, A.D. 1880, and it consists in leading the gases from the blast furnace or other source into condensing or separating apparatus of the kind described in the last-named patent, but made principally of wrought iron, and the water boxes connected by pipes led from the tops of the lower boxes to the highest parts of the upper boxes, the object being to prevent heated water from remaining in the tops of the upper boxes. From the condensing apparatus the gas passes to scrubbers made of rectangular section in plan, the gas entering in a broad equal stream by an inlet extending along one side, and passes in a similar stream from each space to the next one, between inclined perforated diaphragms of metal. Steam is introduced into the scrubber so as to clean the diaphragms when necessary.

3787. Velocipedes, *H. Wilkinson, Stamford Hill.*—31*st August*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to means for regulating the speed and power as required, and consists of a double clutch arrangement to throw either one or other of the two sets of driving gear into action.

3788. Ink-stands, &c., *J. S. Downing, Birmingham.*—31*st August*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in the application of india-rubber or other yielding material to the underside of the ink-stand or other article, so as to afford a better hold to the place on which it stands.

3794. Dyeing and Printing Textile Fabrics, &c., *J. Wolff, Salford.*—31*st August*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to dye wool in the hot state, or cotton in the cold, in all shades of indigo, and to effect this an alkaline bath is prepared, and to it a metallic acid or a peroxide is added, and also indigo reduced to a fine powder, subsequently any suitable reducing agent, such as finely divided iron or zinc, is introduced, and the mixture either heated or used at the ordinary temperature.

3800. Steam Boilers, *J. R. Oldham, Sunderland.*—1*st September*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to boilers in which return tubes or flues are formed in the bottom or lower portion of the boiler, or sometimes under the boiler, and it consists in forming the boiler with side furnaces only, the centre and lower portion being devoted to the return tubes or flues, and from the furnaces nests of tubes or flues are led to the back of the boiler.

3802. Stands for Bottles, &c., *G. F. Rendall, London.*—1*st September*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to means for locking the bottles in position by means of a hinged crossbar fixed to the stand.

3803. Sewing Machines, *W. R. Lake, London.*—1*st September*, 1881.—(*A communication from H. Bond, Massachusetts, U.S.*)—(*Not proceeded with.*) 4*d.*

This relates to machines with duplicate sets of stitch-forming mechanism to form two parallel rows of stitching simultaneously at an adjustable distance apart, and the object is to guide the work accurately during the operation of attaching an inside covering stay.

3806. Rotary Grain Meters, *A. J. Boult, London.* 1*st September*, 1881.—(*A communication from A. Gleason, Ohio, U.S.*)—(*Not proceeded with.*) 2*d.*

This consists essentially of a cylindrical bucket wheel divided into three equal compartments by radial partitions terminating in narrow hinged end wings, such wheel being journalled in a frame carrying the scale beam, which is pivotted upon the main frame by knife edge pivots on which the scale beam balances.

3810. Moulding Bricks, *T. Le Poidevin, Guernsey.*——1*st September*, 1881.—(*Not proceeded with.*) 2*d.*

A mould frame containing a number of brick moulds is laid upon a cement hack formed of a layer of concrete covered with cement, and the mass of clay is placed on the frame and forced into the moulds by means of a heavy roller and a scraper.

3814. Loom-pickers, &c., *E. K. Dutton and J. Holding, Manchester.*—2*nd September*, 1881.—(*Not proceeded with.*) 2*d.*

The pickers are made of wood of T or Γ-shape the horizontal limb being bored to slide upon the spindle, and the strap is secured in a jaw fixed to the top or back of the picker, a packing of leather being provided to receive the blow of the shuttle.

3816. Condenser and Feed-water Heater, *L. McIntyre, Glasgow.*—2*nd September*, 1881.—(*Not proceeded with.*) 2*d.*

The condenser is especially applicable to steam launches, lighters, &c., and it consists of a vessel containing a tube of large diameter, so as to leave an annular space through which the steam flows, while the water from the sea, river, or canal is pumped through the inner tube.

