THE ELECTRIC LIGHTING ACT.

The inventions and improvements of the last five years in the applications of electricity seem to foreshadow a new branch of industrial manufacture, and to open a new field of labour to the engineer. Although legislation has learned to avoid sumptuary and other similar laws, it has yet to learn that economic science does really point out certain directions in which legislation should be avoided. The one great incentive to legislation now is "exigency." That is a word to conjure with, and, like other evils, at times proves a blessing in disguise. At times "exigency" extends too far, at others it contracts legislative powers, and we think that if the real evidence from various sources could be obtained, the Electric Lighting Act of the past session would be found to be an honest endeavour to hit a mean, safe path, and to avoid extreme measures.

The report of the Select Committee, dated 13th June, 1879, recommends that "if corporations and other local authorities have not power under existing statutes to take up streets and lay wires for street lighting, or other public uses for the electric light, ample power should be given them for this purpose." Further that "gas companies have no special claims to be considered as the future distributors of electric light," and that the committee "do not consider that the time has yet arrived to give general powers to private electric companies to break up the streets unless by consent of the local authorities." This committee collected a vast amount of valuable scientific information, but at the same time the minutes are increased in length by the examination of men who have no claims to a knowledge of electrical matter—men who have been connected with a number of different companies and done more harm to electric lighting proper than can be easily explained. The evidence given by such men as Thomson, Tyndall, Siemens, and Hopkinson, has already become classic, inasmuch as it showed the opinions of the highest scientific culture of 1879 upon the position and probable future of the electric light. We insist upon its value, although in most cases the conclusions were erroneous—being drawn without a knowledge of the wonderful progress which took place during the immediately following years. This Select Committee paved the way for a greater interest in the Paris Electrical Exhibition, and subsequently that at the Crystal Palace. Public opinion favoured legislation somewhat on the lines of the Select Committee, and last session the Electric Lighting Act was passed. This Act permits the Board of Trade from time to time to *license* any local authority, as defined by the Act, or any company, or person, to supply electricity for public or private purposes, subject to certain conditions, such, *e.g.*, as (1) the consent of the local authority; (2) the limitation of time of license to seven years, &c. The Board of Trade may from time to time authorise by *provisional order* any local authority, company, or person, to supply electricity without requiring such consents as are required to the granting of a license, but such order is only granted on complying with certain conditions, such, *e.g.*, as (1) giving due notice of intention to apply for provisional order; (2) having the order *confirmed by Act of Parliament*, &c. Provision is made in the Act to enable the Board of Trade to rescind, alter, or repeal rules in relation to the application for licences or provisional orders. An important clause in the Act, viz., Sect. 6, states that "The undertakers shall be subject to such regulations and conditions as may be inserted in any license, order, or special Act affecting their undertaking with regard to the following matters:—(*a*) The limits within which, and the conditions under which a supply of electricity is to be compulsory or permissive; (*b*) the securing a regular and effective supply; (*c*) the securing the safety of the public from personal injury or from fire or otherwise; (*d*) the limitation of the prices to be charged in respect of the supply of electricity; (*e*) the authorising inspection and inquiry from time to time by the Board of Trade and the local authority; (*f*) the enforcement of the due performance of the duties of the undertakers in relation to the supply of electricity by the imposition of penalties or otherwise, and the revocation of the licence, order, or special act when the undertakers have, in the opinion of the Board of Trade, practically failed to carry the powers granted to them into effect within a reasonable time, or discontinued the exercise of such powers; and (*g*) generally with regard to matters in connection with the undertakings;" and so on.

The Board of Trade has drawn up a set of rules for the guidance of those seeking licences or provisional orders. These rules relate of course more to formalities than to principles, except perhaps as to the principle of publicity, which is insisted upon. Advertisements giving notice of intention to apply to the Board of Trade for licenses or orders have to be inserted in certain papers, and each applicant must supply a sufficient number of printed copies of such draft orders, &c., so that copies of each draft order may be obtained by the public at a cost of not more than one shilling per copy. The time after which no application was received, and the time for the deposit, &c., of the draft orders, in compliance with the Act and rules for this year, has passed, and the draft orders are obtainable on application. Great interest must necessarily be excited in the first of these draft orders. It is a step in a new direction, and there is little or nothing to guide the draftsman. Several of the companies are to be congratulated in having obtained the services of one of the ablest members of the legal profession to draft their orders. The draft orders of these applicants are similar in construction, differing, indeed, only in the details relating to the position of the prospective work and the company. A careful study of one of the draft provisional orders is conclusive as to the care and anxiety spent upon it to comply with the spirit of the Act, and to be just at once to the public and undertakers. Many of the clauses of such provisional order must necessarily refer to technical details, and certain expressions will, if the orders meet with the approval of Parliament, become common and stamped into the every-day vocabulary of electric lighting. The draft provisional order has to give the description of the area of supply, the powers of the undertakers, the purposes of the supply, the nature and mode of supply, the conditions of supply, compulsory supply, price, measurement, provisions as to testing mains, &c., as to testing supply, pains and penalties, regulations as to safety, and so on. The task to describe the above in good legal phraseology is by no means easy; yet we think it has been done satisfactorily.

Our attention has been directed to a fact which, so far as we are aware, has not previously been noticed by the press, that this is the first Act to legalise the distribution of energy—a something not matter. We have thus far expressed a general opinion on this subject, and must relegate minute criticism to a further opportunity, and till after the various clauses in the draft order have been given fully or in abstract.

The general powers to be taken under this order are—(1) The authority to supply electricity within a given area; (2) to manufacture, let, sell, supply, erect, and maintain the apparatus for such, and in connection with such supply; (3) to take up streets, obtain and dispose of works, &c. The supply of the electricity is to be—

(1) By the "direct system." This is technically known as the multiple arc system. The section describing this system defines certain conductors as "service lines" and "distributing mains." Thus: "The branch conductors leading from such mains to the consumer's premises are herein termed 'service lines,' and the portions of such mains which are used for the purpose of giving origin to service lines are herein termed 'distributing mains.'"

(2) By the "storage system." In this system storage is to be used, the reservoirs for such storage to be upon the premises and in the charge of the undertakers, and not in the charge of the consumers. The reservoirs can be filled, *viâ* charging mains, either by the direct or series system, continuously or intermittently, as is found desirable.

(3) By either or a combination of the above systems, with earth returns in lieu of a continuous metallic circuit.

(4) By the "series system," or a system under which one consumer is not independent of another consumer, as he is in the direct system.

The distribution is not restricted to these methods, but may be by any method by agreement.

The following section is so important as to require to be given in full:—"The supply of electricity upon any premises shall (except by agreement or as herein otherwise provided) be given at two poles situated thereon at a safe and convenient distance from one another in connection respectively with the positive and negative mains—or with the main and the earth as the case may be—and the undertakers shall not, otherwise than by agreement, incur any liability, or be in any way responsible as to the fittings, conductors, or arrangements within the consumer's premises, whether for the utilisation of the electricity supplied or otherwise, but their liability shall only extend to securing that the two poles are in a fit and proper condition, and that a proper and efficient supply can be derived therefrom."

This is analogous to the undertaking to supply, say, a certain pressure of water to a certain tap in a certain position, the consumer taking the water from the tap in a manner and direction to suit his own convenience. In order that the mains when once laid should not be disturbed, provision is made for distributing and testing-boxes at intervals. From these boxes "service lines" radiate, and tests of any or all of the lines from one such box can be made at the box without disturbing street or householder.

A recent deputation to Mr. Chamberlain learned that the Act was not to be a dead letter, and that if a provisional order was obtained it was to be acted upon. The sections relating to conditions of supply then are of importance. Either the distribution of electricity will be profitable commercially or unprofitable. If the latter, the public will not support the undertakings with capital, and the whole fabric of electric lighting will melt into thin air. No doubt the idea of many people is to let someone try and succeed or fail; then, if success is met with, to step in and grasp the profits. This is the wisdom of the world. The conditions under which success or failure will occur are somewhat as follows:—The undertakers apply for an order for a district. This district is divided into sections, more fully described in the schedules attached to the draft. The undertakers shall lay and maintain mains such as the system of supply determined on requires in a certain district, shall supply street lamps by the "series" or other system at a price to be agreed upon or fixed by arbitration, so that a fair profit is obtained; they may also lay down mains, &c., in the other sections. If within three years mains, &c., have not been laid in these latter sections, the Board of Trade may "call upon them to lay down and maintain such mains, &c.," provided they are not called upon to do work where loss is certain. The manner and method in which the action of the Board of Trade takes place is clearly defined. Due notice must be given, and upon non-agreement an arbitrator may be appealed to. In order to obviate the disadvantage that might arise to the public by an undertaker putting into the schedule a number of streets, lanes, &c., on purpose to make the optional district non-profitable, the Board of Trade has power to strike out from any section of the schedule "any streets or parts of streets that they may consider it advisable not to include or retain therein."

The supply may be constant or intermittent; it is, however, to be always with an agreed upon difference of potential between the mains at given points. The difference of potential may be different for different points and for different hours; 10 per cent. is the maximum variation of difference of potential to be allowed. "The resistance of the service lines by which the supply is given to any consumer shall not, except by agreement, be greater than would cause the difference of potential at the positive and negative poles in any consumer's premises to be less than the corresponding difference of potential at the point of junction of the mains and the service lines by which he is supplied, by more than $2\frac{1}{2}$ per cent. of the corresponding standard pressure when the maximum current is passing through such service lines." The case of alternate currents is provided for, as is the time for testing, also when supply ceases, as for example, it may in some business districts for a certain time on Sundays and holidays, "unless from the state of the weather it may be reasonable to provide artificial lighting." With regard to compulsory supply, this is restricted to street lighting either with incandescent or arc lamps, and to occupiers of premises "situate within 50ft. from any distributing main." In case the maximum current which a consumer may require seems to be greater than the premises reasonably require, the supply may be declined unless he satisfies the undertakers that he really requires such a current. If the maximum current exceeds fifty Ampères the supply may be delivered at more than one pair of poles, so that the maximum current at each pair of poles does not exceed fifty Ampères.

The charge for the supply is to be determined by any of the five following methods—if otherwise, then by agreement:—(1) By the quantity of energy contained in the supply; (2) by the actual quantity of electricity supplied; (3) by the number of hours the consumer is supplied; (4) by a yearly rent depending on the maximum current required; (5) by a rent depending partly on quantity and partly on maximum current supplied. If the charge is by any other method than quantity supplied the consumer is not to store the energy supplied. Approved meters will be used, and be paid for or rented as are gas meters; such meters to be under the control of the undertakers, to be tested, and it may be compared with, meters, &c., erected for the purpose by the local authorities.

The regulations for safety are briefly as follows:—(*a*) The current through any distributing main or service line shall not exceed 2000 Ampères per square inch of section of a pure copper wire of equal conductivity; (*b*) the insulation of all distributing mains or service lines shall be such that the leakage is not more than 10 Ampères per mile run; (*c*) (*d*) (*e*) (*f*) (*g*) (*h*) and (*i*) state that the mains are to be waterproof, and protected from injury, that the supply can be turned off outside a building, safety fusible plugs shall be used in the service lines which cut off the supply when the current exceeds by more than 100 per cent. the maximum current which such service lines is intended to supply, the terminals shall be of approved pattern and not less than 3in. apart, the earth contact when used shall be good, the difference of potential between the two conductors of the distributing main is never to be more than 300 volts, that in any charging main is not to exceed 4000 volts.

In the case of arc lighting in series, special arrangements, subject to the approval of the Board of Trade, can be made; and whilst the undertakers supply under settled conditions, the consumers must also use under given conditions. The conductors they use must be such that the current does not exceed 2000 Ampères per square inch of section of a pure copper wire of equal conductivity; it must not be naked and unprotected; if laid along or within 6in. of walls, ceilings, &c., it must be waterproof, and have an external fireproof coating also, insulated so that it has a "minimum insulation for the whole building of not less than 5000 ohms per volt in the standard pressure at the junction of the mains and service lines by which the building is supplied."

The conductors shall be 1in. or more apart. No portion of the circuit is to be put to earth by the consumer, and in the cases where earth returns are used, not put to earth except by being connected to the earth pole provided by the undertakers.

The penalties attached to the breaking or non-compliance with the rules vary from simple pecuniary fines to exclusion from the district.

We have dealt with the provisional order more from the standpoint of considering its contents so far as they concern the engineering part of the question, because in such details it must necessarily present new features. With the schedules, except Shedule C, we have nothing to do; A and B simply detail districts and streets in such districts, but C gives definitions and maximum prices. It must be remembered, however, that although X, Y, or Z takes power to charge a maximum price, that price is not necessarily the price he will charge. We give Schedule C in full, because of its importance.

"The term unit, as used in Schedule C, shall be deemed to mean the energy contained in a current of one thousand Ampères flowing under an electro-motive force of one volt during one hour.

Section I.—In case the undertakers shall elect to charge any consumer by the quantity of energy contained in the supply given him, they shall be entitled to charge him at the following rates per quarter of a year:—For any quantity up to one hundred units, three pounds fifteen shillings; and for each unit over one hundred units, ninepence per unit.

Section II.—In case the undertakers shall elect to charge any consumer by the actual quantity of electricity supplied to him, they shall be entitled to charge him according to the rates set forth in Section I. of this Schedule; the quantity of energy contained in the supply given to him being taken to be the product of the actual quantity of electricity supplied to him, and the standard pressure at the point of junction of the mains and the service lines by which he is supplied.

Section III.—In case the undertakers shall elect to charge the consumer by the number of hours during which he shall actually use his supply, they shall be entitled to charge him at the rates specified in Section II. of this Schedule; the quantity of electricity supplied to him being calculated on the supposition that the consumer uses the maximum current specified by him under the provisions of Section 27 during all the hours that he has used the supply.

Section IV.—In case the undertakers shall elect to charge the consumer a sum by way of yearly or other rental, they shall be entitled to charge him the rates specified in Section III. of this Schedule; the number of hours during which he has taken the supply being taken to be *three-fourths* of the number of hours during which the supply was continued during the period to which such rental relates.

Section V.—In case the undertakers shall elect to charge

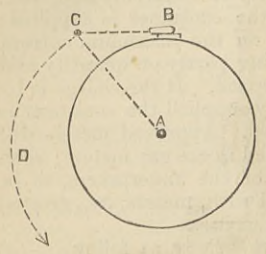
the consumer by the method set forth in Section 34, Subsection (5), they shall be entitled to charge as follows:—At the rate of thirty shillings per annum for every Ampère in the maximum current, in case the supply is given at a standard pressure of not more than 100 volts, and at a price higher in proportion to the standard pressure, in case such pressure is more than 100 volts, and in addition thereto, a charge of sevenpence halfpenny for every unit actually used."

LETTERS TO THE EDITOR.

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

THE LAWS OF MOTION.

Sir,—Will some of your mathematical readers solve the following problem for me:—Let A in the accompanying engraving be the earth, let B be a gun, and C a ball projected from it; let the dotted line represent the influence of gravity on the shot C. Now, it is stated in text-books that if the shot had momentum enough it would be driven to a point where gravity would exactly balance momentum, and the shot would then revolve for ever round A, the centrifugal force precisely balancing the pull of gravitation. But it appears to me that the shot could never get beyond the range of gravity, and would fall into the moon or some of the planets, or even the sun, if it got away from the earth. It is admitted that this would take place if the shot was thrown upwards; I want to know why it will not do so if the shot is projected at a tangent to the earth's circumference.



For both statements, in a slightly different form, I would refer your readers to Professor Huxley's little work dealing with the laws of motion, and not long published. F. Dare.

December 18th.

BOILER FUEL ECONOMISERS.

Sir,—I notice in The Engineer of December 8th inst. an account of a paper read by Mr. W. E. Mills, before the Liverpool Engineering Society, called "Notes on the Mallett System of Controlled Combustion," which gives a short description of an invention by Mr. Mallett for burning the smoke generated in boiler furnaces. I have for some time been engaged in projecting and experimenting with a new invention in the form of an economiser for boilers, which has for its object, among other advantages, the burning of the smoke. I cannot see how Mr. Mallett burns the smoke in his invention, because my experience is that the place to burn the smoke of a furnace is in the furnace itself, because if the heat in the furnace chamber is not hot enough to burn the smoke, it is useless to try to burn it outside the furnace chamber. I should also think that Mr. Mallett's invention, from the description, would necessitate a good deal of alteration in a boiler, and of course there would have to be a new perforated septum wall every time the boiler was let down for cleaning or repairs, all of which would entail a good deal of expense. Even supposing that Mr. Mallett's invention does burn all the smoke, I do not think it would be found to save anything like forty-five per cent., because by the experiments which I have had with my own invention—which embraces a more important advantage in an economising point of view than the burning of the smoke—I find that I cannot effect a saving of much more than thirty per cent. I may say that my invention is a very much simpler one than Mr. Mallett's, insomuch that it can be applied to a boiler in less than an hour without any skilled labour and removed in the same time if necessary, and it is not fixed to the boiler in any way, nor does it require any alteration in the boiler. I do not think Mr. Mills is acquainted with my invention, as it has not been brought before the public yet, but I shall be pleased to explain it to him or anyone else who takes an interest in this subject if he will afford me an opportunity of doing so.

North Woolwich, Dec. 18th. Economiser.

BACK-LASH IN CORN MILLS.

Sir,—It is a fact well known to millwrights that the principle quoted from "Molesworth" by your correspondent, Mr. Gill, is of the utmost importance in the smooth working of millstones and the gearing in connection therewith, and I generally make the velocity of the periphery of the fly-wheel about 50 per cent. in excess of that of the periphery of the stones—that is to say, that for millstones 4ft. 4in. diameter, running 140 revolutions per minute, the velocity at periphery is=1906ft. per minute; a fly-wheel 15ft. diameter, going sixty revolutions per minute, would likely lead to good results. I say likely advisedly, for if there is a considerable number of millstones, and the fly-wheel be deficient in mass, the back-lash will not be overcome, although the velocity may be calculated on the above principle, and your correspondent is, therefore, quite right in asking, "Is it not a matter of momentum, and not alone of velocity?"

I know a case where the fly-wheel contained all the necessary surplus of velocity; still the back-lash could be heard at the remotest corner of the mill. The fly-wheel was doubled in weight without altering the velocity, and the back-lash at once disappeared. I could multiply instances of an almost similar nature, but perhaps this may be sufficient for your correspondent.

184, Buchanan-street, Glasgow, John Turnbull, Jun.

December 26th.

THE INSTITUTE OF PATENT AGENTS.

Sir,—In my letter on the above subject which appeared in your issue of the 8th inst. I propounded two questions, with the view of eliciting from some responsible member of the Institute a satisfactory definition of the functions of a patent agent; but as no gentleman connected with that body has thought fit to reply to my questions, I venture, with your permission, to answer them myself, in accordance with my ideas of the analogy existing between the duties of a patent agent and those of any other professional man.

I submit, then, that a professional man is a man who himself practices a profession. He is not like, say, a wholesale grocer, who finds capital to carry on the business, and exercises a certain amount of supervision over it, but rarely handles the commodities in which he deals; but he is a man who attends personally to the professional duties devolving upon him. The public consult him on questions in the solution of which he is supposed to be proficient, or entrust him with work requiring professional skill, and they expect that the professional opinions which he gives shall be the conclusions drawn in his own mind from the premises submitted to him, and that the work which he issues shall bear the impress of his own genius. If his opinion is the result of the operations of another mind, or the work which he turns out is executed by other hands, he is deceiving the public and forfeiting all claim upon their confidence and support.

Now, let us apply this train of thought to the particular profession under consideration—that of a patent agent. A patent agent is a man who is employed by others to professionally assist them in the obtainment and maintenance of letters patent for inventions, and to advise on the various questions arising out of letters patent for inventions. In the exercise of these functions he is required to draw specifications of inventions, although it is now plainly hinted that this branch of his duties is quite subsidiary; to prepare reports and opinions upon questions of validity and infringement, draw disclaimers, and do other important work needing combined legal and scientific knowledge and training. If, now, he does not personally discharge these responsible professional duties, but relegates their performance to others, how can he be said to practice the profession? Surely if heads of departments do the important work, it is they who are the real patent agents, rather than the principals.

It is no answer to this allegation to say that the same thing exists in other professions. There is good reason to believe that such is the case; but two or any number of wrongs do not make one right.

Much has been said about the impartiality which the promoters of the Institute have observed in inviting the co-operation of qualified practitioners with whom members of the Council were acquainted. Well, Sir, I will give you as one example a case in point:—A patent agent who numbers among his clients some of the most eminent men in the scientific world was formerly and for a number of years manager in one of the principal patent agency offices, and in that capacity discharged all the responsible professional duties devolving upon a patent agent. The principal of this establishment is an influential member of the Institute, but his former manager was not invited to join, although it is to be presumed that as the latter for years sustained the reputation of that gentleman's office, no doubt could be entertained as to his qualifications. At the same time other gentlemen have been invited, and are now, in fact, fellows of the Institute, who have been neither in practice on their own account nor in the office of one of the fellows for the respective periods stipulated in the articles of association.

These anomalies must be explained if ever the Institute is to obtain the confidence of the public. Meanwhile, intending patentees when they scan the copies of the list of fellows which it is proposed widely to circulate, will remember that the profession contains other respectable honourable men, who, on the score of efficiency, can hold their own against anyone, although they may happen not to be connected with the Institute of Patent Agents.

December 23rd. P. A.

Sir,—You have published a considerable number of letters concerning the recently constituted Institute of Patent Agents. The writers all point in the same direction; they have one and all the same object in view. Your correspondents all complain that the admission of members to the Institute is determined by something akin to favouritism; that, in a word, the new Institute is a mutual admiration society, and that thoroughly good men have been excluded because they do not fraternise with or belong to a certain clique. These are grave charges, but they are not graver than those I anticipated. Such charges are incidents which invariably attend the formation of any new club, body, society, or institute. The very fact that to belong to a select circle confers certain advantages, vexes those who are not received within the sacred precincts. Human nature has always talked as your correspondents talk. You have not published any complaints from the elected members of the Institute of Patent Agents that good men have been left out in the cold. It is only the outsiders who feel the pinch. Those inside the charmed circle hold that they are all right, and advocate stringency in the rules for electing more members. The members of the Institute do not reply to outsiders; they take no notice of them. They have got what they want, and they would not improve their position by explaining why those not elected have not been chosen members of the new Institute. *Væ victis.*

But it happens that there is a public, which is somewhat interested in the proceedings of patent agents as a body. There are, in round numbers, 5000 patents granted every year in this country alone. At the lowest estimate these average £10 each paid to patent agents for their services, and quite exclusive of office fees. This amounts to £50,000 a year. Then there are foreign patents, for obtaining which the patent agent is again paid. I do not think I shall overshoot the mark if I say this stands for £10,000 a year. Thus, then, the patent agents of Great Britain draw from the inventing members of the body politic, say, £60,000 a year. This is a very considerable sum, and it seems more considerable when we remember that any inventor who has sufficient common sense can comply with the necessary forms, pay the proper fees, and take out his own patents without any assistance from a patent agent. A patent being secured, at the end of three years £50 has to be paid to prolong it for four years. Now it is only necessary to take the patent and £50 to Somerset House, and to pay the money to a clerk, who endorses the fact that the money has been paid on the patent. Ten minutes' work; patent agent's fee, £2 2s. At the end of seven years the patentee has to pay £100. The same operation over again; patent agent's fee, £3 3s. I am quite prepared to admit that the aid of a patent agent saves a great deal of trouble, and it is, on the whole, worth while to enlist his services; but he must not imagine that he can receive £60,000 a year and escape criticism. It is argued that patent agents know how to draw up specifications and that inventors do not. This is true of some inventors and some patent agents; it is not universally true. When a specification has to be drawn with caution, it is usually considered by prudent men essential to success that a barrister be employed to settle the specification. There are patent agents who are competent to settle a specification without the aid of counsel. But I would not like to assert that this is true of every member of the profession. There are, I think, no special peculiarities about patent agents which exempt them from criticism. I recognise their utility, but I consider myself at liberty to comment on their failings.