3818. Index Scales, *J. C. Mewburn, London.*—2*nd September*, 1881.—(*A communication from J. Post, Hamburg.*)—(*Not proceeded with.*) 2*d.*

This relates, First, to index scales, in which a finger indicates on a plate the weight of the article, and it consists in making the index-plate straight instead of curved; and Secondly, to the pendant frames of such scales, and on which removable weights are kept, and it consists in marking on the frame the value of such weights, so as to readily see what weights are removed.

3819. Metal Kegs or Vessels for Containing Paint, &c., *J. Storer, Glasgow.*—2*nd September*, 1881. —(*Not proceeded with.*) 2*d.*

The object is to construct kegs for conveying paints, &c., by land or sea, and which when opened will form conveniently handled cans or pots for painters' use.

3823. Preserving and Transporting Eggs, *J. Wetter, New Wandsworth.*—2*nd September*, 1881.—(*A communication from A. Cruveiller, Paris.*)—(*Not proceeded with.*) 2*d.*

To destroy or neutralise the minute organic germs which may have penetrated the shell, the eggs are treated with a solution of 100 parts pure boracic acid and 3 parts distilled water; and to prevent the further penetration of organic germs they are coated with a mixture consisting of 100 parts potassium silicate, 100 parts distilled water, and 10 parts chalk.

3825. Bale Ties or Bale Fastenings, *W. C. Stiff, Birmingham.*—2*nd September*, 1881.—(*Not proceeded with.*) 2*d.*

A piece of iron rod is bent at about one-third of its length so as to bring the two parts parallel to and at a short distance from one another, the long part being then bent at right angles at about the middle, and the bent part arched into a semicircle over the short part. The arched part is concentric with the short part over which it is situated, there being sufficient distance between it and the short part to permit of a loop on one end of the bale band or strip of hoop iron to pass on to the short part.

3830. Preparation of Tea, *J. P. Brougham, Inverness.*—2*nd September*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to a machine for rolling, curling, or otherwise preparing tea-leaves in an expeditious and efficient manner.

3835. Planing and Finishing Wood, &c., *J. M. Wilson, Lancaster.*—3*rd September*, 1881.—(*Not proceeded with.*) 2*d.*

Knives or cutters are mounted on a shaft and driven by pulley and band either by hand or power, the frame being fitted with handles by means of which the machine is guided over the work.

3836. Condensing Steam, Heating Feed-water, &c., *L. McIntyre, Glasgow.*—3*rd September*, 1881.—(*Not proceeded with.*) 2*d.*

The feed-water is made to issue from an annular passage formed by two nozzles, and comes in contact with the steam to be condensed, the steam being conveyed to the nozzles by a casing surrounding the same.

3837. Portable Cranes or Hoists, *J. Wetter, New Wandsworth.*—3*rd September*, 1881.—(*A communication from J. J. Hardouin, France.*)—(*Not proceeded with.*) 2*d.*

This consists chiefly of an inclined stand in the shape of a ladder and carrying the winding mechanism, and of a horizontal beam secured to the latter, so that its height may be varied as required, and from which the load is suspended.

3838. Ratchet Braces, *C. Neil, Sheffield.*—3*rd September*, 1881. 4*d.*

The frame or fork part and the handle are made in two pieces, the former having a hole to receive the handle which is secured by a pin, and projects through the hole so as to form a means of attachment and abutment for the pawl.

3840. Protecting Locomotive Engines and Trains from Damage by Collision, *C. Colwell, Southtown.*—3*rd September*, 1881.—(*Not proceeded with.*) 2*d.*

This consists of an under carriage connected to the locomotive and carrying two or more sets of cylinders communicating by pipes, and each cylinder containing a piston the rod of which is connected to the engine buffer. The cylinders contain water, and the upper cylinders of each set are provided with compressed air holders.

3841. Mincing Meat, &c., *F. J. Gardner, Birmingham.*—3*rd September*, 1881. 6*d.*

The bowl containing the meat is rotated by a worm capable of sliding on its shaft, so as to disengage it from the worm wheel on the bowl. The bearings of the knife spindle are placed on the front and back parts of the framing.