Up to the year 1852 the number of patent agents was small, patents were few, and costly. If an agent took out one or two in a year he did well. A dozen taken out within the year would justify a young man in marrying, and perhaps keeping a brougham, with one horse. Since 1852 the number of patents taken out has enormously augmented. It began to increase at once. There was an instantaneous rush of patentees to the Patent-office as soon as the price of a patent fell from about £300 to £25. That is thirty years ago, and for thirty years the inventors of Great Britain and Ireland—not to speak of the numerous foreigners who take out patents here—have on the whole done very well without an Institute of Patent Agents. These last do not often become bankrupts; no run away with other folks' money. Take it for all in all, the profession of patent agent is eminently respectable. There may be black sheep among its members, but they are not prominent; they are unobtrusive, and are not found out. For myself I doubt their existence. I do not doubt the existence of absolutely incompetent patent agents; but this is quite another thing. After thirty years of peace and contentment, we, however, have an innovation. We have an Institute of Patent Agents, and I think it would be well that the outsiders—that is, the inventors, the men who pay the £60,000 a year or so, and thus all the Institute fees and expenses—in short, the indirect supporters of the body, should be made to understand clearly for whose benefit the new guild is being formed. Up to the present no information at all has been supplied on this subject. May I hope that the appeal which I now make for more light may elicit a response? There is only one way in which the Institute can be of any public utility, viz., by taking care that a certificate of membership is a certificate of competence. But up to the present we have no guarantee of the kind. Everyone understands how such a guild is formed. Some of the rising men of a profession get hold of the oldest members, men of renown, and urge them to form an institute. After a great deal of consideration, and bickering, and disputing, and several meetings have been held, the institute is formed. Now, there are two courses open to the founders: they can elect every one in the profession a member or associate, or they can make a selection. It is obvious that the first course will not be followed; nor is it expedient. For example, if every patent agent were a member of the Institute, what would be the good of being a member? The value of membership depends on its exclusiveness. Consequently, a choice must be made, and as there is no examination or genuine test of ability, who are or who are not to be members or associates depends on the will of a very few men; and these self-elected electors say, and with justice, "This is our institute; we started it, and we will have just who we like in it." This is the course which is invariably pursued, and the policy is generally attended with a certain amount of success. For a time no one cares one pin about the new society or institute. After a while, however, it makes itself obtrusive. Then its own younger members or outsiders arise in their might. They say plainly, "We will not have anything more to do with a sham. This institution must be reorganised;" and it is. The institution then enters on its second period of existence, and becomes of value.

The Institute of Patent Agents is now in the first stage, and to be or not to be a member of it is no proof of competence or the reverse. It may be a proof that a man has spent seven years in a patent agent's office; but I know men who have spent three times that time who could not be trusted to draw the specification for a kitchen boiler. This is the plain truth; and the plain truth in such cases is best spoken. The Institute will probably continue to exist for some time without doing directly either harm or good. At length some adventurous spirit will arise and say, "This Institute must become an examining body, and membership must be equivalent to a certificate of competence to perform the duties of a patent agent." Then, and not till then, will the Institute acquire any real dignity and importance. Whether the present Institute contains within itself the germs of success or not I cannot pretend to say. Money will certainly be wanted, and as every new member represents money, there will be a strong temptation to admit anyone who can pay the fees. Councils newly established are invariably eminently virtuous during the first year or two. Men will not be admitted even as associates who, if they will but wait a little, may find themselves in the presidential chair. Time is required to adjust matters. If prudent counsels guide the operations of the Institute it will no doubt be successful. But its original operations are certain to be crude and imperfect. As it grows older it will grow wiser. Are there really patent agents enough to keep up such an institution, candidates enough to make it worth while to appoint an examining body? Perhaps so. Meanwhile I advise those interested to turn a deaf ear to suggestions for the promotion of a rival body. There is certainly not room enough for two Institutes of Patent Agents; some persons doubt if there is enough material for one.

It is stated that it is the intention of the Institute to model itself on that of the Law Society, and that a charter will be obtained, and perhaps an Act of Parliament. Powers, in short, will be got to enable the Institute to prosecute anyone taking out patents for money fees and not holding the diploma of the Institute. There are at present about fifty members of the Institute. That so few men should expect to obtain so many privileges seems strange. When they have got them they will fix their own fees. So suppose they double the existing fees, what will happen to the inventor? He will be simply powerless. We shall be as much in the hands of the patent agents as we are in the hands of the lawyers. It is surely time that the inventors said a word on the whole subject. Concerning the duties of a patent agent, and his claim to be regarded a professional man, I shall, with your permission, say something at another time. An Inventor.

London, December 22nd.

RAILWAY SPEEDS AND FARES.

Sir,—If you can find space in The Engineer for the accompanying facts about the nine great railways which start from London, I believe they may be of interest to your readers. To compare the merits of one railway with another, it is necessary to consider the speed of the trains, the number of trains, and the price of the tickets.

For the purpose of the following table, I have taken the six fastest journeys, three "up" and three "down," between London and each of six most important towns upon each railway system; and the average speeds are, therefore, those of the thirty-six fastest journeys thus performed. As the same trains frequently run to more than one of these towns, their number averaged is less than the number of journeys, and it is fair to remember that the fewest trains may probably show the best averages. The fastest average speed to any one place, is to Nottingham by the Midland, at 46·4 miles per hour. The highest fares charged are to Folkestone and Dover by the South-Eastern expresses, being 3·4d. and 3·3d. per mile. These tables appear to show finally that the northern lines are cheapest and fastest; the western and eastern lines are fast and rather expensive, while the southern lines are both slowest and dearest; and moreover, the South-Eastern, the London, Chatham, and Dover, and the London, Brighton and South Coast, are the only ones on which express fares are charged:—

Railways.	Trains averaged.	Average speed for 36 journeys.	Fastest run of over 50 miles.	Longest run without stopping.	Average fares per mile.	
					1st.	2nd.
		Miles per hr.	Miles per hr.	Miles.	d.	d.
Great Northern	24	42·1	50·3	105¼	1·6	1·2
Midland	23	40·6	49·7	97½	1·6	—
L. and N. Western	27	39·4	48·2	91½	1·7	1·3
Great Eastern	23	38·4	44·8	70¼	2·1	1·6
Great Western	21	37·5	53·2	106¾	1·9	1·4
L. and S. Western	22	36·1	44·3	48¾	2·4	1·7
L., C, and Dover	25	34·6	44·5	78	2·5	1·8
L., B., and S. Coast	32	34·4	43·1	55½	2 5	1·8
S. Eastern	34	33·7	44·4	75½	2·4	1·8

The above figures are based upon the various companies' time, tables for September last.

The towns which have been chosen are the following:—

Midland Railway: Nottingham, Leeds, Manchester, Liverpool, Glasgow, Edinburgh.

Great Northern Railway: Nottingham, Leeds, Manchester, Newcastle, Hull, Edinburgh.

L. and N. Western Railway: Birmingham, Manchester, Liverpool, Holyhead, Glasgow, Edinburgh.

Great Eastern Railway: Norwich, Yarmouth, Ipswich, Colchester, Harwich, Cambridge.

Great Western Railway: Plymouth, Exeter, Bristol, Swansea, Birmingham, Birkenhead.

L. and S. Western Railway: Plymouth, Exeter, Salisbury, Portsmouth, Southampton, Weymouth.

L., C., and Dover Railway: Dover, Canterbury, Ramsgate, Chatham, Sheerness, Maidstone.

L., B., and S. Coast Railway: Portsmouth, Hastings, Eastbourne Worthing, Brighton, Tunbridge Wells.

S. Eastern Railway: Dover, Folkestone, Margate, Hastings, Reading, Maidstone. J. F.

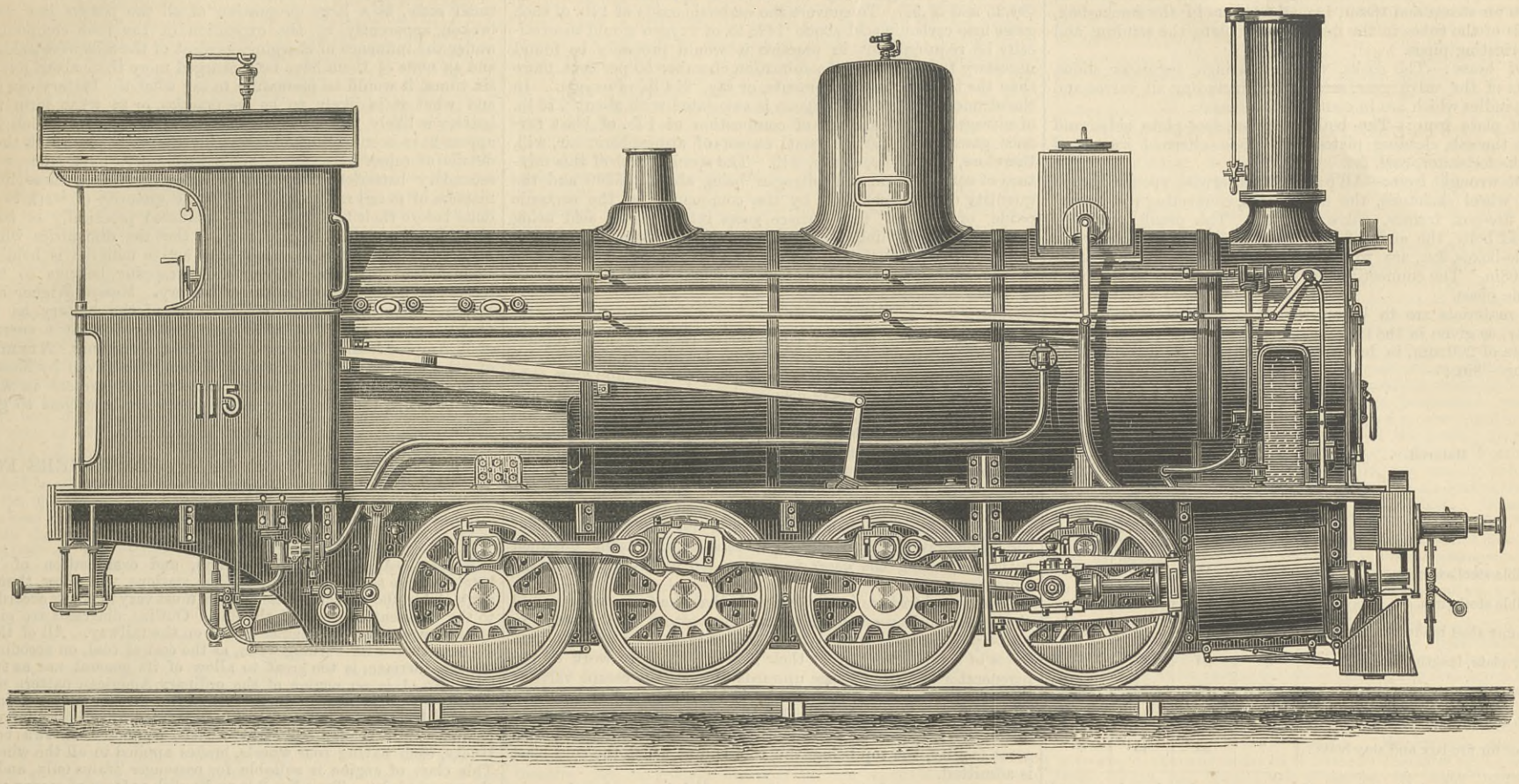
December 27th.

HYDRAULIC BALANCE LIFTS.

Sir,—In his letter dated 19th inst., Mr. Barr endeavours to meet our statements by some speculative estimates of his own. With the object of proving our statement as to weights to be erroneous, he estimates the weight of the ram and cage you illustrated at 21 cwt., and that of the balance cylinders and rams as 24 cwt. Instead of this the weights really are 23 cwt. and 20 cwt,

EIGHT-COUPLED LOCOMOTIVE, ST. GOTHARD RAILWAY.

CONSTRUCTED BY MESSRS. MAFFEI, MUNICH, FROM THE DESIGNS OF HERR J. STOCKER.



respectively. The metal of the balance weights will, as we stated, suffice to make the balance cylinders, &c.

He next proceeds to estimate the cost of the balance cylinders and rams, and of the parts which they displace from the old type of lift. He provides 18 cwt. of iron, say, 1 cwt. of steel rope, and two pulleys and bearings, which would not be safe if lighter than about 3 cwt. the set, making a total of 22 cwt. of finished machinery for £17 10s., or at the rate of 16s. per cwt. If Mr. Barr will supply and fix at this rate, he will be much sought after. We have only considered the parts mentioned by Mr. Barr, but that gentleman has quite overlooked the guides for the balance weights, and the strong overhead framing required to support the whole, as well as the greater cost of fixing the gearing he advocates, as against that of fixing our balance cylinders at the ground level.

We have had erected a series of our lifts in a building where the walls of the lift wells were so weak, that for the purpose of supporting a dead weight balance lift they must have been rebuilt at a cost of about £50 per lift. But for our lifts the walls were good enough, and the expense was saved.

We think Mr. Barr's question, implying that the power required to work lifts at a pressure of 700 lb. per square inch, is greater than that required for 400 lb. in the proportion of 700 to 400, must be misprinted; but in case your printers are not in error, we must apologise to your other readers while we explain to Mr. Barr that, with the accumulator at 700 lb. pressure, the volume of water to be pumped is only four-sevenths of that required with the accumulator at 400 lb., and the work to be done in pumping is precisely the same. We would say in this connection, that we have neither advocated nor used 700 lb. pressure for hydraulic balance lifts.

Into Mr. Barr's analysis of friction we will not attempt to follow him; but when he can produce practical results showing more than 78 to 80 per cent. efficiency on the upward journey of a dead-weight balance lift we shall be pleased to compare notes with him.

Mr. Barr has been informed that some steel wire ropes have run for eighteen months "constantly" without failure. "Constantly" is not scientific. Can Mr. Barr find a case where steel ropes $\frac{3}{4}$in. diameter running over a pulley 2ft. diameter—alternately in reverse directions—at a speed of 100ft. per minute for eight hours per day have worked for eighteen months without sign of failure? This is the sort of test which is involved in their use in a large London building. It is noteworthy that for the purposes of his argument, Mr. Barr finds it desirable to take the dimensions and pressure, viz., 450 lb., of the lift illustrated. But this he is scarcely entitled to do. For one dead-weight balance lift for passengers erected in connection with an accumulator, twenty have been erected to be driven by low-pressure water from the town mains or an elevated tank. In such a case how will Mr. Barr obtain the high-pressure which alone will enable him to use the small ram on which his arguments respecting cost are based? We did not in our first letter allude to a "larger lift" as Mr. Barr supposes, but to a lift designed to do precisely the same work as that illustrated, but actuated by water at about 50 lb. pressure per square inch. According to usual practice such a ram and cage would weigh about 2 tons, and the increased weight will materially affect Mr. Barr's figures. The hydraulic balance lift, however, increases the pressure to any desired amount, and therefore directly reduces cost.

Mr. Barr says two weights and two sets of ropes, guides, head-wheels, bearings, girders, &c., are safer than one. Probably so; but three, or even four, would be safer still. But then, what about cost and simplicity, for which Mr. Barr has also expressed considerable regard?

Mr. Barr still misunderstands the arrangement for returning water to the top of a house, and speaks of the additional first cost required. May we remind him that the water is returned by the hydraulic balance lift, and that the relative cost of this is the question under discussion; and farther, that the lift returns either to the main or to the top of the house without any difference in cost.

Since writing the above we have seen in the *Times* of the 25th inst. a notice of a fatal colliery accident caused by the failure of wire rope. The portion bearing on the question now under discussion we quote. "On Saturday morning a fatal colliery accident, resulting in the loss of three lives, occurred at the Cannock Chase Colliery Company's No. 3 pit, near Brownhills. The pit, in which 400 men are employed, is one of the best-regulated in the extensive Cannock Chase Colliery district. After the workings had been examined and found safe for the men to descend, the wire rope in the down-cast shaft was tested with a 2-ton load and found apparently all right. Three men, named Thomas Collis, 50; Herbert Grimley, 26; and Francis Horton, 19, then entered the cage to go down to "fettle" the horses. Immediately after the cage had disappeared from view the wire rope attached to the cage snapped asunder with a loud report, and the cage, with the three men, was precipitated to the bottom of the shaft, a distance of 150 yards. It is the custom with the owners of the colliery to replace the wire ropes every three years; this one had only been in use five months." As we have before pointed out, the conditions for using wire rope are far more favourable at collieries than in hotels and warehouses.

JOHN S. STEVENS.
Queen's-road, Battersea, Dec. 23rd. C. G. MAJOR.

PERMANENT WAY, INDIAN STATE RAILWAYS.

SIR,—In your issue of the 10th ult., page 351, under the heading of "Contracts Open—Permanent Way, Indian State Railways," we notice drawings and specifications of cast iron plate sleepers for the Indian State Railways, metre gauge. As these drawings—No. 204 and 213—are exact copies of those furnished by us, the patentees, we are at a loss to understand why everything has appeared excepting the name by which the sleeper now extensively used in this country is known, viz., the "Denham-Olpherts." As these drawings have appeared in your valuable paper, we think it may interest you and your readers to know to what extent this form of sleeper has already been adopted in this country. The trunk line from Calcutta to Delhi has upwards of half a million in use of the design marked A on the accompanying lithograph. The State lines have 82,000 of the drawing No. 213 referred to above, and 82,000 of that marked B on lithograph. The drawing No. 204 referred to represents the "Denham-Olpherts" sleeper, with Mr. Guildford L. Molesworth's cast iron wedge fastening. As in reproducing the drawings for publication the names of the patentees have been omitted, we shall be obliged by your publishing this letter. Should any further information be desired, it can be had on application to Messrs. Thomson and Browning, our agents, 3, Victoria-street, London, S.W.

C. H. DENHAM,
For Denham and Olpherts.

Hourah, Bengal, December 5th.

THE ELECTRIC ARC.

SIR,—It is to be assumed that, in the case of arc lamps, there is for each some current which is better than any other. What this current shall be is determined by the diameter of the carbons and the length of the arc. Can any of your readers tell me where I can obtain information on this point? I find that practice varies largely. Thus Brush lamps, with 12-millimetre carbons, are generally worked with an arc of about $\frac{1}{32}$in. long, or less. Indeed the carbon points are all but in contact. Brockie uses an arc of over $\frac{1}{8}$in. Crompton works between $\frac{1}{8}$in. and $\frac{1}{4}$in. in such of his lamps as I have had a chance of examining. The Siemens arc is very variable in length. The André lamps shown in the Crystal Palace worked with $\frac{1}{8}$in. arcs. There must be some length of arc which gives more light than any other. Can any of your readers tell me what it is? Messrs. Ayrton and Perry, and other photometric experimenters, are quite silent on this important point.

London, December 27th. LUX.

CHILLED ROLLS FOR GLAZING CALENDERS.

SIR,—It is quite true that English paper-makers are compelled—as you quote on p. 449 from a correspondent in *Contract Journal*—to go to America for the best chilled rolls, although this course involves a greater expenditure of time and money than the purchase of English rolls. I believe that some Scotch and Lancashire firms profess to supply first-class chilled rolls, but experience has not yet gained them sufficient confidence to supersede those from the United States, when and where the greatest economy is required. "Cheap and nasty" spells ruination in the paper trade.

PAPER-MAKER.

December 21st.

EIGHT-COUPLED ENGINE, ST. GOTHARD RAILWAY.

WE publish this week drawings of the 8-coupled engines now in use for working the heavy traffic of the St. Gothard Railway. These engines are of the Class D, described in the report published in our issue of November 17th, and are excellent examples of continental work. The engines were built by Messrs. Maffei and Co., of Munich, from the designs of Herr J. Stocker, locomotive superintendent of the St. Gothard Railway. The design is founded upon the 8-coupled mountain engines of the Southern Railway of Austria, the Upper Italian Railway, and the Paris and Lyons Railway—the latter used for the Mont Cenis—but with considerable modifications, which are due to Herr Stocker himself. The arrangement of the trailing axle below the fire-box, with a special disposition of the springs, to enable the fire-box to be properly supported, is a novelty. The steadiness of the engine at high speeds is thus greatly improved, and this was a matter of much importance, in order that the engines might run at a sufficient speed through the great tunnel and elsewhere. The whole engine is made as short as possible, in order that the overhanging weight, beyond the short wheel base, rendered necessary by the curves of the line, may be as small as is practicable. Another point of novelty is the construction of the rear part of the boiler, which is more on the American pattern.

The whole of these fifteen engines were at work by June 1st, 1882. The specification stipulated that they should be able to haul 150 tons on a gradient of 2·7 p. c., but this has been frequently exceeded. It has already happened that two of these engines have hauled a train of 410 tons over the mountain section of the St. Gothard, at a speed of 9 to 12 miles an hour; whilst on the valley section, with gradients of 1 in 100, one engine easily hauls 500 tons at 15 miles an hour. The directors of the St. Gothard Railway are perfectly satisfied as regards both their working and construction.

The general dimensions of this set of engines was given in the table published in our issue of November 15th, but it is here repeated for greater convenience of reference:—

	French measures.	English measures.
Fire-grate:—Length	2·125 m.	7·0ft.
Width	1·02 m.	3·31ft.
Surface	2·15 sq. m.	23 sq. ft.
Tubes:—No.	225	225
Outside diameter	50 mm.	1·97in.
Length between tube plates	4·2 m.	13·78 sq. ft.
Heating surface:—Fire-box	9·5 sq. m.	102 sq. ft.
Tubes	148·5 sq. m.	1600 sq. ft.
Total	158·0 sq. m.	1702 sq. ft.
Boiler:—Mean diameter of shell	1·535 m.	5·04ft.
Total length, with smoke-box	7·445 m.	24·42ft.
Height of centre line above rails	2·100 m.	6·89ft.
Pressure	10 atm.	149 lb.
Frames:—Thickness of plates	35 mm.	1·38in.
Axles:—Diameter of journals	200 mm.	7·87in.
Length of journals	240 mm.	9·45in.
Wheels:—Diameter of tread	1·17 m.	3·84ft.
Engine:—Diameter of cylinder	520 mm.	20·4in.
Stroke	610 mm.	24·0in.
Diameter of crank pin, driving axle	130 mm.	5·12in.
Valve gear	Gooch	—
Weight:—Empty	44·7 tonnes.	44·0 tons
In working order	51·7 tonnes.	50·8 tons

These figures show very clearly the great power of these engines, having practically 20in. cylinders and 2ft. stroke, with the high working pressure of 150 lb. As an illustration it may be mentioned that the work done by one only of the two cylinders at each stroke would be about 1,000,000 foot-pounds, or equal to the whole amount stored in the Faure battery, which made such a sensation when conveyed from Paris to Glasgow not many months ago.

The general specification of these engines was the same as for the other types built for the St. Gothard Railway. It presents several points of interest as compared with the ordinary specification of an English locomotive, and we therefore give an abstract of it. Omitting the mere general and ordinary conditions, the main features are as follows.

The locomotives and tenders are to be constructed according to the dimensions given for each particular class, and the general drawings annexed. All detail drawings which may be required are to be made by the contractor. Before beginning the work he is to lay copies of these and of his general drawings before the managers of the railway. Any alterations required by them are to be made by the contractor, and the drawings when approved will remain with the company and form the basis of the contract. In addition, the contractor, at the end of the contract, will supply a complete set of drawings to one-tenth scale of the engine as built—elevation, longitudinal section, horizontal section, and cross sections through the fire-box and smoke-box—and with all the chief dimensions written upon them. The materials are to be of the best quality; the works supplying them are to be named in the tender, and proof must be given when required that these works are really employed. Tests of strength will be made by the company before use, either in the works of the contractors or in some proving-house which they may select. The tests will be at the cost of the contractor. The various parts will be made of the following materials:—

A. Of crucible steel:—The axles, both locomotive and tender; the tires for the locomotives, the eyes for all the eye-bolts.

B. Of cast steel:—The tender tires, the springs, leaf and

spiral; the pistons, the slide bars, the axle-box guides with their keys, and the screwed rods for the valve gear.

C. Of cast iron :—The cylinders and covers, the slide valves, piston rings, steam pipes, grate bars, brake blocks, and all parts of support and construction.

D. Of copper :—The inner fire-box, the horizontal stay bolts, all pipes for steam and water, including those in the smoke-box, the ends of the tubes in the fire-box-tube plate, the sanding and the lubricating pipes.

E. Of brass :—The cocks, valves, bearings, regulator slides, the nuts of the valve gear, screws, &c., including all valves and valve spindles which are in contact with steam.

F. Of plate iron :—The boilers, frames, foot-plate, sides and roof of the cab, cleading plates, the tubes—charcoal iron—and the tanks for water, coal, &c.

G. Of wrought iron :—All parts not otherwise specified, such as the wheel skeletons, the crank pins, connecting rods, axle-boxes, fire-box frames, valve rods, &c. The crank pins, the crosshead bolts, the ends of the connecting and coupling rods, the axle-boxes, &c., are to be case-hardened to a depth of at least 0·08in. The connecting and coupling-rods are to be forged from one piece.

The materials are to be subjected to tests of strength and ductility, as given in the table below. The test pieces are to be cylinders of 200 mm. in length—say 8in.—and at least 20 mm. diameter—·8in. :—

Material.	Stress which is not to cause above 0·5 mm. set.	Minimum breaking strength.	Minimum elongation.	Minimum contraction of area.
	kg. per sq. mm.	kg. per sq. mm.	per ct of original length.	per cent.
1. Crucible steel axles	26	55	18	35
2. Crucible steel tires	35	65	15	25
3. Bessemer steel tender tires	30	60	15	30
4. Boiler plate, lengthwise	20	36	15	—
5. Boiler plate, crosswise	18	34	12	—
6. Rivet and stay iron	20	36	18	—
7. Copper for fire-box and stay bolts ..	7	20	45	—

The spring steel is to be made into a spring 1 m. long, and hardened, and must then be bent with a stress of 76 kg. per square millimetre, without taking any permanent set. The tubes must sustain a pressure, inside and outside, of twenty atmospheres, without any permanent alteration of form. The various parts of each engine and tender must be interchangeable, especially the axles, axle-boxes, springs, pistons, crossheads, connecting and coupling rods. The screws are to be on the Whitworth system, and are arranged in sets, so as to require as few spanners as possible. All nuts within the boiler or smoke-box are to be locked. Nuts requiring to be frequently unscrewed, and other wrought iron parts exposed to friction, are to be case-hardened. The eyes of all eye-bolts are to be bushed with hardened rings of crucible steel, forced in by hydraulic or screw pressure. They are to be kept from turning round, and provided with means of lubrication, as are also all other parts exposed to wear by friction.

The work is to be done under the inspection of an officer appointed by the company, and the contractor is to notify to the company the commencement of work upon the boiler and other important parts, such as axles and springs, in order that they may be inspected during progress. The boiler is to be tested by water to 50 per cent. above the working pressure in the inspector's presence. Before the putting in of the tubes, one out of every fifty is to be selected for testing, and if it fails the whole lot may be rejected. Every spring is to be tested by a lever apparatus, to carry in the middle a dead load corresponding to a stress of 76 kg. per square millimetre, without taking any permanent set.

On delivering the locomotives, the contractor must send in the statement of the exact weights which will be upon each axle of the machine and tender, both when they are quite empty and when there is 6in. of water above the roof of the fire-box, and the water tank and the coal bunkers are quite full. A detailed statement of the weight of each part, and of the weight of the separate materials composing it, is also to be given.

The engine, when delivered, will be expected to run 400 km. —say 250 miles—before it is accepted by the company. There will be, however, a deposit of caution money by the contractor, which will be returned when the engine has been two years in service or has run 30,000 km.; for the axles, wheels, tires and crank pins the period will be four years.

In conclusion, we may express our obligations to Herr Stocker, and the officials of the St. Gothard Railway at Lucerne, for their kindness in facilitating our reproduction of these valuable drawings.

HARVEY'S HOT BLAST STOVE.

In our last volume—*vide* page 430—we illustrated and described a blast furnace and set of regenerative hot blast stoves combined in one structure, and also one form of separate stove, designed by Mr. Thomas F. Harvey, of Dowlais. We now illustrate on page 484 another design of separate hot-blast stove, and give Mr. Harvey's views concerning it.

For heating the stove, the fuel used is in this, as in nearly all other instances, the waste gases from the blast furnaces. The combustion of these gases is effected by means of atmospheric air in a fire-brick chamber at the bottom of the stove. In order to effect complete combustion of a combustible gas, it is necessary that the gas and the supporter of combustion be well mixed together. When the fuel is solid, such as coal or coke, the mixing of the combustible and the air is fairly done by causing the latter to pass between the pieces of the former, as takes place in an ordinary fire-grate; but gaseous fuel should be divided into small jets and the air into proportionate jets preparatory to combustion, so that every particle of air may meet with a particle of gas. In the regenerative system of hot-blast stoves it is important that the whole of the heat be generated in the hot end of the stove, or, in other words, that the combustion of the gases be effectually done in the combustion chamber. If combustion be allowed to take place throughout the whole length of the stove, or nearly so, the chimney end, or what should be the cool end of the stove, will be at nearly as high temperature as the hot end, when a great loss of heat will accrue by the gases escaping to the chimney too hot. Through this cause, that is, tardy combustion, owing to incomplete mixture of the air and the gases in the combustion chamber, the chimney valve is sometimes kept at a temperature of red heat. There is then not only an unnecessary loss of heat up the chimney, but the temperature of the combustion chamber or hot end of the stove is reduced, and consequently the temperature to which it is possible to raise the blast is also lowered.

The following is an estimate of the maximum temperature attainable by the perfect combustion of blast furnace gases. The average composition of the waste gases of modern coke furnaces of ordinary height may be taken as approximately CO^2.18 CO.25 and N .57. To convert the carbonic oxide of 1 lb. of such gases into carbonic acid about ·1428 lb. of oxygen would theoretically be required, but in practice it would probably be found necessary to admit to the combustion chamber 50 per cent. more than the theoretical requirements, or say, ·214 lb. of oxygen. In the atmospheric air this oxygen is associated with about ·716 lb. of nitrogen. The products of combustion of 1 lb. of blast furnace gases, with 50 per cent. excess of atmospheric air, will, therefore, be 1·93 lb., or say, 2 lb. The specific heat of this mixture of carbonic acid and nitrogen being about ·23386 and the quantity of heat generated by the combustion of the carbonic oxide of 1 lb. of the furnace gases into carbonic acid being 2403 × ·25 = 600 units Cent.; the maximum attainable temperature of the products of combustion above the temperature of the gases and the air before combustion will therefore be

$$\frac{600}{23{,}386 \times 2} = 1285 \text{ deg. Cent.} = 2314 \text{ deg. Fah.}$$

The regenerator, however, could not be raised to that temperature but by allowing the gases to be burning in the stove for several hours—probably from fifteen to eighteen—and then only by allowing the products of combustion to escape to the chimney at a high temperature, which would result in loss of heat, unless the regenerator is excessively large and proportionately expensive.

In the stove under consideration, owing to the complete mixture of the air and the gases in the combustion chamber, and consequent perfect combustion, it is anticipated that the temperature of the hot end will be sufficient to heat the blast to about 1800 deg. or 1900 deg. Fah.; and also that the capacity of the regenerator will permit that temperature being obtained without allowing the gases to escape too highly heated to the chimney.

A principal feature in the design is that the furnace gases and air for combustion are admitted at the bottom of the stove in split-up portions over the whole area of the floor, and the products of combustion impart their heat to the brickwork of the regenerator in their passage upwards towards the escape valve at the top of the stove, the usual tall brick chimney and culvert leading thereto being dispensed with. This simple arrangement of the stove, moreover, permits the cleaning to be effected with great facility, the top being the cool end at which the cold blast is admitted.

It will be seen that there are five parallel flues under the combustion chamber, each of which communicates therewith by means of port-holes spaced at intervals of about 18in. throughout the length of the flues. The gases are admitted through a slide valve, which, together with its seat, is kept cool by circulating water into two of these flues, and the air for supporting combustion is admitted through ordinary wing valves fitted in the cleaning doors into the other three flues. The air and the gases meet and mix in the port-holes which lead from the flues into the combustion chamber, which occupies nearly the whole internal area of the bottom part of the stove; and thorough combustion takes place at the bottom of the stove, and all over the floor, rendering every square foot of heating surface available for absorbing heat and imparting an equal temperature throughout any given horizontal plane. The regenerator is supported upon a series of semicircular arches bonded well together, and the arches are built in two distinct rings, the under arches being independent of the upper ones. The bricks of the upper ring form the horizontal base upon which the regenerator flues are built, and from the top of the arches to within 5ft. or 6ft. of the dome the entire cross section is utilised for regenerator, the flues of which are 7in. by 9in. in cross section. The upper part of the stove may be built entirely of an inferior quality of fire-brick, as the gases are robbed of their heat on their way upwards, and this effects a material saving in cost of bricks.

The chimney valve regulates the velocity of the products of combustion through the regenerator, the quantity of gas consumed being controlled by the gas valve. The cold blast is admitted at the top, and passes downwards in a contrary direction to that of the heating gases, and the whole capacity of the stove is traversed by the blast which issues through the gas flues, and through a valve which is a duplicate of the gas valve, into the hot blast main.

The stove may be partially cleaned by discharging a gun into the bottom part, at the same time keeping the top of the stove closed and allowing a current of cold blast to pass through from top to bottom. The current of blast will drive the dust to the bottom, and it can then be raked out through the doors provided for that purpose. An effectual cleaning at intervals of a month or six weeks, dependent upon the quality of the gas consumed, may be done by workmen standing in the upper part of the stove upon the plate covering the regenerator, and using scrapers or wire brushes to loosen the deposit, a downward current being caused by the cold blast admitted at the top as before described. The downward current may, however, be produced by using a small exhaust fan attached to one of the cleaning doors at the bottom, keeping the top of the stove open; or a steam jet may be used at one of the bottom connections to cause the downward current. In any case no time is wasted in allowing the stove to cool before the operation of cleaning begins, as the top part of the stove is the cool part.

It is claimed that this class of stove provides heating surface at less cost than any other system, and in some cases for one-half the cost.

The weight of the wrought iron casing is 33½ tons; the quantity of first quality bricks, 9 × 4½ × 2¾, is 27,000; the same for regenerator, 9 × 6 × 2, 52,000; weight of dumps, A, B, C, D, E, F, &c., 51 tons; number of second quality bricks, 9 × 4½ × 2¾, 53,000; and for regenerator, 9 × 6 × 2, 17,000.

LIARDET AND DONNITHORNE'S SECONDARY BATTERY.

On Friday week a number of electricians and others interested in electrical matters were invited to inspect some batteries made under patents taken out in January and October of this year by Messrs. Liardet and Donnithorne, and exhibited at the offices of Messrs. Wigner and Harland, Holborn Viaduct, where electric currents are supplied by the Edison Company. The batteries shown are on a small scale, most of them, comprising fifty cells, having elements or electrodes of one-twelfth of a square foot in area, while a few, fifteen cells, have an area of one-fifth of a square foot. A cell contains a pair or more of thin lead plates supported on a wood backing. Compounds of lead, consisting of finely divided lead, obtained direct from galena by means of hydrochloric acid, with peroxide and sulphate of lead, are held against one side of the sheet of pure metallic lead by placing the whole in flat porous jars, a pair of jars being placed in each cell and surrounded by dilute sulphuric acid. Instead of holding the compounds of lead against the lead plate by placing them with the plate in porous jars, it is proposed to employ porous earthenware plates. To the upper part of the lead plates a copper connecting strip is soldered. Messrs. Wigner and Harland have reported upon these batteries, and they were shown at work on Friday last, but inasmuch as the batteries are on a very small scale, as a large proportion of all the porous jars were broken apparently by the expansion of the lead compounds under the influence of charging, as most of the cells were leaking, and as none of them have been charged more than about five or six times, it would be premature to say what the battery can do, and what it is likely to be in practice, or in what form the battery is likely to appear when the detail difficulties which yet appear have been overcome. The inventors seem to think these details of minor importance, but a little more experience with secondary batteries will probably show them that these little matters of detail represent a formidable quantity of work to be done before their battery can be considered practically or commercially complete. It appears to us that the difficulties which belong to all batteries in which the active material is held up against lead plates by supports or wrapping, belongs to this battery as much as to the Faure battery. Messrs. Wigner and Harland give the electro-motive force of the battery as 1·9 to 1·95 volts, and that after being charged with a current of 63 Ampère hours, they gave back 54 Ampère hours. A number of other figures as to weight and efficiency are given by Messrs. Wigner and Harland, but as the battery is at present in what may be called the laboratory stage, it would be useless to give these.

THE INSTITUTION OF CIVIL ENGINEERS FOR IRELAND.

THE MEXICAN RAILWAY.

[*Concluded from page* 474.]

Engines.—A glance at the section, and examination of the heights above sea level at the various stations, will show that to work the traffic efficiently the engines must vary in power according to the different divisions of the line. Outline diagrams are given of the seven types of engines in use on the railway. All of them are constructed for burning wood, as the cost of coal, on account of the sea carriage, is too great to allow of its general use as fuel. Type No. 1 is an engine of the ordinary American pattern with outside cylinders 15in. in diameter by 22in. stroke, having a four-wheeled bogie truck in front, and four coupled wheels 5ft. diameter behind. The tender has eight wheels, composed of two bogie trucks, each having four wheels, brakes applied to all the wheels. This class of engine is suitable for passenger trains only, and on the upper plains. Type No. 2 is an English pattern of engine with outside cylinders 16in. by 22in., a pair of wheels in front fitted with radiating axle-boxes, and four coupled wheels 5ft. in diameter behind. The tender has six fixed wheels, with brakes applied to all. This class of engine is suitable for passenger trains or light goods trains on the upper plains. Type No. 3 is a very excellent class of American engine, well adapted for heavy passenger trains or goods trains. It has outside cylinders 16½in. by 24in., a four-wheeled bogie truck in front, and six coupled wheels 4ft. 7in. diameter behind. This arrangement of six wheels admits of good distribution of the weight; and as the front pair are without flanges on the tires, the engine is able to pass easily round very sharp curves, the wheel base being practically reduced to 7ft. 3in. The tender has eight wheels in two bogie trucks with brakes to all. Type No. 4 is an American engine, generally known as the "Mogul" pattern. It is designed more particularly for passenger or goods trains on heavy inclines. It has a two-wheel pony truck in front, and six coupled wheels 4ft. 6in. diameter behind, the flanges being turned off the middle pair of coupled wheels. The cylinders are outside, and are 17in. by 24in. The tender has eight wheels on two bogie trucks, with brakes to all wheels. Type No. 5 is a French goods engine of the ordinary six-wheeled coupled pattern, with outside cylinders 18in. by 26in., and wheels 4ft. 3in. diameter. It is a strong, well-built engine, and capable of doing excellent work with heavy goods trains on easy curves. It has a six-wheeled tender with brakes to all the wheels. Type No. 6 is a very powerful class of American engine, generally known as the "Consolidation" pattern. It is specially designed for working at low speeds on very heavy inclines. It has outside cylinders 20in. by 24in., a two-wheel pony truck in front, and eight coupled wheels 4ft. 2in. in diameter behind. Of the coupled wheels, the leading pair and the last pair but one are without flanges on the tires; in this way the weight is distributed over a great length, and the wheel base for passing round sharp curves is reduced to 9ft. The tender has eight wheels on two bogie trucks, with brakes to all wheels. Type No. 7 is a double bogie, double boiler, four-cylinder engine of the Fairlie pattern, with outside cylinders 16in. by 22in. Each bogie truck consists of six-coupled wheels 3ft. 6in. diameter, the centre pairs of each being without flanges on the tires. Brakes are fitted to all the twelve wheels. This engine is without tender, the wood fuel being carried in iron lattice work racks on top of boilers and the water in side tanks. These engines are reserved for working the very heavy inclines of 1 in 25 between Orizava and Boca del Monte. In the engines of types Nos. 1, 3, 4, and 6, the wheels of the bogies are all of the solid chilled cast iron disc pattern, and the coupled wheels are of cast iron with strong steel tires. Types Nos. 2, 5, and 7, have wrought iron wheels with steel tires. As the engines are all wood burners, they are fitted with wide topped smoke stacks and approved form of spark arresters. Of the above types of engines Nos. 3, 4, and 5, are found best suited for the division between Vera Cruz and Paso del Macho; Nos. 4 and 6 between Paso del Macho and Orizava; No. 7 for the 1 in 25 inclines between Orizava; and Nos. 1, 2, 3, and 5, for the upper plains between Boca del Monte, Mexico, and Puebla. In addition to the strong hand-power brakes on all the tenders, the engines working the heavy inclines, as well as the regular passenger engines, are fitted with steam brakes, and also with the Westinghouse brake.

Carriages.—The carriage stock is arranged for the accommodation of first, second, and third-class passenger traffic. There are two types of stock in use—the ordinary English pattern, in which the carriage is divided into compartments with doors at the sides, and the American pattern, with doors at the ends. The carriages are neatly furnished, but more attention is paid to the provisions for coolness than for warmth. In the first-class carriages the cushions are covered with light-coloured canvas or brown holland, which not only has the advantage of being cool without collecting dust, but can be readily removed and washed. The seats of the second-class carriages are covered either with leather or light-coloured woollen material. Plain wooden seats of convenient form are used for the third-class. The side windows, as well as the upper part of the doors of all the carriages, are made to open. On the opening of the earlier completed sections of the line all the carriages sent out were of the ordinary short English four-wheel type, and it was only in later years that long carriages of the American pattern were introduced. When completing the construction of the central or heavy mountain portion of the railway, and preparing for the opening through of the entire line, it became necessary to decide upon the best way of utilising the carriage stock on hand. It was clear that the short four-wheeled, rigid-wheel base carriages, which had served so well on the upper plain, or on the lower line near Vera Cruz, would never do for passing round the sharp curves of 325ft. and 400ft. radius in the Cumbres and Chiquihuite. Neither would it be prudent to discard them altogether as useless, as they were too many in number, and really in excellent condition. It was at this time that the idea suggested itself to the author to splice the carriages together in pairs, and to make in this way one long carriage, with an American four-wheeled bogie truck at each

end. This idea was carried out, and with most excellent results. The main frames of the carriages were of wrought iron, and were spliced or fished together with strong wrought iron joint plates 3ft. 6in. long, securely rivetted, thus making each of the main frames into one continuous piece or girder. To assist in stiffening these frames three tension or truss rods, each 1¼in. in diameter, were placed, and carefully adjusted under the carriages. The carriage bodies, which were of teak, were also strongly bolted together at the sides and roof. A four-wheeled centre pin bogie truck was placed at each end of the carriage. In addition to the Westinghouse brake, which is fitted up on the carriages of the Mexican Railway, a hand brake-wheel was placed on the top of the carriage, which applies the brake shoes, which are of cast iron, to all the eight wheels at once. The result of this splicing of two carriages together has been a perfect success, and all those thus treated are found to be very easy both for passengers and permanent way. They pass smoothly round the sharp curves in the mountain range, and are found to be equally efficient on the comparatively level and straight road on the upper plains, where the running speed is much faster than on the more difficult parts of the line. It may be interesting to mention here that for two or three months, during an alteration in one of the tunnels, some of these spliced carriages forming the through trains had to pass daily round three temporary curves of 150ft. radius. The spliced carriages, having first and third-class accommodation, are 46ft. 3in. long, and carry 74 passengers. They have three first-class compartments, each holding eight persons, and five third-class compartments of ten each. The spliced carriages combining second and third-class, are 44ft. 9in. long, and carry 90 passengers. They have nine compartments, four for second-class and five for third, the compartments holding ten each. In the same manner most efficient brake vans have been made by splicing two of the original vehicles together. In each of the long vans thus obtained, one compartment was divided off for the conveyance of the mail bags and attendants. The first-class carriages of the American pattern have the seats placed transversely, with a space or pathway down the middle; but in the third-class the seats are placed lengthways of the carriage, one seat under each line of windows, and a double row back to back down the centre. A hand brake-wheel is placed in the gangway handrail on the outside platform at both ends of each American carriage. A powerful brake van is always placed at the end of the train, and a communicating cord is passed from this van along all the carriages to an alarm gong placed on the weatherboard inside the cab on the engine.