3843. Metal Bedsteads, *R. Peyton, West Hampstead.*—3*rd September*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the joints in the parts of metal bedsteads and to means for tightening up the iron lath bottoms.

3844. Salts of Magnesia and Salts of Zinc, *A. M. Clark, London.*—3*rd September*, 1881.—(*A communication from A. Lanquetin, Paris.*) 4*d.*

This relates to the manufacture of chloride of magnesium with dolomite and chloride of calcium. If oxide of zinc, carbonate of zinc, or calamine be operated upon, a salt of zinc and chloride of calcium will be obtained.

3846. Salts of Soda and Magnesia, *A. M. Clark, London.*—3*rd September*, 1881.—(*A communication from A. Lanquetin, Paris.*)—(*Not proceeded with.*) 2*d.*

This consists in the production of carbonate of soda and chloride of magnesium by means of chloride of sodium and carbonate of magnesia.

3847. Bottles or Receptacles for Aerated and other Liquids, &c., *W. N. Wilkinson and I. W. Lister, Oldham.*—5*th September*, 1881.—(*Not proceeded with.*) 2*d.*

Bottles with internal stoppers are formed with a globular-shaped neck to receive a spherical ball with passages through it, so that when partly turned a passage is opened for the gas or the liquid.

3849. Nose-bags for Horses, &c., *J. Archibald, Kensington.*—5*th September*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to prevent loss of grain when the bag is tossed upwards by the horse, and it consists in securing a ring of india-rubber or other suitable material round the top of the inside of the bag, a hole being left in the centre for the passage of the horse's mouth.

3850. Preparing Colouring Matters Suitable for Dyeing and Printing, *J. H. Johnson, London.*—5*th September*, 1881. —(*A communication from Badische Anilin and Soda Fabrik, Germany.*)—(*Not proceeded with.*) 2*d.*

This relates to the conversion of cœruleine into a new soluble compound of the said colouring matter by means of and together with the bisulphites of the alkalies.

3851. Detaching or Disengaging Ships' Boats, *S. Pettit, Windsor.*—5*th September*, 1881.—(*Not proceeded with.*) 2*d.*

Between the lines that carry the boat a tube is fitted horizontally, and in it work two bolts, one end of which passes through a fork fixed to each of the suspending lines so as to hold the shackles connected to the bolt. The bolts are actuated in the tube by a compound lever so as to simultaneously withdraw them from the fork pieces.

3853. Globe Holders for Gas and other Burners, *J. Chatwin and H. Shipway, Warwick.*—5*th September*, 1881.—(*Not proceeded with.*) 2*d.*

The holder has two arms formed as usual while the third arm, in place of an external screw to take over the rim of globe, is fitted with an internal button, screw hook, or excentric which bears on the inside of the globe.

3855. Lubricants, *W. J. L. Hollis, Surrey.*—5*th September*, 1881. 2*d.*

This consists of Russian tallow, castor oil, in combination with other vegetable oils, and mineral oil, soda and silicate of soda, the proportions varying according to the degree of heat to which the lubricant will be subjected when in use.

3944. Improvements in Telephones, in Part Applicable to other Electric Apparatus, *W. E. Irish, Sunderland.*—12*th September*, 1881. 6*d.*

The improvement consists in winding the wire in continuous convulutions around both poles of the magnet and the intervening space as though there were but one pole, so that when a current is sent both poles are utilised for reproducing the sounds transmitted. The inventor also uses two diaphragms, one in the usual position and the other at the opposite end of the magnet, that is, between it and the part of the case to which it is secured.

4032. Sewing Machines, *C. A. Snow, Washington, U.S.*—19*th September*, 1881.—(*A communication from F. G. Altman and F. Pommer, Missouri, U.S.*)—(*Complete.*) 6*d.*

This relates to a device for threading sewing machine needles, and which forms part of the machine, and it consists of a conical tube attached to a spring arm, and having a groove at its smaller end for the passage of the needle, the arm being actuated by a lever, so as to bring the tube opposite the eye of the needle, in which position it is held while the thread is passed into the larger end of the threading tube and is guided through the eye of the needle.