Wagons.—To meet the requirements of a general traffic there are low-sided open wagons, cattle wagons, covered wagons, and specially fitted wagons for the conveyance of "pulque," or national beer of the country. The above stock is made up of two descriptions—first, the short four-wheel wagon of the ordinary English pattern, with which the earlier-opened sections of the line were supplied; and second, the long American pattern of wagon with a four-wheeled bogie truck at each end, which type was adopted when stocking the later-completed portion of the railway, and has since been accepted as the standard class of wagon best suited for the traffic. All the wagons are fitted with hand brake-wheels, placed conveniently on the top in the case of the covered wagons, and about 3ft. above the floor of the open wagons. Experience has shown that oak timber, whether British or American, is altogether unsuited for the construction of wagons for Mexico. Although carefully selected and of the best description, it deteriorates so rapidly that in three or four years large heavy frames and uprights quite lose their strength, and become decayed and unreliable. For this reason good pine timber is used for all the woodwork. Experience has also shown that the ordinary English or European style of building covered wagons with the upright framework placed outside must be departed from in the trying climate of Mexico. The great tropical heat of the lower portion of the line, and the extremely rarefied atmosphere arising from the great altitude of the upper plains, reduce all the woodwork of the rolling stock to such a thoroughly dry condition as to be more than usually predisposed to fire. Small red-hot sparks from the wood-burning engines strike the ends and sides of the wagons, and, working themselves into the small crevices between the uprights and inside boarding, are soon fanned into a flame by the speed of the train. In a few minutes the woodwork is in a blaze, and before the train can be stopped and assistance procured, the entire wagon and most of its contents are destroyed. After trying ineffectually several plans to remedy this defect, the author had to rebuild a large number of these wagons by placing the boarding outside the upright framing, and vertically, and without any base moulding or other projecting pieces which might give a lodgment for falling sparks. A diagram sketch is given of one of the long American class of covered wagons now adopted as the standard pattern most suitable for the requirements of the traffic. It is 26ft. 9in. long by 7ft. 9in. wide and 7ft. 2in. high in the middle, inside measurement; contain about 1440 cubic feet of loading space, and is intended to carry about fifteen tons of general merchandise. It has a four-wheel bogie truck at each end, and a hand-wheel brake at the top, which applies the brake shoes to all the eight wheels. The upright framing is placed inside, and the vertical boarding outside. A light boarding is also placed horizontally inside the wagon to a height of about 5ft. for protection of upright framing and facility of loading. It is an excellent class of wagon for general work, and especially for long journeys, runs very steadily, and is easy on the permanent way. It weighs when empty about 9½ tons. For comparison, a diagram sketch to same scale is shown of one of the ordinary covered wagons on four fixed wheels in use on the 5ft. 3in. gauge of the Irish railways. This wagon is about 13ft. 3in. long by 7ft. 3in. wide by 6ft. 6in. high in the middle, inside measurements, and contains about 565 cubic feet of loading space. On a line with such exceptional gradients it is obvious that each wagon must be provided with a brake, and one that can be applied while the vehicle is in motion. The side lever brake of this country would be useless except when shunting in a station. Various descriptions have been tried, but the one now adopted, both for carriages and wagons, as the simplest and most efficient, is the ordinary American car brake, consisting of a small horizontal hand wheel fixed to a vertical wought iron shaft about 1½in. in diameter. The upper end of this shaft is supported by a bracket just below the hand wheel, and the lower end has a small collar and is stepped into a bracket properly secured to the under frame. One end of a short piece of chain is fastened to the shaft, and the other end to light iron rods which pass under the vehicle, and are connected with the brake levers. The turning of the hand wheel coils the chain round the shaft, draws the light rods forward, and puts on the brakes. By means of a small ratchet wheel and pawl conveniently placed for working by the brakesman's foot the amount of application can be easily regulated, and the brake kept on as long as required. The diameter of the hand wheel or leverage is arranged so as to prevent, as far as practicable, the possibility of skidding the wheels. Under the vehicle are strong bow springs, which are in their normal position when the brake is off, and are compressed when the brake is put on. So soon as the pawl and ratchet are disengaged by the foot, the vertical shaft is released, and the compressed bow spring pulls off the brakes. This description of hand brake is perhaps the simplest which can be made. The brakesman has merely to put it on—the pawl and ratchet keep it on, and the bow springs take it off when no longer required. It is very inexpensive to make and easy to keep in order. Oil is used in all the axle-boxes, whether engines, carriages, or wagons. As the brakes have to be kept on for such long distances, it is evident that only wheels of the best and strongest description can be used to resist the severe strains. Two kinds of wheels are employed—one is the wrought iron spoke wheel with steel tires, and the other the chilled cast iron disc wheel. The former is so well known as to require no description. The latter is made from a peculiar quality of American iron which admits of a fine chilled surface being given to the tread, while the centre and disc remain of a softer and more flexible nature. Special appliances, and long experience enable the makers to turn out these wheels remarkably true on the circumference, and the chilled portion, which extends about ⅜in. into the metal, is very uniform. The wheels are bored out very carefully, and forced on the axles by hydraulic pressure. No keys are used. These wheels are strong and reliable, and well suited for rough and heavy work, as well as for lighter service. They are not affected by variations in temperature, and from their almost universal adoption in the United States and Canada, it is fair to presume they are considered the best wheels to withstand the very severe frost of a North American winter. They give a long life or train mileage, though much depends on the quality of the wheel in the first instance, and more upon the description of work to which it is exposed. From a number of statistics compiled it appears that the life of good chilled cast iron wheels may be assumed as varying from 80,000 to 130,000 miles according to the description of line, load, and gradients. When no longer fit for use they can be recast into wheels or worked up into other first-class castings, for which they make the very best foundry metal. Annexed to this paper will be found the abstract results of a series of experiments made with a number of cast iron test bars, including four bars of the Salisbury iron so much used for first-class cast iron chilled wheels in America. The experiments were made by Mr. Kirkaldy, with the exception of the last two, which were made by Mr. Forbes and Mr. Abel. It will be noted that not only did the Salisbury iron sustain a much greater breaking stress, but its ultimate deflection was more than double that of any of the other bars.

Climate and Scenery.—It would require an able pen to describe the grandeur and beauty, and variations in climate, of the district through which this railway passes. Geographically speaking, the country between Vera Cruz and the upper plain is designated by the inhabitants under three distinct zones:—The lower is termed the "*tierra caliente*," or hot country; the intermediate, the "*tierra templada*," or temperate country; and the upper plains, as the "*tierra fria*," or cold country. In the "*tierra caliente*" we have all the heat and luxuriant vegetation of the tropics. Many of the ravines are very fine, especially the valley of the Chiquihuite, which is a perfect picture of floral beauty. Here the trees are covered with flowering creepers—orchids, convolvuli, and many other coloured parasites climbing to the tops of the highest branches. The ground is a carpet of wild flowers of every hue; and curious birds, strange insects, and rare specimens of reptile life are met with at every turn. As we proceed further, passing large plantations for the cultivation of coffee and sugar, we come to the milder climate of the "*tierra templada*," rich in the fruits and flowers of its own more salubrious temperature. Tobacco, pineapples, mangoes, and bananas are grown here in large quantities. From Cordova to Orizava the district is more thickly populated, and the greater extent of land under cultivation gives the country less of the wild, rugged character met with lower down. The town of Orizava is beautifully located in a large plain, surrounded by mountains, and its charming scenery and lovely climate make it a favourite resort for the Vera Cruzanos during the intense heat of their summer months. As we journey onwards up the steep inclines of the Cumbres, we meet with nature on the grandest scale. The line makes so many twists and turns to gain length that we constantly obtain new and ever-varying peeps of the valley below. Nearing Boca del Monte the railway runs along a narrow ledge cut in the rocky mountain slope, and from this place, perched some 1600ft. above Maltrata, the traveller looks down almost perpendicularly upon the little town spread out like a tiny chess-board at his feet. Once divested of the sense of insecurity which the passenger at first feels when he hears the engine labouring up the heavy incline, he cannot fail to be charmed with the glorious panorama passing before him. The wonderful transparency of the atmosphere, which renders distant objects so distinct, contributes most materially in producing scenic pictures rarely met with. The term "*tierra fria*," or cold country, as applied to the upper plains, must only be taken in a comparative sense. Far from being really cold, the temperature is agreeably warm, and rarely are the days in winter colder than with us in May; or in summer, hotter than our June. The scenery of the upper table lands is doubtless less effective than that of the narrow mountain passes, but it is nevertheless very interesting. The soil is rich in fruits and vegetables, and produces fair crops of grain, but there is much room for improvement in the methods of agriculture. In many districts the only cultivated growth is that of the "*maguey*," a species of cactus or aloe, 7ft. or 8ft. high, from which is extracted the "*pulque*," or favourite drink of the country. Prominent amidst the bold outlines of the distant hills stand the two great snow-topped mountains of "*Ixtaxihuatl*" and "*Popocatepetl*," the former over 16,000ft., and the latter over 17,000ft. high. So conspicuous are these two great land marks that they are clearly seen in the city of Mexico, Puebla, and other much more distant places. Although in the midst of a volcanic region, Mexico appears to have enjoyed for many years a special immunity from earthquakes. Shocks are frequently felt, but never of a very dangerous character, and the inhabitants have not been deterred from erecting lofty churches and public buildings. Occasionally we find the outer walls of some of these slightly bent, or out of the perpendicular, but this trifling injury is all that appears to have ever taken place.

Working or traffic arrangements.—In arranging the traffic movements, one of the important points to be kept in view is to organise the service in such a way that no trains shall have to run in the dark on the section between Orizava and Boca del Monte, this division of the line being naturally more exposed to dangers from falling rocks, trees, and other obstructions. This restriction is not considered necessary on the other parts of the line, and there several of the principal trains, and through trains, perform part of their journey during the night. All the engines are furnished with very powerful head lamps, most of them with reflectors 33in. in diameter, and these cast a strong steady light for a long distance in advance of the engine. Indeed, without these powerful head lights it would be almost impossible to work night trains in a country where the railway is unfenced, and where people and cattle have such a propensity for walking on the line. A reference to the section will show that there is no difficulty in working the traffic on the comparatively level plains between Mexico, Puebla, and Boca del Monte, and that all the heavy work is below the latter place. It is not easy at the first glance to comprehend thoroughly the haulage work to be done in ascending to this great summit level of over 8000ft. Our home experience, where nature is on such a much smaller scale, affords us scarcely any similar practice for comparison. We have, it is true, a few isolated cases of severe gradients, but they are only for very short distances. Tourists who have walked to the top of Snowdon, in Wales, or Ben Macdhui, in Scotland, will no doubt retain a vivid recollection of the labour undergone in reaching the summit, and how the ascent was looked upon as quite an undertaking; and yet these mountains, the former about 3600ft., and the latter about 4400ft. above sea level, are only half the height of the summit level to which the locomotives have to haul the trains on the Mexican Railway. The 1 in 33 gradients between Paso del Macho and Orizava are very severe, but the heaviest work for the engines is, of course, on the long 1 in 25 inclines, between Orizava and Boca del Monte, and on this latter portion it is considered very good work for one of the four-cylinder double-bogie engines to haul a train containing 90 tons of actual freight or paying load, exclusive of weight of engine and wagons. The work can be better understood when we keep in mind that the engine of such a train has to stop at intermediate points to take in fuel and water, and start again on an incline of 1 in 25. The passenger trains from the lower to the upper line can be worked through without divisions, but the wagons of merchandise are taken up to Boca del Monte in several trains, and there formed into fewer but longer trains suitable for the easier gradients of the upper plains. In descending the incline, the length of train presents no difficulty, as, with the excellent brake power at command, the number of carriages or wagons is immaterial. The line is worked throughout by telegraph, on the absolute block system, without any train staff. A code of signalling has been carefully arranged, and an entry of every transaction or train movement is duly recorded in a book kept for that purpose at each station. So soon as the operator has obtained "line clear," by telegraph, his duty is to fill in a special form, giving the names of stations from and to which it applies, inserting date and time, and then attach his signature. This form is then handed to the station master, who examines it, and if found correct, signs it, and hands it to the guard of train, who in like manner signs it and hands it personally to the engine driver. The form is then placed in a brass case with a glass front, fixed in a conspicuous place on the weather-board, or inside of cab on the engine. The forms, as received, are placed one over the other—in this way, the latest issued is always in view. These forms are printed on pink paper for the up journey, and on yellow paper for the down journey. The writer introduced the above system of line-clear tickets with the view of insuring, as far as possible, the issue of correct and safe orders for the movement of the trains. The examination and signing of the papers by three different persons may at first appear a little irksome, but the three-fold checking is found to be most valuable, and the importance of the safe working warrants the taking of every precaution. The arrangement is found to work most satisfactorily, and to be very simple in its management. No two trains, even if going in the same direction, are allowed to be on the one section at the same time. Every train despatched with a line clear ticket must arrive at its destination before another can be started. For the working of the traffic on the heavy inclines between Boca del Monte, Orizava, and Paso del Macho, special gangs of brakesmen are appointed. Upon the arrival of a down train at the summit station at Boca del Monte, it is put in charge of a foreman of brakesmen, who carefully examines all the brakes, and places a proper number of men according to the description and length of the train. In the case of the passenger trains, which are fitted with the Westinghouse brakes, the brakesmen have little to do, and merely hold themselves in readiness in case of a failure in the air-brakes, requiring their immediate attention to the hand-brakes. Occasionally for practice, and by pre-arrangement, the trains are taken down by the hand-brakes alone, without assistance from the Westinghouse. The goods trains are taken down by the hand-brakes alone. On the tops of all the covered wagons convenient seats are fixed for the brakesmen, and the hand-wheels can be worked when the men are seated. The vertical shaft passes up through a foot-board placed about 18in. below the seat, and the pawl and ratchet is on the level of this foot-board. When the brake ends of two wagons come together, one man can easily work the two hand-wheels. When ascending the steep inclines the brakesmen have all to be at their post, and ready to bring the train to a stand should any unforeseen obstruction be met with on the line. They have also to pull up and hold the train while the engine takes fuel and water on the 1 in 25 and 1 in 33 inclines. Merchandise can now be conveyed in as many hours as it formerly required days; and this rapid transit has opened out a market for many commodities, whose necessary speedy conveyance was hitherto impossible. Many branches of industry previously limited in extent have now the means of development, and year by year new channels of enterprise are opening out which owe their existence and success to railway communication. The imports are still very much in excess of the exports, but as the advantages of increased industry become more and more understood it is reasonable to expect that the latter will be largely increased, without any diminution of the former. In conclusion, the writer hopes that some of the particulars in the preceding remarks will be found of interest to the members of this Institution. They show how the Mexican Railway, one of the heaviest lines in the world, has been made and successfully worked with a gauge of 4ft. 8½in., and exceptionally heavy gradients and sharp curves. It will be observed that in several of the details referred to in this paper there has been a considerable departure from the ordinary methods in general use in this country. These changes have been made after very careful consideration and experiment, and their success in practice has fully justified their adoption.

MEXICAN RAILWAY—MAIN LINE.

List of Stations with the Distances from Vera Cruz and Corresponding Heights above Sea Level.

English miles from Vera Cruz.	Stations.	Heights in English feet above sea level.	English miles from Vera Cruz.	Stations.	Heights in English feet above sea level.
—	Vera Cruz ..	6	—	Acocotla (summit)..	8309
9½	Tejeria	106	176¾	Apizaco	7909
19	La Purga.. ..	146	186¼	Guadalupe H , ..	8132
26	Soledad	305	193½	Soltepec	8224
39¼	Camaron	1117	205¾	Apam..	8157
47¼	Paso del Macho	1559	215½	Irolo	8044
53½	Atoyac	1511	221¼	Ometusco	8077
65¾	Cordova	2712	225¼	La Palma	7897
70¾	Fortin	3308	229	Otumba	7706
82	Orizava	4026	236	S. Juan Teotihuacan	7483
94½	Maltrata	5549	243	Tcpexpan	7363
107¼	Boca del Monte	7922	263¼	Mexico (city)	7346
126¼	San Andres ..	7971	—	Apizaco	7909
139	Rinconada ..	7732	10½	Santa Ana..	7505
150¼	San Marcos ..	7784	21¾	Panzacola..	7189
161	Huamantla ..	8160	29½	Puebla	7067

APPENDIX.

Abstract Results of Experiments made with a number of cast iron test bars, 3ft. 6in. long, 2in. deep, and 1in. thick, placed on edge upon supports 3ft. apart, and weight applied in the centre.

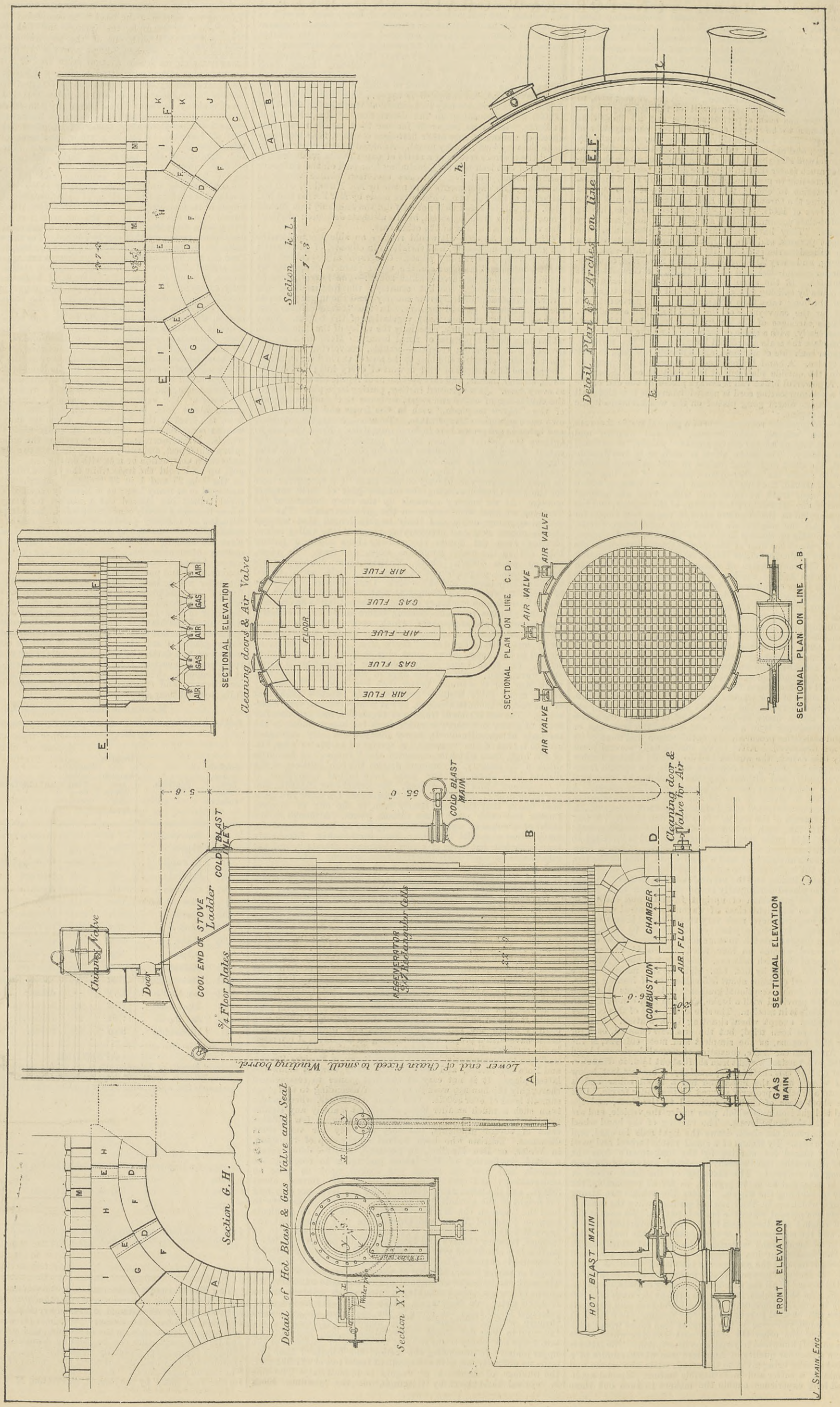
	Breaking Stress in cwts.	Ultimate Deflection in inches.
Average of a large number of Staffordshire bars in 1873	29·45	0·340
Do. do. do. 1876	28·55	0·309
Do. do. Glasgow bars in 1871 ..	31·76	0·314
Do. do. ,, 1876 ..	30·91	0·308
Four bars of Salisbury iron, cast by the Barnum-Richardson Co., Lime Rock, Conn, U.S.A.	36·31	0·623
	32·24	0·671
	37·50	0·670
	36 00	0·720

THE METEOROLOGICAL SOCIETY.—At the meeting of this Society on the 20th inst., papers were read on "Popular Weather Prognostics." by the Hon. R. Abercromby, F.M.S., and Mr. W. Marriott, F.M.S. The authors point out (1) that prognostics, will never be superseded for use at sea and other solitary situations; and (2) that prognostics can be usefully combined with charts in synoptic forecasting, especially in certain classes of showers and thunderstorms, which do not affect the reading of the barometer. The second paper was on "Report on the Phenological Observation for the Year 1882," by the Rev. T. A. Preston, M.A., F.M.S.

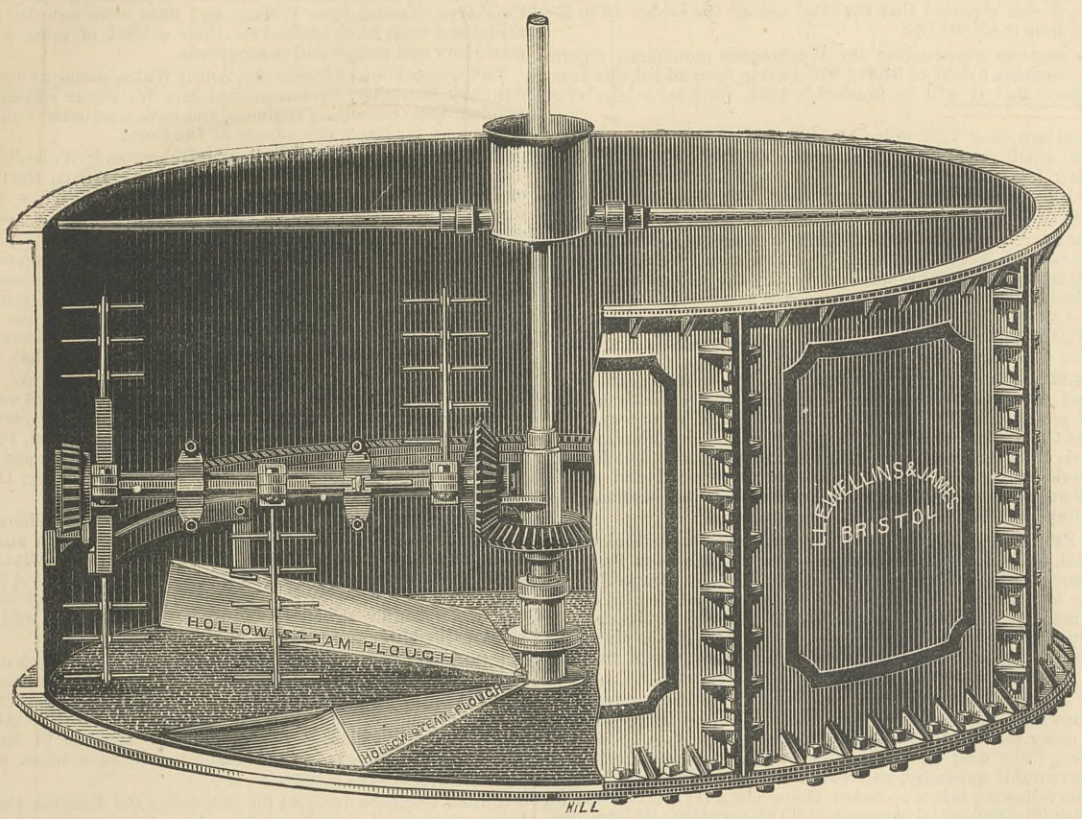
PATENT HOT BLAST STOVE.

DESIGNED BY MR. T. F. HARVEY, DOWLAIS.

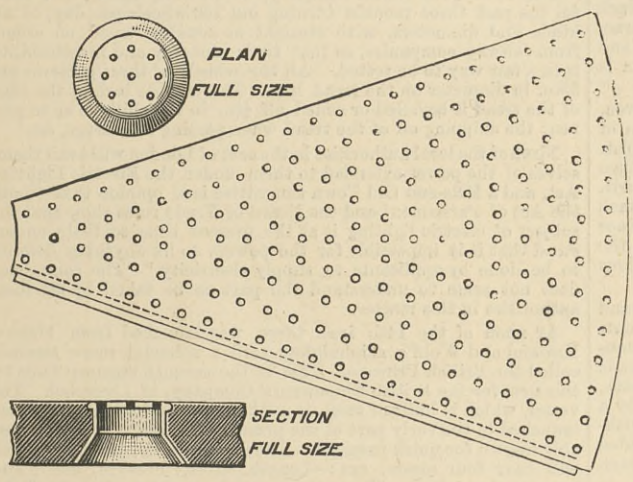
(For description see page 482.)



CAVE'S MASH TUN FOR RAW GRAIN AND MALT.



IN a recent notice of the Brewing Exhibition, reference was made to the mash tun exhibited by Messrs. Llewellin and James, of Bristol. This tun we illustrate above. It is adapted for mashing either malt alone or malt in conjunction with raw grain, and produces a complete conversion without the aid of any



acid or reagent, or of any converter or extra plant. To a hollow vertical shaft are attached two hollow copper ploughs or rousers. From the hollow shaft either steam or cold water is admitted into these hollow ploughs as required to control the heat. The ploughs in the bottom of the tun scrape the false bottom plate, and thoroughly mix the raw material with the malt. Thus, by the admission of steam to the rotating ploughs the temperature can be raised to a boiling point, which is necessary for bursting the starch cells, and by shutting off the steam and admitting cold water to the ploughs the temperature can be readily reduced. In using this tun, maize or other raw grain with a very small proportion of malt are mashed together at a low initial temperature. Steam is then admitted into the ploughs, raising the temperature of the mash to a certain point at which it is for a short time allowed to stew; the heat is then raised to boiling point, and the mash is boiled for a short period in order to burst the starch cells. The steam being then shut off, cold water is admitted to the ploughs, which quickly reduces the temperature to the normal mashing heat. A small additional quantity of malt is then mashed in the usual manner. By this arrangement the brewer has perfect control over his heats, without fear of injury to his mash, as in the case of steam jackets or coils. These steam ploughs and fittings can be adapted to existing mash tuns, whether wood or iron. They have been in operation in several breweries for many months past, and beers brewed by aid of them even in the hot weather have turned out most satisfactory. The mash tun was fitted with Cave's patent false bottoms, which we illustrate by the annexed detail engravings, showing the thimble in plan and section. These bottoms are made of cast iron, with holes about $\frac{1}{8}$in. in diameter, lined with inserted copper thimbles perforated at the tops. By this means strong false bottoms may be used, and yet the perforations through which the wort is strained may be very small. Similar copper inserted false bottoms are made for existing tuns and hop backs.

AYRTON AND PERRY'S DYNAMOMETER.

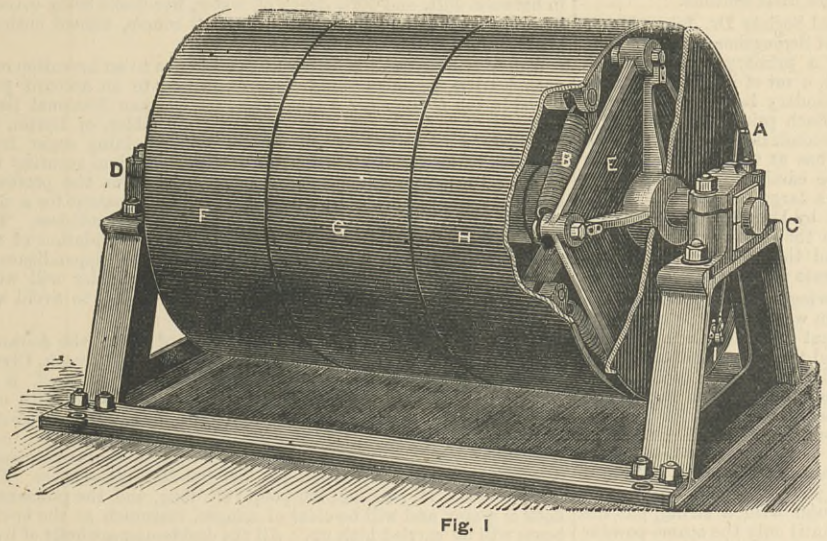


Fig. 1

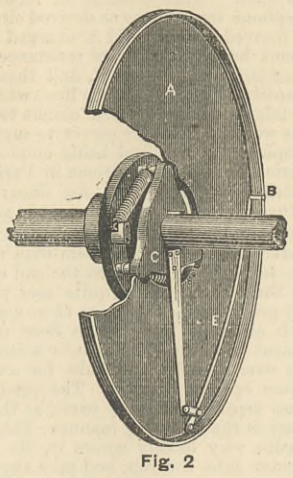


Fig. 2

SOME time since—in THE ENGINEER, 5th August, 1881—we gave a diagram showing the principle of this dynamometer, the invention of Messrs. Ayrton and Perry. The accompanying engraving shows it as worked out practically and made by Mr. A. R. Sennett, Hatton-garden, London. It is for the purpose of measuring the power transmitted by belting from one machine to another. F is a pulley rigidly fixed to the shaft C D, turning in two plummer blocks carried by A frames resting on the floor or by brackets fastened to the wall; *g* is a loose pulley, and H is a pulley loose on the shaft but joined by the spiral springs B to a ribbed plate E, which is rigidly fixed to the shaft C D. The engine belt is put on F, and the belt to the dynamo electric or other driven machine on H, or *vice versâ*; hence the pull to drive the machine is transmitted through the spiral springs, which are consequently stretched, and the amount of stretch measuring the twisting force transmitted. To measure this stretching the following device is employed—An arm fixed to the plate E on a small link motion, seen at the right hand lower corner of the figure, and which causes a bright bead A at the end of the left arm to approach towards the centre. Consequently the radial motion of the bead A records on a magnified scale the extension of the spiral springs. As the bead revolves a bright circle of light is seen, the radius of which diminishes as the pull on the springs is increased. Hence the horse-power being transmitted at any moment is at once known by observing on a fixed graduated scale supplied with the instrument the radius of the circle of light described by the bright revolving bead and the speed of rotation.

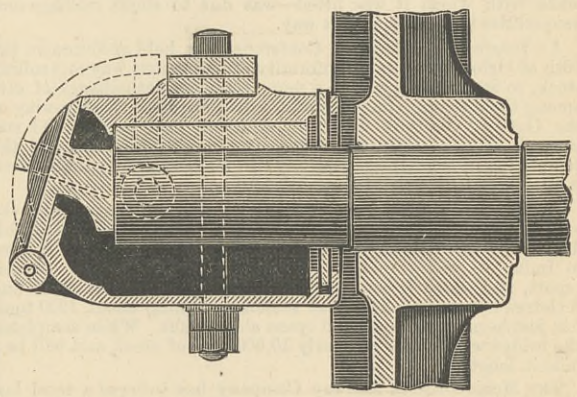
To obtain great delicacy for powers varying within certain limits from that normally transmitted, the arm carrying the bead is made slightly flexible, so that when no power is being transmitted, the bead is pressed with a certain force against the rim of the front plate, hence the plate does not commence moving until a certain pre-arranged horse-power at a given speed is being transmitted, and its whole radial motion therefore is completed for a certain additional transmitted horse-power, the necessary addition depending on the power of the springs and the leverage of the circle motion. Consequently a large change in the radius of the circle of light is produced by a small change in the transmitted horse-power.

Further, one of the pins in the links can be taken out and put into another hole, which has the effect of greatly altering the leverage of the links, thus increasing the magnification and causing the motion of the bead to be completed for another range of power—for example, the springs and link motion may be arranged so that with one of the adjustments the bead may commence to move when 8-horse power is being transmitted, and may complete its whole motion from the circumference to the centre, when this transmitted horse-power varies from 8 to 12. With the adjustment, the bead may start moving when 4-horse power is being transmitted, and the entire travel of the bead from circumference to centre completed by the transmitted horse-power increasing from 4 to 6.

Fig. 2 shows a dynamometer coupling. The plate C carried by one of the shafts of the coupling is attached to the plate carried by the other by means of the spiral springs, and the stretching of these is therefore a measure of the transmitted twist. The angular motion of the one plate C relatively to the other causes the bright bead B to approach the centre, and as before, the radius of the circle of light measures the horse-power transmitted at any particular speed. The arm E carrying the bead is also, as before, slightly flexible, so that when no power is being transmitted the bead B is pressed with a certain force against the rim of the larger plate.

THE RAOUL AXLE BOX.

THE accompanying engraving illustrates an axle box which is now being used a good deal in the United States. It will be seen that the objectionable shoulder is got rid of; the axle is

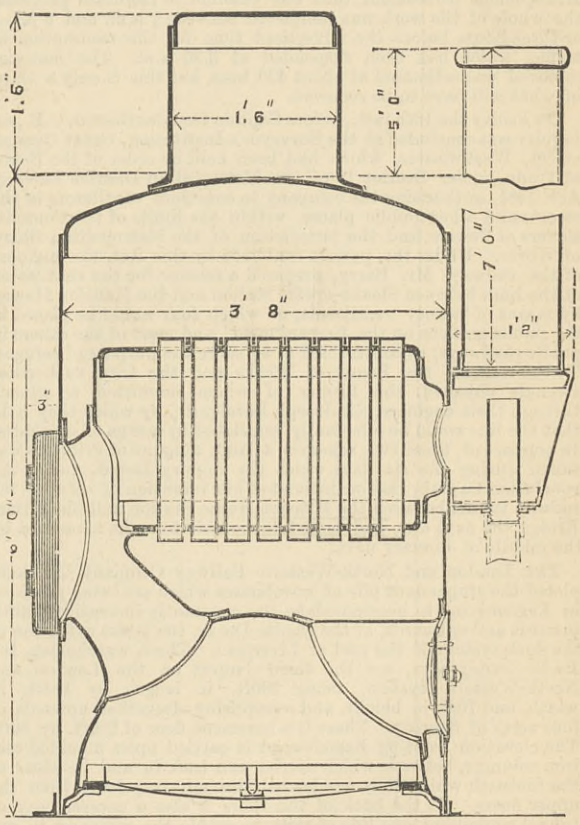


end stopped, the stop being secured with a removable clamp. The journal may be made any desired length and diameter. It is claimed that the life of the axle is doubled, the expense of brasses and lubricants enormously reduced, and wear of brasses, and hot-boxes obviated. It is now in successful operation on trucks of engines, tenders, passenger and freight cars. It is manufactured by the Ramapo Wheel and Foundry Company, Ramapo, N.Y.

MARSTON'S PATENT VERTICAL BOILER.

WE illustrate by the accompanying engraving a 16-horse power vertical boiler, used to supply steam for machinery in motion at the recent North-Eastern Marine Exhibition. Its construction will be understood at a glance. The advantages claimed for this boiler are: (1) That there is a large amount of effective heating surface in a small space with a perfect circulation of the water, thereby minimising the tendency which these small boilers have to prime; (2) every part where deposit or incrustation is likely to take place is thoroughly accessable; (3) the ends of the tubes

SECTIONAL ELEVATION



are not exposed to the action of the fire, which is the case with most boilers of the class, and which is the fruitful source of endless trouble and expense; (4) the perfect circulation of the water continually washing the interior of the tubes, the tendency to corrode and wear out is entirely obviated, and thus the tubes will practically last as long as any other part of the boiler; provision is, however, made for readily replacing any of the tubes should it become necessary; (5) the fire-box is made entirely without rivets or overlapping joints, and of a form capable of resisting a very great pressure; (6) by the arrangement of the tubes the gases are divided into thin sheets, and are rendered very effective by having to travel by a circuitous route to the smoke box. We have no information as to the evaporative powers of this boiler.

RAILWAY MATTERS.

The Mysore Government have sanctioned the construction of a tramway from Mercara to the capital of the State, a project which will have the effect of bringing the coffee districts into communication with Bangalore by rail.

Experiments on lighting trains by electricity are being made on the Paris, Lyons, and Mediterranean Railway, with, it is said, an A Gramme machine, Swan lamps, and thirty secondary batteries. The experimental train consists of two first-class carriages and two vans, the carriages and front van only being lighted—so far, it is said, with success.

A provisional committee, with Mr. Charles Boysset, vice-president of the French Chamber, as president, has been formed for organising an international exhibition of appliances calculated to ensure the safety of railway passengers, to be held in the Palais de l'Industrie, Paris, in 1883. The three classes of objects to be admitted are:—Systems of coupling, arrangements of signals, and various brakes.

The steam engine is about to be introduced on the new three-mile tramway connecting Birmingham and Aston. Major Hutchinson has recently inspected both the line and the engine. The latter is supplied by Messrs. Kitson and Co., engineers, of Leeds, and at the trial was driven by the Hon. R. G. Parsons, a member of the firm. In speed, noiselessness, and steadiness, our Birmingham correspondent says, it surpassed expectations.

From the report of Major Marindin on the derailment of the Great Eastern down express engine and train, near Helpringham, on the Great Northern and Great Eastern Joint Railway, on the 25th October, it appears that the accident—which resulted in injury to fourteen persons, and would probably have been a most disastrous accident had it not been for the continuous air-pressure brake with which it was fitted—was due to slight sinkings and inequalities in the permanent way.

An International Railroad Conference was held at Berne on the 16th of October to obtain uniformity of permanent way and rolling stock, so as to make possible a more complete interchange of cars among the different countries of Central Europe. The opening of the Gothard Railway makes it desirable that cars should run through between Italy and Germany across Switzerland, and the completion of the Arlberg Railway will make interchanges between Austria and Switzerland almost necessary.

Our Birmingham correspondent says:—"Prominent among the valuable contracts upon which the constructive engineers of this district are just now engaged is the steel bridge to span the Ganges, in India, to which reference has previously been made in this report, and which is being manufactured by the Patent Shaft and Axletree Company. The first section, weighing about 1200 tons, has just been turned out, and spans about 320ft. When completed the bridge will consist of nearly 10,000 tons of steel, and will be a mile in length."

The Moscow-Kursk Railway Company has suffered a total loss of not less than half a million roubles by the catastrophe at Mzensk, according to the computation of the *Hamburger Nachrichten*. One quarter of this sum is loss of traffic, and a like proportion is represented by the sums paid to other railway companies for the transport of goods during the temporary interruption of traffic. There were thirty-five compensation claims settled for a total sum of 38,000 roubles, while the cost of reconstruction makes up the balance of the sum named.

On Sunday morning the big wall at the Central Station, Liverpool, running from Newington Bridge to the tunnel mouth, fell, with a large quantity of the material behind it, on to the rails and station platform, and so large was the quantity of material that several hundred men hard at work for about fifteen hours only cleared one line. The Bijou Opera House has been closed in consequence of the possible danger to which it and other buildings on the soft sandstone retained by the wall are subjected. The remaining part of the wall has been strutted, but it is likely that a good deal will have to be taken down, unless the back pressure can be relieved by piercing the walls or by other means.

The extensive alterations and additions that are taking place at the New-street station, Birmingham, of the London and North-Western Railway, have already involved the removal of about 77ft. of the north tunnel extending from the Navigation-street Bridge. Sunday, the 18th inst., was selected for this operation, and by the employment of between 300 and 400 men, and making every arrangement beforehand that was possible to facilitate progress, the whole of the work was completed between 7 a.m. and 6 p.m., or three hours before the advertised time for the resumption of traffic, which had been suspended at 3.30 a.m. The material removed was estimated at about 400 tons, but this is only a third of what will have to be removed.

On Friday the 16th inst., before Captain Douglas Galton, C.B., an inquiry was concluded at the Surveyor's Institution, Great George-street, Westminster, which had been held by order of the Board of Trade, under Section 12 of the Metropolitan District Railway Act, 1881, authorising the company to construct ventilators in the streets and other public places, within the limits of the Commissioners of Sewers and the jurisdiction of the Metropolitan Board of Works. Under the powers conferred by this Act, the engineer of the railway, Mr. Barry, prepared a scheme for the ventilation of the lines between Sloane-square station and the Mansion House, by means of twenty ventilators, of which four would be placed in the public gardens on the Embankment, and most of the others in public roadways, so constructed as to serve the purpose of refuges. To this scheme the Board of Works and the City authorities strongly objected, the former of whom submitted a scheme through their engineer, Sir Joseph Bazalgette, by which they held that the line could be effectually ventilated by means of six shafts. In support of these two schemes a large amount of evidence was taken during the six days which the inquiry lasted, and at the conclusion Captain Galton intimated his intention of viewing the railway tunnel between the Mansion House Station and Blackfriars Bridge the next day, and hoped to be able to make his award by the middle of January next.

The London and North-Western Railway Company has completed the stupendous pile of warehouses which are being provided in Regent-road to accommodate the constantly-increasing traffic, inwards and outwards, of the Bootle Docks, the latest extension of the dock system of the port of Liverpool. These warehouses, the *Bootle Times* says, are the third largest on the London and North-Western system, being 290ft. in length by 155ft. in width, and 70ft. in height, and comprising altogether upwards of four acres of flooring. There is a basement floor of 280ft. by 50ft. The elevation fronting Regent-road is carried upon moulded cast iron columns, between which lorries can back in and be clear of the footpath whilst they are loaded through trap-doors from the upper floors. At the back of this there is also a covered way or tunnel containing one line of rails, to enable the company to run goods trains from the warehouses to their land on the other side of Church-street. At the back of the tunnel is a paved roadway 48ft. wide with trap-doors over, so that lorries may load or discharge under cover through trap-doors communicating with every floor. Then comes a platform over the basement, 290ft. by 50ft. in extent, specially designed for storing tin and other valuable metals which would be injured by exposure. Past this platform is a road with two lines of rails, with crossings and turntables at each end, and from the wagons on these lines goods will be hoisted to the upper floors. There are 700 tons of cast iron columns and stanchions, and 2600 tons of wrought iron girders, the number of girders being 3200. Hydraulic machinery for the purpose of raising and lowering goods is fixed in the roof, and on the platform floor there is a series of cranes. The manipulation of railway trucks and wagons from one part to another, and in and out of the warehouse, will be effected by means of hydraulic capstans, of which there is a great number.

NOTES AND MEMORANDA.

At the November meeting of the trustees of the East River Bridge, it was reported that the total cost of the bridge up to the present time is £2,809,136.

The engineer constructing the Washington monument reports that it reaches a height of 340ft., 90ft having been added this year. He expects that it will be finished in 1884, the total height being 550ft.

There are now 828¾ miles of water mains for the supply of London which are constantly charged. Of these the New River Company has 214 miles; Lambeth, 136½; Southwark and Vauxhall, 117; West Middlesex, 86½; Kent, 85; East London, 85; Chelsea, 67; and Grand Junction, 37½ miles.

From the report of the United States Commissioner of Agriculture it appears that 2,500,000 packages of seeds have been distributed, and 260,000 copies of special reports printed by the department. The statistical division estimates the following as the yield of 1882:—Corn, 1,635,000,000 bushels; wheat, 400,000,000 bushels; oats, 470,000,000 bushels; barley, 45,000,000 bushels; rye, 20,000,000 bushels; and buckwheat, 12,000,000 bushels.

Rubber packing may be made steam and air-tight, the *Engineering and Mining Journal* says, by brushing it over with a solution of powdered resin in ten times its weight of strong water of ammonia. At first this solution is a viscid, sticky, mass, which, however, after three or four weeks, becomes thinner and fit for use. The liquid sticks easily to rubber, as well as to wood and metal. It hardens as soon as the ammonia evaporates, and becomes perfectly impervious to liquids.

Dr. Russell, of the Chemical Laboratory at St. Bartholomew's Hospital, a member of the committee which has been for some time carrying on extensive experiments on the composition of London fogs, at the request of the Meteorological Council of the Royal Society, states that he has already obtained results showing that the increase in the amount of carbonic acid in the air of the City during fogs in some cases amounted to upwards of two and a-half times the quantity ordinarily present.

The relative longevity in various occupations has not yet been made out from the census returns of 1881. In 1851 it appears that out of every thousand persons between the ages of twenty-five and fifty-five, forty died on an average. Classified according to the most favourable mortality, and increasing downward the returns gave the following tables:—Below the average (1) merchants; (2) weavers; (3) cobblers; (4) carpenters; (5) blacksmiths; (6) labourers. Above the average: (7) miners; (8) tailors; (9) bakers; (10) butchers; (11) liquor dealers.

For a black aniline ink, the "Journal" of the Society of Chemical Industry gives the following:—Dissolve 5 parts nigrosin in 100 parts water, and if the solution is very blue add a few drops of an aqueous solution of Bismarck brown. With the addition of 5 per cent. of glycerine it becomes a copying ink. For a black lacquer for leather dissolve best shellac, 40 grammes; sandarac, 10 grammes; mastic, 5 grammes in ½ litre methylated spirit, and add 20 to 30 grammes pure Venetian turpentine. The solution is coloured a deep black by adding nigrosin.

For waterproofing brick walls the following has been given. Dissolve soft paraffine wax in benzoline spirit in the proportion of about 1 part of the former to 4 or 5 parts of the latter by weight. Into a tin or metallic keg place 1 gallon of benzoline spirit, then mix 1½ lb. or 2 lb. wax, and when well hot pour into the spirit. Apply the solution to the walls whilst warm with a whitewash brush. To prevent the solution from chilling, it is best to place the tin in a pail of warm water, but on no account should the spirit be brought into the house, or near to a light, or a serious accident might occur.

At a recent meeting of the Académie des Sciences, M. Bertrand reported that he had been present with M. Du Moncel at experiments which appeared to absolutely confirm the correctness of the law formulated by M. Marcel Duprez, viz.:—(1) The intensity of an electric current remaining the same, whatever be the speed of the motor, the static effort does not change; and (2) in a machine worked by a current, the speed may be doubled, quadrupled, or decupled, without the intensity of the current varying. M. Du Moncel added that during the experiments the resistance of the circuit had been varied without changing the intensity of the current.

At a recent meeting of the Paris Academy of Sciences a paper was read on "The Range of Sounds in Air," by M. Allard. Experiments with different instruments yielded the result that the intensity of sound in air decreases much more rapidly than according to the law of the square of the distance. The second cause of enfeebleness is considered to lie in the non-homogeneous character of the air. A given sound may have, apart from the influence of wind, very different ranges, varying, *e.g.*, from two to twenty nautical miles. For small augmentations of range the work required increases very rapidly. The differences of range for different pitches within the octave are little sensible.

At a recent meeting of the Physical Society Dr. James Moser read a paper on "A General Method of Strengthening Telephonic Currents." This consists in forming a primary circuit of the telephone transmitter or derived circuit, a set of induction bobbins in derived circuit, and a charged secondary battery, the whole circuit having a very low resistance. Each primary bobbin has a secondary wound over it, and these secondaries are connected in quantity to the telephone line, which has at its remote end a set of telephones in derived circuit to the earth or return wire. In this way one line wire serves to supply a large number of separate telephones, a hundred being employed by Dr. Moser to transmit music from the Hippodrome in Paris to the Place Vendôme. The system is applicable to long lines; and the induction noises are reduced by subdivision among the separate telephones.

For making luminous paint the following has been given:—Take oyster shells and clean them with warm water; put them into the fire for half an hour; at the end of that time take them out and let them cool. When quite cool pound them fine, and take away any gray parts, as they are of no use. Put the powder in a crucible with alternate layers with flour or sulphur. Put on the lid and cement with sand made into a stiff paste with beer. When dry put over the fire and bake for an hour. Wait until quite cold before opening the lid. The product ought to be white. You must separate all gray parts, as they are not luminous. Make a sifter in the following manner: Take a pot, put a piece of very fine muslin very loosely across it, tie around with a string, put the powder into the top, and rake about until only the coarse powder remains; open the pot and you will find a very small powder. Mix into it a thin paint with gum water, as two thin applications are better than one thick one. This will give a paint that will remain luminous far into the night, provided it is exposed to the light during the day.