4046. Heating Apparatus, *H. Defty and C. C. Braithwaite, London.*—20*th September*, 1881.—(*Complete.*) 4*d.*

This relates to a condenser consisting of an arrangement of tubes placed transversely in a chamber, so that air, water, or other fluid passing through them shall become heated by absorbing the heat of the products of combustion from a fire placed beneath the tubes, and which circulate around such tubes.

5579. Removing Iron from Ferruginous Aluminous Solutions, and Recovering or Purifying Waste or Spent Plumbic Dioxide Containing Iron, *C. Semper and C. Fahlberg, Philadelphia, U.S.*—20*th December*, 1881.—(*Complete.*) 4*d.*

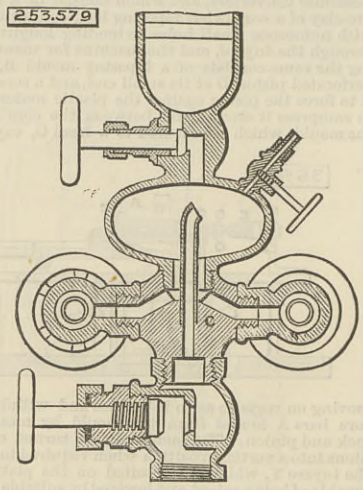
This consists, First, in treating ferruginous solutions with plumbic dioxide for the precipitation therefrom of iron, as plumbate of iron; Secondly, in treating ferruginous aluminous solutions with plumbic dioxide in order to obtain sulphate of alumina or aluminous cake, free, or almost free, from iron; and. Thirdly, in treating the spent plumbic dioxide and, ferric plumbate resulting from the operation of precipitating iron from ferruginous solution with nitric or other acid, or acid salt, to remove the iron therefrom.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

253,579. Oiler for Locomotives, *Alva O. Brooks and Philip A. Bowen, Milwaukee, U.S.*—*Filed October 1st*, 1881.

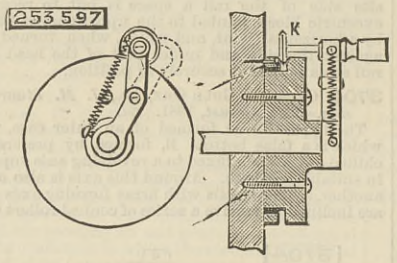
Claim.—The combination of oil cup, reservoir having



vent, the valve chamber C, steam inlet and oil outlet, and valves or stop cocks, as set forth.

253,597. Telephone Signal Generator, *James F. Gilliland, Indianapolis, Ind., assignor to the Gilliland Electric Manufacturing Company, same place.*—*Filed January 3rd*, 1881.

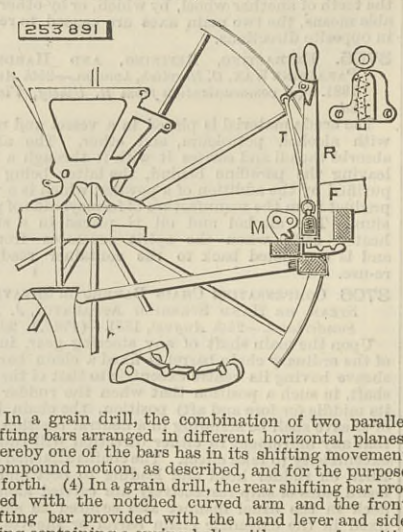
Claim.—(1) The combination of two insulated contact plates, with an extensible spring-retracted crank carrying a contact plug, substantially as specified. (2) The combination, in a magneto-electric machine, of a crank consisting of arms pivotted together, a contact piece carried by the outer arm, and a retrac-



tible spring, whereby the shunt circuit is closed when the crank is at rest and opened and held open automatically when power is applied to turn the crank. (3) The combination of an extensible spring-retracted crank with metallic disc K, and insulated contact plates so placed as to form a groove in which said disc is held by the spring when the crank is at rest, so as to close the shunt circuit around the armature, said disc, when power is applied to the crank, being lifted from the groove, so as to open and hold open the shunt.