An important agricultural and manufacturing industry is about to be developed in the Western States of America, namely, the cultivation of flax and manufacture of the fibre. The area planted to flax in the Western States in 1881 was 1,127,300 acres, divided as follows:—Iowa, 287,400; Indiana, 193,400; Kansas, 160,900; Illinois, 160,300; Minnesota, 95,200; Ohio, 80,600; Missouri, 55,000; Nebraska, 50,000; and Wisconsin, 44,500. Yet upon all this area no merchantable flax fibre was produced, the flax being burned or allowed to rot. The yield of seed was about 8,000,000 bushels, valued at about eight millions of dollars. The total acreage of flax in Europe, where the fibre is utilised, amounted, the *Times* says, in 1880, to 3,334,329, and the value of the fibre produced to 108,408,000 dollars. The average money yield per acre in flax-seed, therefore, in the Western States, was only about seven dollars, as against an average yield in Europe for fibre alone of thirty-two dollars. Belgium, on an area one-eighth as great as that given to flax in the Western American States, annually produces 1,000,000 dollars more; and France, with one-seventh of the area, produces annually 3,000,000 dollars more.

MISCELLANEA.

At the Cornwall Mining Institute Exhibition, held lately at Camborne, Messrs. John Warner and Sons were awarded a silver medal and were much praised for their exhibit of mine pumping machinery and pumps and mining tools.

The Corporation of Pembroke, South Wales, acting as the Urban Sanitary Authority, have appointed Mr. W. Barns Kinsey, C.E., London, their consulting engineer, and have instructed him to prepare plans for the water supply of the town.

The promoters of the Dudley, Sedgley, and Wolverhampton Tramway have decided to appeal to Parliament from the decision of the Board of Trade refusing the use of steam. They will ask for the employment of "mechanical power" for seven years, the speed not to exceed ten miles an hour.

The draft of a copyright convention has now been agreed upon between France and Germany, who have been represented in Berlin by special Commissioners; though it will be some time before the convention is complete. It seems that one of the chief difficulties was the question of translations, about which Germany was inclined to take a more indulgent view than France.

During the year 1882 Messrs. Raylton Dixon and Co., Cleveland Dockyard, Middlesbrough, have launched eighteen vessels of a gross tonnage of 27,249 tons and 2755 nominal horse-power. The average of fourteen screw steamers gave 1822 tons gross, 180-horse power; one gun vessel, 1000 tons displacement, 200-horse power; two hopper barges, 313 tons each; one paddle steamer, 118 tons, 40-horse power.

During a recent tornado in Brewer, Me., a plank was blown with such force against a cistern with wooden walls an inch and a-half thick, that the board, the *Scientific American* says, penetrated some distance through the wall into the water. It was found that the board was wedged in so closely that the water did not leak, and the owner simply sawed the plank off, leaving the wall of the cistern all right.

Early on the morning of the 21st inst., while a batch of about twenty-five miners were being raised out of a coal pit near Dortmund, the rope broke, and the cage containing the workmen fell to the bottom of the shaft—a distance of 1800ft. All were instantaneously killed. The calamity is ascribed to the overweighting of the cage, which ought not to have taken up more than twenty men at a time.

Three immense dredgers for excavating the Panama Canal are being constructed at Philadelphia. One was launched last week. It is believed that this is the largest dredge in the world, being 100ft. long, 60ft. in breadth, and 12ft. in depth. It is named "Count de Lesseps." The second of these boats will be launched in February, and the third in March next. They will cost, with their machinery, altogether £80,000.

The Griffin Car Wheel Company, of Detroit, Mich., has been for the past three months turning out 150 wheels per day, of all kinds and diameters, with straight or coneless tread, on orders from railway companies, so that their economy and practicability is in a fair way to be tested. All the wheels of these patterns are 33in. in diameter on the tread line. The outside inch of the edge of the tread is bevelled or coned off ½in. in the chill, so as to prevent the chipping off of the tread when passing over frogs, &c.

None of the local authorities in the east of London will avail themselves of the power extended to them under the Electric Lighting Act, and a Mile-end Old Town committee is of opinion that "both the Act of Parliament and the Board of Trade rules show that the subject of electric lighting is at the present time so little understood that it is impossible for the powers to fix anything definite to be done by applicants to supply electricity." The committee does not seem to understand the part to be taken by the local authorities in this matter.

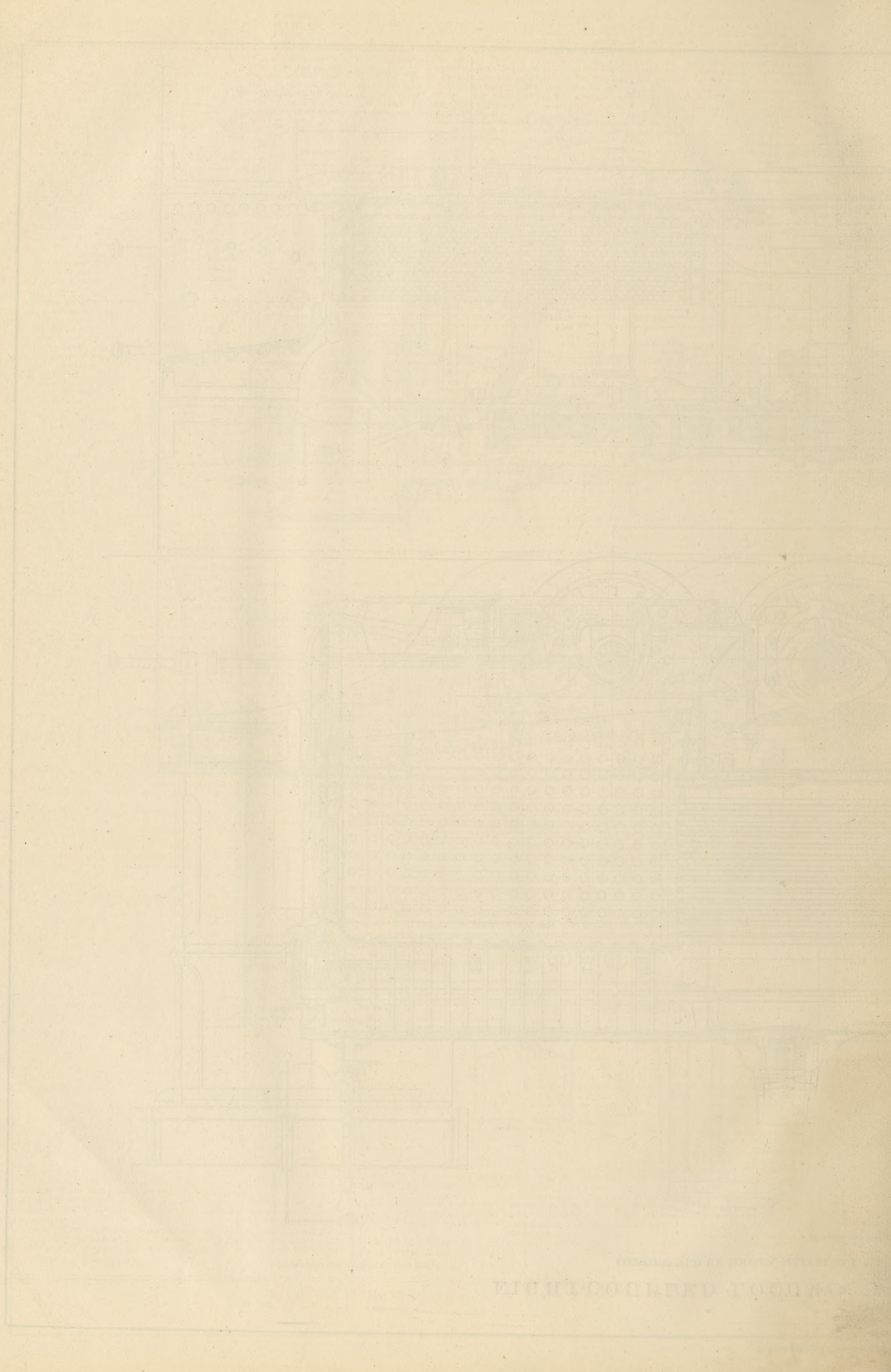
At noon of the 14th inst. there was launched from Messrs. Harland and Wolff's shipbuilding yard a splendid screw steamer called the British Princess. This is the seventh steamer built by this firm for the British Shipowners' Company, of Liverpool. The vessel, which is built of steel, is a sister ship to the British Prince, launched in the early part of the present year, and already favourably known for quick passages. The dimensions of the ship, which will have four masts, are:—Length, 420ft.; breadth, 42ft.; and tonnage about 4000. The engines and boilers have been made by the builders. She is to trade between Liverpool and Philadelphia.

Speaking of the sinking of the Austral, the Adelaide *Evening Journal*, of November 11th, says:—The Austral has been busily coaling for some time from lighters moored alongside of her. The coal, however, had been placed in the bunkers on the starboard side, which gave the vessel a list, and as the weight gradually increased the water rose nearer to her lower port-holes. These were, unfortunately, left open, and immediately they reached the level of the water a torrent poured into her, which no human skill could counteract. The vessel gradually filled and settled down in between 40ft. and 50ft. depth of water, her decks being covered by probably 2ft., and her masts being, of course, almost entirely above water.

A curious dispute has arisen in Germany as to an invention connected with the sugar industry. According to an account published in the *Hamburger Nachrichten*, the German National Bank some time ago purchased from Professor Scheibler, of Berlin, for 1,000,000 marks—£50,000—a process for obtaining sugar from molasses by means of strontianite; at the same time securing the right of the first offer of such further discoveries as the professor might make. He has now, it is said, taken out a patent for a new process which renders the previous one almost worthless. The bank has commenced legal proceedings for the invalidation of the new patent instead of acquiring it by a further expenditure of capital. It has been rumoured that Professor Scheibler will work the patent himself instead of selling it, thus trying to avoid any serious difficulty.

On Tuesday, the 26th inst., a new Cunard liner, the Aurania, was launched from the yard of Messrs. J. and G. Thomson, Clydebank. The new vessel, which is built entirely of steel, is of 7500 tons gross register, is 470ft. in length, 57ft. in breadth, and 39ft. in depth. She has eleven water-tight bulkheads, all carried up to the deck. She will carry enormous sail, and will be independent of steam should accident render such a course necessary. She will have accommodation for 500 first-class passengers. Her forecastle is 97ft. long and her poop 74ft. long, and the promenade deck is roomy and will be clear of danger, inasmuch as the twelve boats will be carried high up. All the deckhouses are built of iron, and all the openings to the engine and boiler-room are protected by double casings. The ship will be lighted by 600 Swan electric lights, and the propelling engines are capable of developing about 10,000 horse-power. The vessel, when launched, was named by the Countess of Eglinton.

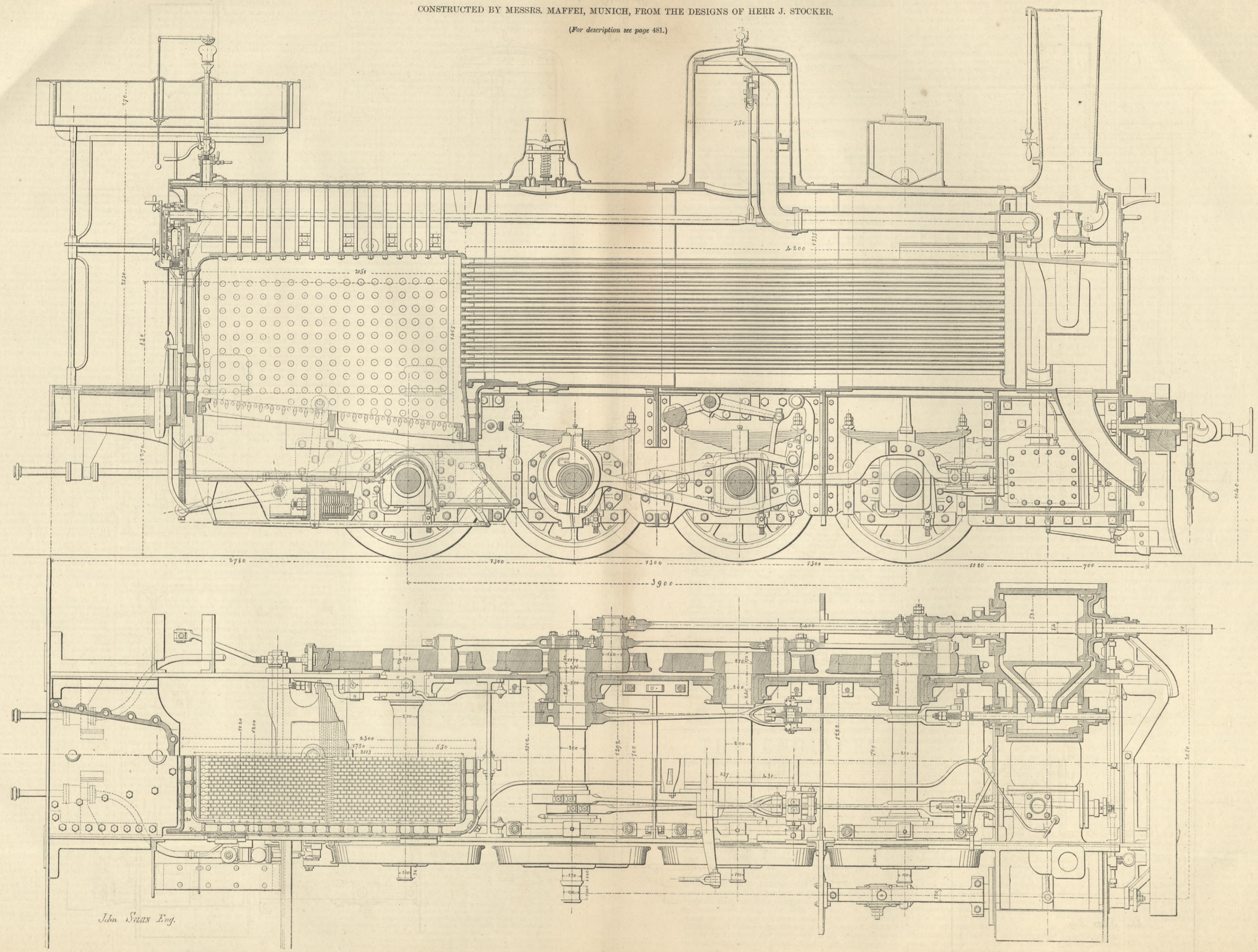
"I have been told," said Mr. Dubious, watching the great steam hammer in the rolling mill, "that a good hammerman can break the crystal of a watch with that thirty ton hammer." "Yes, sir," said the hammerman, "it can be done." "I should like to see it," said Mr. Dubious, eagerly, feeling in his watch-pocket. "I can do it, sir," replied the man." "And will you?" replied Mr. Dubious, drawing out his watch. "Come, I am anxious to see it tried." He laid his watch on the great anvil plate. The hammer rose up to its full height and the next instant all its ponderous weight, with a crashing force that shook the ground for an acre round, came down on that watch. "There, sir," said the hammerman, quietly, "if you don't believe that crystal is broken, just stoop down and you can see it sticking to the hammer." Mr. Dubious swallowed a whole procession of lumps and gasps before he could speak. "But I forgot to say," he exclaimed, "that it was to break the crystal without injuring the watch." "Oh, yes," said the hammerman, "yes, I know I have heard that rubbish myself, but it's all gammon. I don't believe it can be done. But you can break the crystal every time."—*Burlington Hawkeye.*

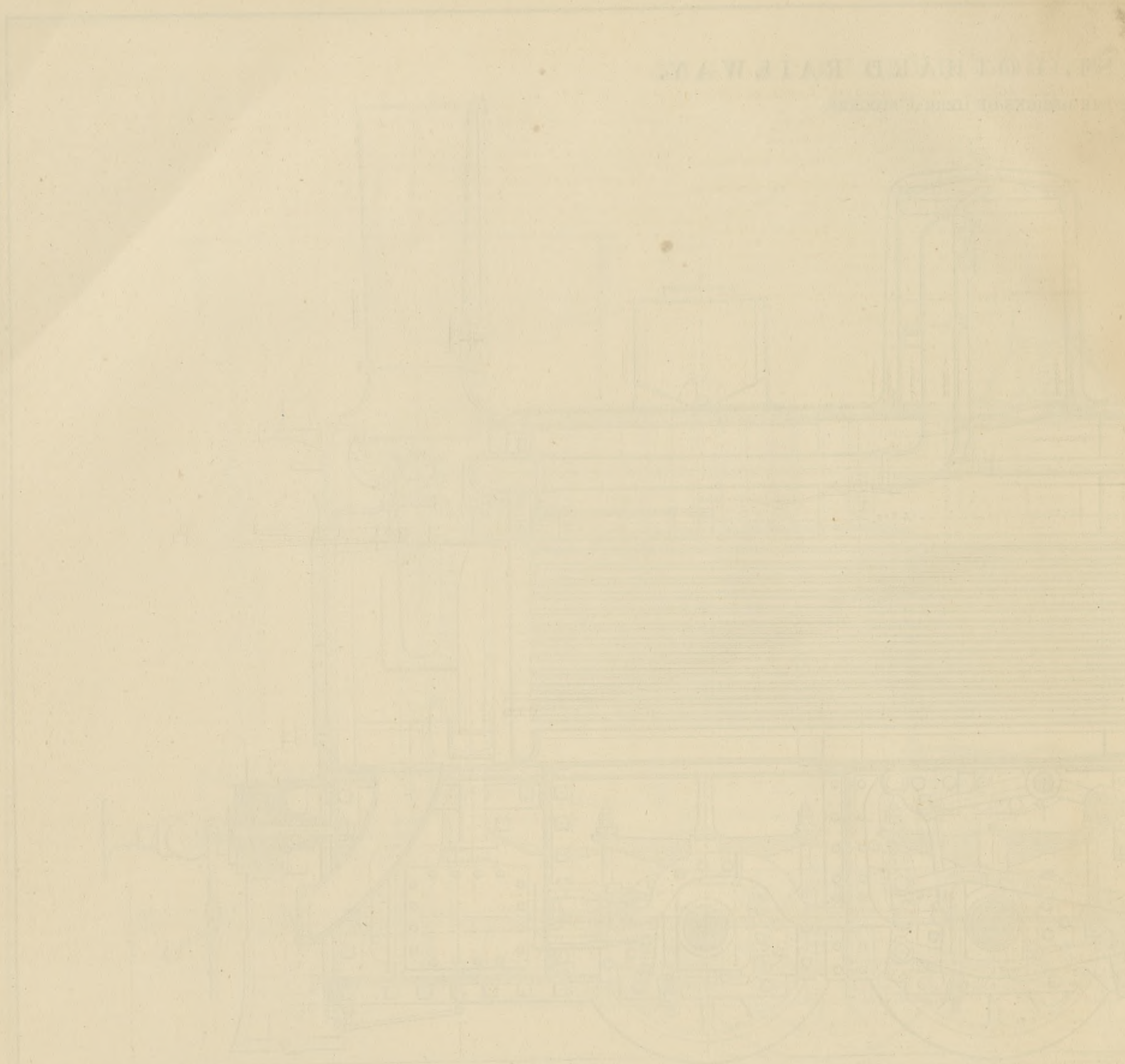


EIGHT-COUPLED LOCOMOTIVE, ST. GOTHARD RAILWAY.

CONSTRUCTED BY MESSRS. MAFFEI, MUNICH, FROM THE DESIGNS OF HERR J. STOCKER.

(*For description see page* 481.)





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TO CORRESPONDENTS.

*** *In order to avoid trouble and confusion, we find it necessary to inform correspondents that letters of inquiry addressed to the public, and intended for insertion in this column, must, in all cases, be accompanied by a large envelope legibly directed by the writer to himself, and bearing a* 1*d. postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

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C. F. (Enschede).—*Send your full address, and we will communicate with you through the post.*

E. M. (Llanelly).—"*The Slide Valve,*" *by J. Rose, 5s.* "*Treatise on Designing Slide Valve Gearing,*" *by E. J. Cowling Welch, 6s.*

J. G. W.—*Your lock nut is extremely simple and ingenious. So far as we are aware it is entirely new. Its defect is that it will not permit the nut to be got off or slackened for any purpose without injury. For certain classes of work, however, this is not a defect.*

R. A. M.—*Your inquiry was not noticed until this week owing to its being enclosed in a second copy of the* "*Gas Consumers' Manual.*" *The methods usually adopted are* (1) *obtaining the velocity of the air by placing an anemometer in air way or fan shaft, the sectional areas of either of which is known;* (2) *calculating the velocity corresponding to the pressure indicated by a water-pressure gauge.*

Aluminium.—*In an article on this subject in our impression of the* 15*th Dec., line* 25 *from top, the word alum should be read in place of aluminium.*

HEATING APPARATUS FOR CHURCHES.

(*To the Editor of The Engineer.*)

Sir,—I shall feel obliged to any of your readers who will recommend me the best mode of heating a church 60ft. by 40ft. by 28ft., situated in a district where frost is exceptionally severe, sometimes registering 5½ deg. below zero. Enquirer.

December 22nd.

RAG-CUTTING MACHINE.

(*To the Editor of The Engineer.*)

Sir,—I want a machine for cutting up old rags into very small pieces. A devil will not do, as it leaves the rags in shreds, which hang together. Can any of your correspondents tell me whether there is a machine made suitable for the purpose? W. W.

London, December 27th.

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

THE ENGINEER.

DECEMBER 29, 1882.

FLYING MACHINES.

Last week we noticed a curious little book by an author who has not thought good to make his name public. We have said of this book that it is a prose poem, and this we think may be held of a great deal that has been written concerning flying. In all ages man has desired to emulate the bird. Indeed, it would not be too much to say that for five thousand or six thousand years he has been trying to fit himself with wings which will carry him through the air. Persistent failure has attended every enterprise of this kind; and the hopes which have been formed that the constructive powers possessed by modern engineers would solve the problem have all been disappointed. We are probably no nearer to flying now than we were a thousand years ago; yet the questions unsolved are not without interest, and it may even serve a good purpose if we place before our readers a few truths which are constantly overlooked by labourers in this particular path of mechanical enterprise.

It is generally assumed that because birds can fly men ought to be able to fly. The operations effected by the bird are just as mechanical as those of the man who walks on dry land or swims in the sea. If only we could perceive precisely what it is a bird's wings do, then we could fly. Now, this seems to us to be a very specious and shallow argument. It is not probable that there is anything occult or mysterious about the action of a bird's wing. So far as the slower birds, such as the rook, are concerned, it is very easy to watch every movement of the wings, and we believe it is more than probable, not only that the wings of many model flying machines act just as do those of the rook or other birds; but that, as far as mere ascension is concerned, almost any species of wing action will serve. For example, we may cite the sixpenny toy called a "flying bat," which is nothing more than a very light screw propeller. This will rise nearly a hundred feet in the air if well made, flutter about for a while, and descend. The wing of a bird offers less resistance to the air when it ascends than it does when it descends; and furthermore it is quite probable that in all cases, and it is certain that in some cases, the down stroke is made far more rapidly than the up stroke, and produces thereby a stronger reaction. This seems to be the whole secret of wing action. When we come to deal with the elegances, as we may call them, of flight, we have to do with the idiosyncracy of the flyer. The rook may be said to resemble a heavy Dutch farmer, skating to and from market, in straight lines, while the swallow is like the most accomplished figure skater that it is possible to imagine; or, put in another way, we may compare varieties in styles of flying with varieties in gait. The hippopotamus, for example, can walk and even run—so can the deer. In both cases the processes, as a series of mechanical operations, are very similar; but from any other point of view they are quite different. We have no doubt that if men could once fly, we should soon have as many styles developed as there are men. If then, it may be urged, there is nothing mysterious about wing motion, and a simple up and down flapping will at least suffice to raise a bird in the air, why should not men fly? The answer is that they are not strong enough. If we consider birds as machines, we see in the first place that they are all comparatively small. There is no bird of flight which weighs as much as even a very light man; but there are many birds which are far stronger than men. The albatross, is, we believe, the largest—we do not mean the heaviest—bird of flight in existence. Its wings measure sometimes as much as 13ft. from tip to tip, but the total weight of the bird seldom if ever exceeds 28 lb., or one-sixth that of a powerful man. But the albatross can keep its wings in motion for a whole day, while the strongest man would be exhausted if he had to keep beating the air with them for half-an-hour. There are many birds with limited or no powers of flying which weigh much more; but we shall not be far wrong if we say that the maximum weight of any natural flying machine, which can fly well, does not exceed, say, 30 lb. Now this is a very important truth, because it goes to show that that is about the limit of weight beyond which the air cannot be utilised for bird flight. Nature does not make many mistakes; or, in other words, the conditions under which species are developed are such that everything goes as far as it can go in size and speed. If it cannot go further, that is because certain conditions interfere to prevent it. If it were possible, we should have birds much larger and heavier than the albatross, or the condor, or the eagle. We may rest certain that the roc of Eastern story is a mechanically impossible creature. The reason why huge birds do not exist is this: It is well known that the strength of every machine rapidly decreases as it increases in dimensions. Thus, for example, the crank-shaft and other parts of a model steam engine, if all made to scale, are immensely stronger than would be those of a similar engine made with the same proportions, and, say, twelve times the size. Let us apply this to the albatross, and suppose that its wing, instead of being some 6ft. long, was 12ft. long. All the bones being doubled in length would be doubled in weight; but they would also have to be at least doubled in strength, which represents another duplication; so that an albatross with a spread of wing of 26ft. instead of 13ft. must weigh, not 28 lb., but four times as much, or 112 lb. at the very least. Nor would the augmentation stop here, for the area of the wing would have to be altered. Merely to double its length would not suffice; its breadth must, *cæteris paribus*, also be doubled, and thus we have four times the area; but this would again double the strength or weight of the bones, and a very little calculation will suffice to show that a bird with a spread of wing of 28ft. could not weigh less than 2 cwt., instead of 28 lb. Next comes the question, is it possible to get as much power in proportion out of 2 cwt. as we can out of 28 lb.?

A great deal has been written from time to time about the effect of the wind on inclined planes in keeping birds afloat in the air. Those who have a competent knowledge of the laws of dynamics are, however, aware that the inclined plane action cannot alone keep a bird from falling to the ground. The action is at best just that of the wind on a kite; and the equivalent of the string must be provided or the bird will be carried away, just as a kite is when the string breaks. Birds, when sailing, are either going with the wind or are using up momentum acquired by previous rapid motion. The work done by the bird will vary continually; but it is strictly analogous to that of a swimmer, who, carrying a load, has to keep himself afloat by his own exertions. There is no way out of this. Nothing is got from the air in the way of help, save when upward currents strike the flying bird; and that such currents exist, every engineer who has seen the decking of a bridge lifted in a gale well knows. Returning then to our albatross, the work it does is equivalent to continually lifting 28 lb. The idea that the bird is buoyant in the air is a delusion. If it weighs dead 28 lb., it will weigh living 28 lb., and the variation in the displacement of the dead and living bird cannot represent more, at the most, than an ounce. In round numbers 13 cubic feet of air weigh 1 lb. The albatross therefore represents no less than $13 \times 28 = 364$ cubic feet of air, while its entire displacement is probably at most 4 cubic feet. An increase in dimensions of one-fourth when alive as compared with the same bird dead, would represent about $\frac{1}{300}$ of its weight saved by extra buoyancy, which is nothing. The weight of the bird then may be regarded in exactly the same light as the weight on a brake driven by a portable engine. The brake wheel is always trying to lift it up. The power expended is measured by the distance passed over by any point in the rim of the brake wheel in one minute, multiplied by the weight and divided by 33,000 per horse-power. Now, if we could tell the distance passed over by the bird's wings at each stroke, and the number of them, we should, knowing its weight, be able to estimate the power expended. We cannot do this in the case of the condor or albatross; but bearing in mind the small specific gravity of air, we shall not be very far wide of the mark if we say that an albatross probably possesses as much muscular energy as a man. The utmost load that a man working at a crane cradle can put forth for a day's work is 20 lb. at a crank handle making about 3ft. per second; and nearly all the muscles of the body are engaged in this work. It will be seen that if even half this work is got out of the very much smaller muscles of the albatross, the energy of the muscles—on whatever it depends—must be very much greater than it is in man. The pectoral muscles of the swallow weigh much more than all the other muscles in its body put together, and in all birds which fly well, it will be found that the muscles actuating the wings are relatively enormous in dimensions. But not only is this the case; the bird works at a higher pressure, if we may use the words, than any other animal. Its temperature is considerably above 98°, that of man and the mammalia generally; and all the swift birds live on food capable of giving out much energy while concentrated as to dimensions. Thus the swallows, eagles, hawks, vultures, &c., are all carnivorous. Again, it will be found that the arrangements for aërating the blood in birds are extremely complete, and this is one reason no doubt for their high temperature. In other words, we have in the bird a machine burning concentrated fuel in a large grate at a tremendous rate, and developing a very large power in a small space. There is no engine in existence, certainly no steam engine and boiler combined, which, weight for weight, gives out anything like the mechanical power exhibited by, let us say, the albatross.

It is then simply for lack of muscular power that man can never fly. There is no combination of wings or arrangements of any kind which will compensate for this fact. Whether he can produce a machine to supplement his own want of force remains to be seen. Such a motor cannot, we think, be driven by steam. It is, however, not impossible that a machine might be made which would be caused to fly by means of a small electric motor run at a very high speed and worked by the aid of a couple of wires from the ground. This, however, would hardly be flying in the true sense of the word. That wings and suchlike things can be made we have no doubt; and experiments enough have been made to prove that, if power enough be available, flight can be achieved. When a machine can be made, each pound of which will develope as much energy as each pound of a bird, flying may be possible—not till then.

PUMPING ENGINES.

At one time the relative merits and demerits of Cornish and of rotary pumping engines were keenly discussed. The subject has lost some of its interest, because the Cornish engine has been practically supplanted by the differential engine, invented by Mr. Henry Davey, and manufactured by Messrs. Hathorn, Davey, and Co., of Leeds. But this type of engine has not supplanted the rotary engine, and the relative merits of the two are still open to discussion, and are keenly contested. It is not our purpose here to pronounce an opinion on this part of the subject, but we think that something may be said with benefit in the way of explaining why the Cornish engine burns more fuel in performing a given duty than either of the other types of engine; and in doing this we shall indirectly explain to what the economy of the latter engines is due. In one word, rotating and differential engines are both more economical than Cornish engines, because they work with more expansion. It must be understood now that we are speaking of none but the best types of all three varieties of the pumping engine; but it will be found on analysis that the rotating and differential engines are not so superior to the Cornish engine as might be supposed when we consider how great is the difference in the range of expansion in the cylinders of each type. The Cornish engine usually worked with an initial cylinder pressure of about 40 lb. above the atmosphere. This was sometimes a good deal exceeded, but little advantage was derived from the use of steam of augmented density. The steam was usually cut off at nearly half-stroke, the expansion being about two-fold. A few engines worked with greater ranges of expansion, but not many; and before proceeding further it is well to explain, for the benefit of those not versed in Cornish engine practice, why expansion was kept down to such small ranges.

In the case of the Cornish engine the steam did little or no pumping during the indoor stroke. That is to say, while the piston was descending water might be raised by suction some 20ft. or so; but the bulk of the work done consisted in forcing the water up the rising mains, and with this the steam had nothing directly to do. The work of the steam was expended in lifting many tons of pump rods, and the descent of these rods forced the water up the mains. Thus the load on the engine was constant. The same spears had to be moved at every indoor stroke. In the case of an 80in. engine, for example, with a 10ft. stroke, working with 40 lb. steam, the gross pressure on the piston would be, at the beginning of the indoor stroke, about 120 tons, which would be reduced at the end of the stroke to 60 tons. The gross resistance to the piston could not exceed the average load on it, which would be about 96 tons. Allowing for friction and other resistances, the actual weight available for lifting water would be about 85 tons of pump spears, &c. But extra weight in the shape of balance bobs had to be added to equalise the motion of the engine. The velocity with which any

body will move varies, other things being equal precisely as the force varies. Thus we know that if the 85 tons of pump spears, of which we are speaking, were allowed to fall freely through, let us suppose, a drop of 16ft., they would acquire by the action of gravity—in other words, by their own weight—a velocity of 32ft. per second; but the steam in a Cornish engine plays the part of gravity, and if the pressure on the piston was just double the weight of the spears, or, say, 170 tons, the rods would rise with a continually increasing velocity, and if the stroke were 16ft. long and lasted one second the velocity acquired would be 32ft. per second, corresponding to 1920ft. of piston per minute, which is very much greater than could be tolerated in a Cornish engine. It will be seen, too, that every portion of the machine would have to be made to bear an extra strain, the work being expended in giving velocity to the pump spears, which velocity would be of no practical value as far as pumping the water was concerned. It will be understood from what we have said that if much expansion is to be employed in the Cornish engine heavy weights must be put in motion to prevent the piston from going indoors at first at a tremendous pace. As, however, the steam expanded, the pressure would fall rapidly, and the engine would have to depend for the completion of its stroke on the momentum of the moving spears. On their upward rush, in fact, would hang the whole working of the engine. If now there was no limit to the speed which they might be permitted to acquire, a Cornish engine might be made to work with a light moving load and a great range of expansion; but inasmuch as the speed must be kept down, it was essential to supply mass in the shape of balance bobs to absorb motion at one time and give it out another. In practice, however, it was found that to put 200 or 300 tons of wood and iron in motion and stop it again six or eight times per minute, involved a good deal of trouble and expense, and so it was considered best on the whole to work with low ranges of expansion and small moving mass, and to keep the pressure and consequently the speed of the piston during the indoor stroke tolerably uniform. When we turn to the rotative engine we find all the conditions altered. We have then double-acting pumps, or their equivalent in two sets of single-acting pumps; the engine is double-acting, and pumps direct without the intervention of a weight, and a large fly-wheel is provided, which takes up and gives out motion as wanted. The value of mass in a regulator of velocity varies as the square of the speed. A fly-wheel rim weighing 20 tons, and moving with an angular velocity of 900ft. per minute, would represent as much energy as 80 tons of pump spears moving at 450ft. per minute. Thus, when the weight is disposed in the shape of a fly-wheel, it is infinitely more easily dealt with than when it appears in the shape of a set of pump spears and balance bobs; and accordingly ranges of expansion, increased to six, seven, or even eight-fold, are possible with rotating pumping engines, although they are quite out of the question with the Cornish engine.

Turning to the differential engine, we find that it is without a fly-wheel, and yet it does not even require the weight of a set of pump spears to enable it to be worked expansively. Mr. Davey secures his object much as Woolf and Hornblower did, only in a far more complete way. He uses compound cylinders, and this keeps the average load on both pistons, taken together, comparatively constant, and so he is able to expand steam even as much as eight times without trouble. There are certain advantages connected with the working of pumps which must not be confounded with the performance of the engine, in favour of the non-rotative engine, and by the suppression of the fly-wheel and crank shaft a cheaper job can be made; but the main reason why the differential engine is a success is that it is a compound engine, and thereby permits steam to be used expansively without needing a great weight of spears.

The best Cornish engines give a duty of 80 millions. It is said that one engine attained a duty of 112 millions, but this is problematical; and the engine split its cylinder after being a few months at work, and the experiment of working a Cornish engine with a five-fold expansion was never repeated. A duty of 80 millions represents 714,285 lb. raised 1ft. high by a pound of coal, and is equivalent to about 3 lb. of coal per horse-power per hour indicated. This performance has only been excelled by a few exceptionally fine rotative engines, and the average performance of such machines does not exceed by much that of the Cornish engine. A duty of 90 millions will represent the best that has been done by all but a very few rotative and differential engines. The hyperbolic logarithm of the number which represents a given ratio of expansion may be taken to represent the extra work got out of a pound of steam by expanding it instead of working at full stroke. Now, the hyperbolic log. of the ratio of expansion in the most economical Cornish engine is ·6931—that is to say, if the steam were worked without expansion its efficiency would be 1, but expanded three times its efficiency becomes 1·693; but the hyperbolic logarithm of the ratio of expansion in the best rotative engines is 2·0794. Thus, the performance of 1 lb. of steam unexpanded being 1, if it is expanded eight-fold its performance becomes 3·0794. Thus if the duty of the Cornish engine was 80 millions, that of the rotative engine should be 160 millions, whereas it is nothing of the kind. Because of cylinder condensation the full advantage can never be obtained from expansion; but in the Cornish engine there is less cylinder condensation than in any other engine, for reasons first explained in this journal on tho 17th of March, 1865. In the Cornish engine one side of the piston and one end of the cylinder never have any communication with the condenser, and so its cooling influence is cut off. It is worth considering whether a considerable advantage might not be obtained from making a compound engine, say, of the differential type, with three cylinders, one high-pressure, the other two low-pressure, these last being single-acting Cornish engines in the full sense of the word. No doubt, a very considerable advantage might be gained by compounding ordinary Cornish engines. We have not heard that this has ever been done in this country, but we know that the differential gear has been fitted to Cornish engines with considerable benefit.

PURE AIR AND DENSITY OF POPULATION.

We owe a great deal to investigators of the many hygienic questions, the solutions of which have afforded us increased comfort in our houses, and more particularly to those who have done the work of efficient drainage and ventilation. If, however, Dr. J. Parkin, of Brighton, is right in what he says in a recent letter to the *Standard*, we have, to say the least, a little yet to learn on the relation between fresh air and certain classes of diseases. In a leading article in the above-mentioned contemporary, it is remarked, while referring to the healthiness of London when compared to other cities less populous, that "London is now almost an exception to the rule that the mortality increases with the density of the population." Dr. Parkin, however, says "that London is not an exception to the rule, but is, on the contrary, a striking example of a rule that is almost universal, no fact being better established in all malarious and unhealthy situations than the superior healthiness of towns when compared with the surrounding districts. More than this, it will often be found that the thinly populated part of a town is more liable to disease than the densely populated districts. Nowhere is this better observed than in Rome. Within the Walls it is precisely in the more elevated and aristocratic districts of Rome, with a scattered population, that fever prevails, rather than in the more densely populated districts. In the Ghetto, situated on the banks of the Tiber, where the Jews reside—and to which they were confined during the late Pontifical Government—where they swarm like bees in a hive, and where the streets are so narrow that it is impossible for a carriage to pass through, fever is almost unknown, although this part of the town is surrounded with every kind of abomination. Another result constantly observed in Italy is still more remarkable. When a monastery or convent has been vacated, for some reason it has been found that the few attendants left in charge of the building have been in certain situations invariably attacked with fever. When, however, the former inmates, or others in the same number, have returned, the fever has immediately ceased. The same result has been observed during the prevalence of the epidemic cholera, the ravages of which have been in an inverse ratio with population, as is more particularly apparent in those countries in which the disease has assumed an unusually severe form. Thus at Kingston, the capital of Jamaica, the deaths during the first outbreak of the cholera in that island in 1850 were not more than an eighth of the population; but at Port Royal and Falmouth, small towns, they amounted to a third. At Port Maria two-thirds of the population were cut off, or six hundred out of nine hundred. In the small villages, or settlements, the mortality was still greater. At Orange Cove eighty out of a population of one hundred died, but at Batchelor's Hall, situated on a calcareous plateau, five or six hundred feet above the level of the sea, seventy out of seventy-three residents were cut off, although a medical man was residing there at the time. It is thus evident to every unprejudiced person that density of population—within certain well-defined limits, those in which the oxygen of the atmosphere is in its normal or nearly normal proportion—instead of being injurious during the prevalence of endemic and epidemic diseases, is actually beneficial. This conclusion, although in direct opposition to the prevalent opinions of the day, is in accordance with the aphorism of the Father of Medicine, Hippocrates, viz., '*Aer est omnium, rex, morborumque causa.*'" Dr. Parkin's facts will no doubt lead to some curious comments, but it is no new thing to observe that the narrow-streeted, closely-packed towns on the Continent have not the highest death rates.

LUDGATE-HILL STATION.

Ludgate-hill Station is one of the most crowded and uncomfortable of stations in the whole world at certain periods of the day. Complaints have been made over and over again, but the company only replies that nothing can be done until its new station is built. This is not true, for apart from the possibility of running longer trains, the discomfort of the passengers at the Ludgate-hill Station would be much lessened if there was some management on the platforms. There seems to be nothing of the kind. On the two platforms are sprinkled about half-a-dozen porters. These generally gravitate into knots of three or so, and when trains come in to either platform they make the place hideous with howlings, generally supposed to consist of the names of the stations to which the trains are destined. No one ever knows whether this is so or not, for these unadministrated howlers commence their announcements of the destinations of the two trains closely one after the other, justs as one dog sets a whole pack howling one after the other. Sometimes it is possible to discover 'mid the disconcerted din that one porter is shrieking "all thir' behind" or "thir' class 'nfront." Passengers are not helped at all, and the station men seem to think that all passengers have grown old and cunning in the use of Ludgate-hill station. Now if there was any attempt made to direct the labour available at the station, the condition of things might be very much improved. To begin with, porters should be taught not to congregate into a lump on an area of about three square feet, but should dispose themselves throughout the length of a platform, which may be easily done, for the length of the train is known. Secondly, they should not all bawl out the same thing at the same time, one word behind the other, but should slowly and, as though drilled to their work, instead of just fetched in from the streets, clearly give the name of the station, and then the route of the outgoing train. If they were thus stationed along the platform before trains came in the passengers might be quietly sorted, so that there need not be any running in every direction under the sun when a train comes in. The noise of these undrilled porters or station-men is perhaps most hideous when it happens, as it does sometimes, that two up trains and a down train reach the platform nearly the same time. If these men were drilled to do their work in a systematic way, instead of joining in guerilla warfare of unintelligible words in each other's faces, as soon as the exciting element in the form of a train appears, even so bad a station as Ludgate might be more bearable. The company has endeavoured by running shuttle trains between Ludgate and Loughborough to lessen the confusion and crush, but much of the usefulness of these trains is lost because the station-men are not properly drilled to instruct passengers that these trains on down lines are really exceptional up trains. A little discipline and one or two more hands would much improve matters at Ludgate at very little cost.

THE WINTER ELECTRIC EXHIBITION AT THE ROYAL AQUARIUM, WESTMINSTER.

We understand that this Exhibition is shortly to be opened. For this purpose motive power, to the amount of nearly 500-horses, has been provided by the directors of the Aquarium, and is being laid down in the buildings specially erected as machine annexes. The body of the hall of the Aquarium will be devoted to arc lighting, which will be represented by fourteen or fifteen systems, of which several are new. The space underneath the galleries, and the galleries themselves, have been subdivided into courts, for the purpose of exhibiting the several systems of incandescent lighting and fittings applicable to it. The ground floor of the whole of the building and parts of the galleries are apportioned out to exhibitors for the purpose of displaying the different accessories of electric application, the most notable feature of which will be the motors—in all fourteen in number—which will drive machinery by transmission of power. The Dining Annexe will be lighted by Messrs. Ferranti, Thompson, and Ince, with 350 incandescent lights actuated by one of their new dynamo machines. There is a series of five courts fitted up for the display of the Edison system. All the other courts are occupied by other firms to illustrate either new incandescent lamps or fittings for their use. Thus the whole of the premises of the Aquarium will be occupied for the exhibition, which will very fairly represent all the present systems of lighting and transmission of power. The Metropolitan Brush Company has contracted to light up the Imperial Theatre during the course of the exhibition, and we understand that the installation will be ready by the 6th January. In conclusion, it may be said that the exhibition promises to be one not only easily accessible, but at the same time one which will place before the public not only most of the standard systems of electric lighting, but also many new departures of novelty and interest.

ELECTRIC LIGHTING.

An illustration of the absolute necessity for secondary batteries or accumulators in electric lighting installations was afforded last week when the Edison machines and engines by which a considerable district round the Edison Company's establishment on the Holborn Viaduct is lighted were by some means rendered *hors de combat*, and the whole of the consumers had for some time to resort to gas. This is not the only instance of the kind, and experience with machinery of almost any sort shows that although engines may be successfully made to run without stopping for a considerable number of days, or even for weeks, it is not often that a combination of high-speed engines, boilers, and high-speed machines can be calculated upon to run for and at any prescribed time without the necessity for an occasional stoppage. Electric accumulators are thus of the utmost importance on an electric lighting installation, in order that the machines may be stopped for a few minutes without affecting the light, and also in order that incandescent lamps may receive a uniform current, and not that variable current which breaks so many.

LITERATURE.

The Practice of Commercial Organic Analysis: a Treatise on the Properties, Proximate Analytical Examination, and Modes of Assaying the Various Organic Chemicals and Products employed in the Arts, Manufactures, Medicine, &c., with Concise Methods for the Detection and Determination of their Impurities, Adulteration, and Products of Decomposition. By Alfred A. Allen. Vol. II. *Hydrocarbons, Fixed Oils and Fats, Sugar, Starch, and its Isomers, Alkaloids and Organic Bases, &c.* London: J. and A. Churchill. 1882.

The author, in proceeding to the preparation of vol. ii. of this work, found the subject grow so much under his hands that he has felt himself compelled to omit all mention of dyes and colouring matters, and coal gas, and the method employed for its examination. Animal products, including blood, milk, urine, gelatine, wool, &c. &c., have also been omitted, or the discussion of these bodies deferred, till a third volume shall be found requisite. Under the heading "Hydrocarbons," we read of "olefins" and "vaselene," and we cannot congratulate the author on the introduction of new spelling of these words; if we are to begin to alter the spelling of words to render them more scientific, it would be difficult to say where we should be led.

In benzol testing he recommends that the sample should be boiled in a retort over the naked flame of a Bunsen burner, and says that the lamp—that is, the Bunsen burner—should be placed in a deep tin basin containing sand or sawdust, in order to absorb the benzol in the event of the retort cracking. We cannot think this a good method; the breaking of such a retort under these circumstances is a terrible event. In such experiments we, with a galvanic current, coat the bottom of the retort on the outside with copper and then the boiling and distillation can be carried on with perfect safety. This, of course, applies to petroleum, carbon disulphide, and all liquids of a similar kind.

We are glad to find, under the heading "Malt-sugar," a notice of the excellent researches of Mr. C. P. O'Sullivan. This is the first occasion in which we have come across any reference to them in a book of applied chemistry.

The assay of gun-cotton is sometimes of importance with a view of judging of its tendency to decompose. In testing gun-cotton for free acids, &c., we are told: "If sulphuric acid, be present, on evaporating this liquid to dryness at 100 deg. C., a small fragment of immersed filter paper will be charred." We should have thought another and more certain test would have suggested itself.

In treating of the volatile alkaloids of vegetable origin, the author has neglected to mention that conine was some years since prepared synthetically, although in the case of trimethylamine he does so, though the difficulty in the case of that body was far less.