253,891. Grain Drill, *George W. Rude, John R. Rude, and Squire B. Rude, Liberty, Ind.*—*Filed September 9th*, 1881.

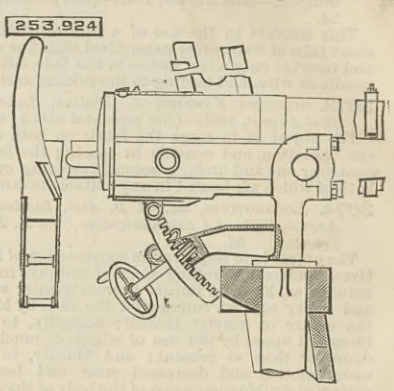
Claim.—(1) In a grain drill, a shifting bar having attached thereto directly an operating lever arranged at the front end of the frame and means for actuating a spring bolt, in combination with a parallel transverse shifting bar provided with a rack to receive the spring bolt of the lever, substantially as described. (2) In a grain drill, the combination of the two parallel shifting bars, one of which is provided with a curved bar having a plurality of notches, and the other provided with a hand lever and an automatic spring bolt for engaging with the notches of the curved bar to secure a lock, substantially as described.



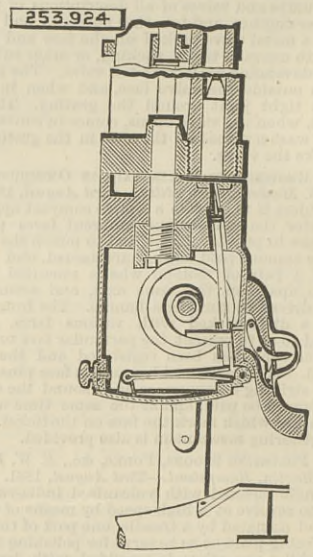
(3) In a grain drill, the combination of two parallel shifting bars arranged in different horizontal planes, whereby one of the bars has in its shifting movement a compound motion, as described, and for the purpose set forth. (4) In a grain drill, the rear shifting bar provided with the notched curved arm and the front shifting bar provided with the hand lever and side casing containing a spring bolt, with means for withdrawing the bolt from its engagement, substantially in the manner as described. (5) In a grain drill, the combination, with the operating lever R, of the bell crank lever M, connecting-rod T, and spring bolt F, inclosed in a casing, substantially as described.

253,924. Machine Guns, *Benjamin B. Hotchkiss, New York, N.Y.*—*Filed March 2nd*, 1881.

Brief.—A trigger serves to stop the loading



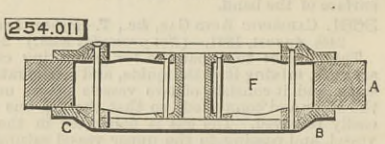
mechanism at a point just short of firing position. A pull of the trigger completes the movement and fires the gun, or the trigger may be thrown out of



connection and the gun operated entirely by the crank. The elevating gear may serve as an auxiliary to the shoulder piece in training the gun, or may be thrown out of gear and the gun manipulated entirely by means of the shoulder piece.

254,011. Elastic Centre Emery Grinding and Polishing Wheel, *Martin Hofstad, San Leandro, Cal.*—*Filed August 3rd*, 1880.

Claim.—(1) A combined grinding and polishing wheel consisting of a central hub, a polishing disc, a removable grinding rim, and means, substantially as described, for securing the polishing disc upon the hub and the grinding rim upon the polishing disc. (2) The combination, with the flanged hub, the clamping



rings C, and the yielding or elastic centre F, of the outer removable clamping rings B, and the detachable grinding rim A. (3) The combined grinding and polishing wheel composed of the outer rim A, the outer clamping rings or flanges B, the inner clamping rings C, the yielding centre, and the hub having fixed and loose flanges, all substantially as described.

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To Prevent Wood from Cracking.—Place the wood in a bath of fused paraffine heated to 212 deg. Fah., and allow it to remain as long as bubbles of air are given off. Then allow the paraffine to cool down to its point of congelation, and remove the wood and wipe off the adhering wax. Wood treated in this way is not likely to crack.