It is pointed out in the assay of aniline dyes that arsenic is a common impurity in fuchsine and other derivatives; and the process for detecting its presence is given. But some years ago a very complete series of these colours was sent to us by a large chemical firm, which were all made without any arsenic whatever being used in the manufacture of any of them.

The few points to which we have called attention are, however, but small drawbacks in a book which contains much that is useful.

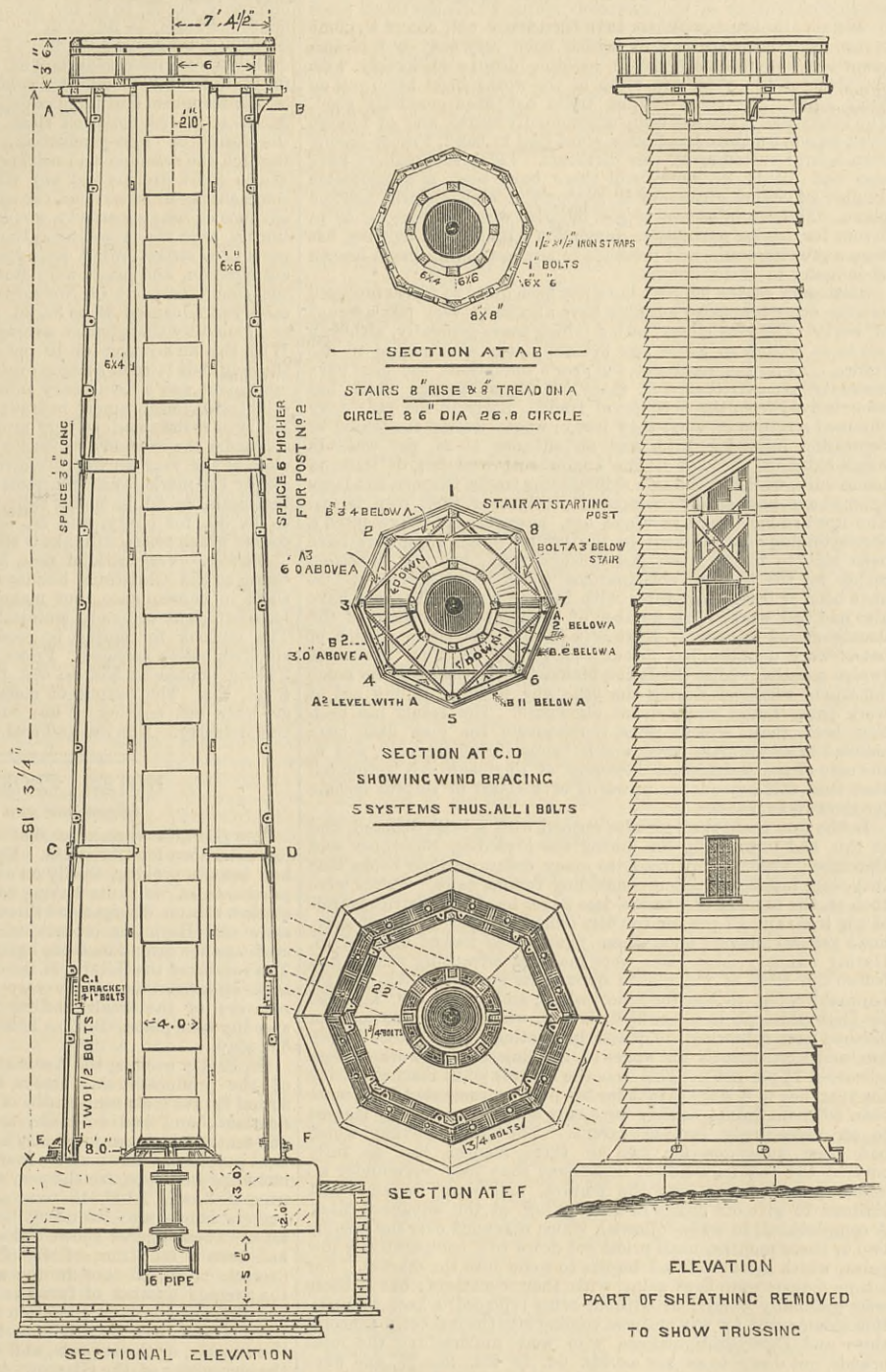
At a recent meeting of the Académie des Sciences, M. Marey made a communication as to the new process of M. Charles Petit, called similigravure, for reproducing photographs on metal, so as to print from them in the same way as from, and concurrently with, ordinary typographical characters.

STAND PIPE AT THE CALUMET MINE, LAKE MICHIGAN, U.S.

THE conditions under which this structure had to be built were such as do not in this country obtain for stand pipes, which are usually buildings of such a permanent character as need to be constructed in a very solid style; but although the exposed position of such a tower at the Calumet Mine, which is subject to the very violent storms that sweep across Lake Michigan, rendered necessary a very strong structure, yet the intense cold of the northern winter, frequently reaching 40 deg. below zero, is best resisted in such a case by sheathing the stand pipe with wood. This material has also the merit of cheapness; thus the present design was made to meet the several demands upon it, a minimum of iron and stone work being made use of. The object of the tower is primarily to raise the available head of water in fire emergencies, when in the case of such an isolated community as this, the property would be entirely dependent on its own resources. The wrought iron tube, 80ft. high, having the lowest seven plates of $\frac{5}{8}$in. thick, the next seven of $\frac{5}{16}$in., and the top seven of $\frac{1}{4}$in., is rivetted to a "gun iron" angle-ring at its foot, which is bolted to a casting forming a base for it and part of the vertical framing. Through a nozzle in this base communication is made with the water supply pipe which runs through the tunnel in the foundation.

The octagonal framing around the tube has the inner sticks of 6in. by 6in. section, and the outer, which are adzed to the octagonal shape, of 8in. by 8in. stuff. A spiral stairway is carried round between the inner and outer framings, which are thus tied somewhat together, being also bolted together at the spliced joints. The frame legs stand in cast iron boxes on the base plates, and besides being bolted through to them, the outer legs are held down by long vertical bolts taking on to a toothed bracket bolted on at some distance up the leg. The vertical tube has no staying, being clear of the wood framing all round. The whole framing is braced diagonally, and 1in. bolts pass round the whole eight posts, engaging in straps cut into them. The structure is sheathed diagonally with 1in. stuff nailed on, which is then covered with $\frac{1}{2}$in. clapboards. The whole is calculated to resist wind pressure of 50 lb. per square foot.

The materials used were all woodwork, 10,100ft. board measure; all ironwork, including all bolts, 40,000 lb. weight; cost of ironwork, 2100 dols. It is possible that a strong yet cheap tower of this description might be found to fulfil all the necessities of some small towns, and certainly of large isolated works in this country, and for this reason we illustrate it.



THE DETERMINATION OF ORGANIC MATTER IN POTABLE WATER.

By PROFESSOR J. W. MALLET.

A FEW months since Dr. J. W. Mallet, F.R.S., Professor of Chemistry and Physics in the University of Virginia, was called upon to report to the National Board of Health on the "Determination of Organic Matter in Potable Water." This and other sanitary questions are occupying a great deal of attention in America, and we now quote from the American *Sanitary Engineer* those portions which may be of special interest to analysts and others who have not access to the original, published as a supplement to the American National Board of Health Bulletin, No. 19.

General Conclusions.—(1) It is not possible to decide absolutely upon the wholesomeness or unwholesomeness of a drinking water by the mere use of any of the processes examined for the estimation of organic matter or its constituents. (2) I would even go further, and say that in judging the sanitary character of a water, not only must such processes be used in connection with the investigation of other evidence of a more general sort, as to the source and history of the water, but should even be deemed of secondary importance in weighing the reasons for accepting or rejecting a water not manifestly unfit for drinking on other grounds. (3) There are no sound grounds on which to establish such general standards of purity as have been proposed, looking to exact amounts of organic carbon or nitrogen, "albuminoid ammonia," oxygen of permanganate consumed, &c., as permissible or not. Distinctions drawn by the application of such standards are arbitrary, and may be misleading. (4) Two entirely legitimate directions seem to be open for the useful examination, by chemical means, of the organic constituents of drinking water, namely, first, the detection of very gross pollution, such as the contamination of the water of a well by accidental bursting or crushing of soil, extensive leakage of drains, &c.; and secondly, the periodical examination of a water supply, as of a great city, in order that the normal or usual character of the water having been previously ascertained, any suspicious changes which from time to time may occur, shall be promptly detected and their cause investigated. (5) In connection with this latter application of water analysis there seems to be no objection to the establishment of local "standards of purity" for drinking water based on sufficiently thorough examination of the water supply in its usual condition. (6) With the facts of this investigation before me, I am inclined to attach special and very great importance to a careful determination of the nitrites and nitrates in water to be used for drinking. If I had entrusted to me the charge of watching a large city water supply I should use all three of the principal processes for the examination of the organic matter present; each gives a certain amount of information which the others do not afford. Under circumstances, admitting only of the use of simpler means of investigation, the albuminoid ammonia and permanganate processes might be employed together, but in no case should only one of these methods be resorted to, such a course entailing practically the neglect of carbon on the one hand, or nitrogen on the other.

Examination of Water Samples in General.—(1) Great care should be taken that water samples be placed in the hands of the analyst and their examination begun with the least possible delay after they have been collected. The changes which take place, sometimes rapidly, on keeping, may seriously affect the results, especially in the case of waters much polluted by foul organic matter. It is very desirable that, besides examining a water in its perfectly fresh condition, samples of it should be set aside, in half-filled but glass-stoppered bottles, for some time, say, ten or twelve days, and one of these examined every day or two so as to trace the character and extent of the changes undergone. Not only may conclusions be drawn from such a series of observations as to the general stability or decomposability of the organic matter present, but light will be thrown upon the changes which may be expected to occur under ordinary conditions, when the water is stored for use, as in cisterns and wells, during periods of drought, or carelessly allowed to remain stagnant in pitchers, water coolers, &c.

Combustion Process.—(1) In applying this process, no matter how skilled or well trained the analyst may be, duplicate or even triplicate concordant results should be insisted upon before accepting the determinations as trustworthy. (2) In order to avoid the presence in the atmosphere about the water bath used for the evaporation of ammonia derived from coal gas, the bath should be heated by steam brought in a small closed pipe from a distant boiler, perferably situated in another room, and the waste steam and condensed water therefrom should be in like manner carried off to a safe distance.

Albuminoid Ammonia Process.—In order to avoid the uncertain ending of the collection of ammonia, whether "free" or "albuminoid," it should be well to adopt the rule that the distillation be stopped when, and not before, the last measure of distillate collected contains less than a certain proportion, say 1 per cent. of the whole quantity of ammonia already collected. This would, in many cases, involve the necessity of replenishing the liquid contents of the retort with ammonia free water. (2) In order to diminish the loss of amines or other volatile forms of nitrogenous matter, a separate distillation should be made with alkaline permanganate added at once in addition to the usual course of treatment prescribed by Wanklyn—distillation begun with sodium carbonate, and continued after addition of the alkaline permanganate. The results of the two separate distillations should then be compared. (3) In reporting the results obtained by the albuminoid ammonia process, including the determination of free ammonia, the evolution of ammonia as collected by separate measures of distillate should always be given.

Permanganate Process.—(1) In view of the evidence obtained, rendering probable the loss of organic matter by volatilisation in the use of acidified permanganate at a boiling temperature, the Tidy form of the process is rather to be recommended than that of Kubel, if but one be used. (2) On the other hand, the advantage of more extended oxidising action, and the greater general accordance of the results by the Kubel process with those for organic carbon by the combustion process, make it desirable, that, as far as possible, the same advantages should be secured by substituting the influence of time for that of temperature, and that the time during which the permanganate is allowed to act in the Tidy process should be increased to at least twelve, better to twenty-four hours, several determinations—on different samples set aside at the same time—being made at such intermediate intervals as one, three, six, nine, and twelve hours in order to trace the progress of the oxidation.

Combustion Process.—(1) I would propose to evaporate the water, not under ordinary pressure and in contact with the atmosphere, as usual, but as the specimens of water were evaporated for the biological experiments, in a closed vessel immersed in a water bath and connected with a good—water jet—air pump, so as to secure a nearly complete removal of air, with a condensing worm to dispose in part of the aqueous vapour given off. It would not do to simply place the water in a flask, since the residue could not be removed for combustion, but it would not be difficult to arrange a suitable vacuum vessel, with wide mouth and tightly clamped on cover, within which might be placed the usual glass dish to receive the water, and the feed might be managed through a nearly capillary tube with a glass stop-cock. By such an arrangement the evaporation might be effected within a moderate time at a fixed temperature much lower than the boiling point, thus probably reducing any loss from simple volatilisation of organic matter; the nearly complete exclusion of air would tend to really diminish or do away with loss of organic matter by oxidation, and permit of large reduction in the quantity of sulphurous acid used; for the same reason the tendency to formation of sulphuric acid would be reduced to a minimum, and the absorption of ammonia from the atmosphere about the dish would be altogether prevented. In testing this last-named effect, two bulb tubes containing pure sulphuric acid might be interposed between the vacuum chamber and the pump, the contents of the one to be tested for ammonia given off from the water, those of the other to guard against any trace of ammonia coming back from the outside air during irregular action of the stream of water. (2) In order to avoid loss during the evaporation of readily volatile substances, such as butyric, valerianic, &c., acids, to dispense with the necessity for the uncertain and unsatisfactory correction for ammonia lost by dissociation to get rid of the influence on the determination of organic nitrogen of any errors in the determination of the total ammonia, and to avoid corresponding difficulties arising from the presence of nitrates if these be allowed to remain, it might be well to evaporate at first with the addition of a small excess of magnesia—as recommended by Lechartier—thus removing all ammonia; and then the water having been brought down to a small volume add a moderate excess only of sulphuric acid with a drop of a solution of a ferrous salt—as directed by Frankland—and complete the evaporation to dryness, the whole process to be carried out in a jet pump vacuum, as above suggested. (3) Further experiments are desirable in order to completely determine the merits and defects of the Williams—"copper-zinc couple"—method for the removal of nitrates. (4) Some preliminary experiments of my own seemed to show that nitrates and nitrites may be completely reduced by evaporating to a small bulk with no great excess of phosphorous or hypo-phosphorous acid, guarding against the evolution of phosphuretted hydrogen by the low temperature employed, then adding magnesia in small excess and completing the evaporation, thus leaving the residue in a pulverulent instead of sticky condition, easy of removal from the dish, and probably allowing of complete combustion without inconvenience from the final oxidation of the small excess of phosphite or hypophosphite, and without any wrapping up of carbon particles. This plan deserves to be carefully tested.

Albuminoid Ammonia Process, including determination of Free Ammonia.—(1) In order to prevent, or at least to largely reduce and render uniform the loss of ammonia from imperfect condensation, I would prefer to effect the distillation, not by a lamp flame, but in a retort of uniformly determined shape and size, uniformly immersed in a bath of saline solution or other suitable material kept at a uniform temperature—say 102 deg. or 105 deg. C.—by means of steam, and to condense in a glass worm surrounded by ice water sufficiently long to bring the distillate to a uniform temperature, not exceeding, say, 5 deg. C. (2) It would be perhaps still better to conduct the distillation in a completely closed apparatus between the retort and the far end of the fully effective condensing tube, with a glass stop-cock to draw off the distillate in successive measured portions, and a little safety valve—mercury or other—near the cold end to prevent any dangerous difference of external and internal pressure. (3) In the determination of free ammonia with a view to distinguishing as sharply as possible between ammonia really existing as such or in ammoniacal salts and that found by breaking up of organic matter, it might be well to try a closed distilling apparatus connected with a—water jet—air pump, so as to maintain a partial vacuum within, keeping the retort at a fixed temperature much below 100 deg. C., and collecting the whole of the ammonia in a flask and one or more bulb tubes containing rather weak mineral acid, interposed between the condenser and the pump. This would, however, be attended with the disadvantage of not readily permitting the progress of the evolution of ammonia to be traced by its collection in separate successive measures of distilate, and it would become necessary to ascertain whether the application of the Nessler test would be in any way interfered with by the sodium salts formed from the acid used to collect the ammonia. (4) In order to overcome, if possible, the most serious difficulty in the way of a correct determination of free ammonia, namely, the ready breaking up of urea—and other amides—when present, on heating with sodium carbonate, it would be well to ascertain at how low a temperature and within what time, if at all, ammonia really existing in ammoniacal salts could be completely driven off from an extremely dilute solution by adding a small excess of magnesia and maintaining a—water jet—air pump vacuum above the liquid, forming a stratum of small depth, with bulb tubes of acid between the liquid and the pump to intercept the ammonia and guard tubes to prevent any being received from the air; in other words, to ascertain whether Schlesing's method for the determination of ammonia admits of being applied to such excessively minute amounts of it as the water analyst is concerned with. (5) In the conduct of the albuminoid-ammonia process proper, *i.e.*, the distillation with alkaline permanganate, I would propose that the original volume of liquid in the retort be maintained *constant*, by running in at the proper rate through a nearly capillary tube with a glass stop-cock ammonia-free distilled water. And in cases in which the amount of organic matter is so large as to wholly or in great part reduce the usual charge of alkaline permanganate, I would determine by a preliminary experiment at about what rate the reagent is used up, and would then progressively supply its solution, instead of simply pure water, at such a rate as to keep the original strength as nearly as possible unaltered.

Permanganate Process.—(1) The principle involved in the last paragraph applies also to this process. Instead of using a fixed amount of permanganate at first, and adding a second or third charge only when the former has been completely reduced, there ought to be a fixed excess at the end of the action, or rather there should be present a constant excess all through the process. Hence, when a preliminary experiment has shown that more than the usual charge of permanganate will be needed, and about the rate at which it will be consumed for the final experiment, additional permanganate solution should be gradually dripped in, from a nearly capillary tube, at such a rate as to maintain the original excess, as nearly as possible, constant. (2) It is desirable that the process be carried on at a pretty nearly fixed temperature. If the Tidy method be followed, a temperature of say 20 deg. C. could, with a little management, generally be secured, and the flasks kept approximately at this point during the time required for the action.

MR. WALMISLEY will deliver his opening lecture at the Society of Engineers on January 8th, "On Land Surveying and Levelling."

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

(From our own Correspondent.)

The gatherings on 'Change in Wolverhampton yesterday and in Birmingham this—Thursday—afternoon were not large, nor was there much new business transacted. Buyers are waiting till the quarterly meetings before placing orders of much size. These are fixed to come off in Wolverhampton on January 10th and in Birmingham on January 11th.

Some of the mills and forges resumed work after the holidays on Wednesday night, and a few others to-day. Certain works now idle would have re-started but that they have been prevented by special circumstances, such as repairs to canal basins, repairs to works, machinery, &c. These concerns, together with others who are standing the whole of this week because the order books are only sparsely filled, will, however, begin again actively next Monday.

Sheets and strips are the descriptions of rolled iron which are in most demand for early delivery. Buyers of these sections were on 'Change to-day pressing for execution of orders. These buyers included merchants doing a large export trade, as well as actual home consumers. Sheet prices were £8 to £8 5s. for singles, and £9 15s. to £10 5s. for lattens. Gas strip was easy at £6 15s. per ton at the works.

Taking the last few months into review, it may safely be asserted that the demand for girder and bridge plates has shown a decided improvement. The quotation for such iron remained to-day at £8 10s., and the price for boiler plates was without alteration at £9 to £9 10s.

The Earl of Dudley's common bars, rolled at the Round Oak Works, are still £8 12s. 6d. per ton, while the other "list" houses, with two exceptions, quote £8. The exceptions are the New British Iron Company, and Messrs. Phillip Williams and Sons, both of whom still quote £7 10s. Bars of medium quality are £7 to £6 15s., and common bars £6 10s. to £6 7s. 6d. easy.

Hoop makers begin the new year with, upon the whole, a fair amount of work on their books, part of it on account of Australia, the United States, and the European Continent. They quote £6 15s. to £7 at works.

Native pig iron makers report business quiet, with prospects not very bright. All-mine pigs are quoted 67s. 6d. for best hot blast sorts, and 65s. would in actual business be accepted by some makers. Part-mine pigs are 55s. to 52s. 6d., and common pigs 41s. 3d. to 42s. 6d.

From the inquiries now on the market for foreign pigs, such as Northampton, Derbyshire, Leicester, and South Yorkshire brands, vendors of these descriptions anticipate a big business in a week or two. They are, therefore, firm in their quotations; 47s. 6d. is the minimum quotation for Northampton and Derbyshire sorts, 50s. is asked for Leicestershire pigs, and 62s. 6d. for Thorncliffe—South Yorkshire. Only little business is doing in hematites. Prices range from 65s. to 70s., according to make.

Coal prices were not particularly strong this afternoon. Domestic coal raised from the thick seams on Cannock Chase was quoted :—Best deep, 11s. per ton at the pits, long weight; best one-way, 10s.; and cobbles 9s. Mined from the shallow seams on the Chase the quotations were :—Best, 9s. 6d.; best one-way, 8s. 6d.; and cobbles, 7s. 6d. Staffordshire forge coal was quoted at 7s. to 7s. 6d. per ton long weight at the pits, and Cannock Chase common forge at from 6s. upwards.

Wages of finished ironworkers will in accordance with the recent award of Alderman Avery, of Birmingham, President of the Mill and Forge Wages Board, advance on January 1st 3d. per ton to puddlers and 2½ per cent. to millmen.

With the new year the manufacture of electric light machinery will be begun in Wolverhampton on a style and a scale that augurs well for the new industry. The manufacturers are the Wolverhampton Electric Light Storage and Engineering Company, who have laid down extensive engineering shops and plant for the purpose. The company will manufacture dynamo machines, high-speed steam engines for running the same, storage batteries, electric motors for driving small domestic machinery of any kind, &c. The batteries will be manufactured under patents which have been taken out in England and abroad, the chief feature being the rapid method of preparing the plates. These are chemically and not mechanically prepared, and hence are not liable to fall to pieces. Under this method of preparation, the company claim to obtain in as short a time as twenty-four hours an exact formation. At date the company is manufacturing in preparation of its stock 250 plates per day, and they expect before long to increase this production.

Messrs. Hughes, Johnson, and Co., who were formerly foremen over considerable departments at Messrs. Tangye's, and who have now started as hydraulic and general engineers at Langley, Oldbury, are turning their attention particularly to brewery, brick-making, and mining machinery, cranes, and heavy smiths' forgings.

Galvanisers have plenty of orders to begin the new year upon, especially in the corrugated sheet departments, which will quickly again be busy in supplying the needs of nearly all the markets of the world. Sheets—in bundles of 22 to 24 w.g.—are quoted £14 5s. to £15 per ton delivered at outports.

In consequence of the decision of the Birmingham Corporation, which I reported a short time ago, all the electric lighting companies excepting one have resigned their intentions to light the town. The persevering firm is the Crompton Winfield Electric Light Company, of Birmingham. They have just applied to the Board of Trade for the requisite provisional order, to the issue of which the Corporation can object any time within the next two months. The company seeks power to supply the light to private houses and streets of the borough. It divides the town into six sections. The first it undertakes to supply within three years, the second within five years, and so on at intervals of two years, the whole being completed within eleven years. These are the legal limits, but if the application is granted the work will probably be completed much more quickly. The powers the company seeks as to price would enable it to charge as much as 6s. 8d. for a quantity of electricity equivalent in lighting power to 1000ft. of 15-candle gas. The present average price of 1000ft. of such gas is about 2s. 6d. The first cost of the lighting plant is estimated at £40,000.

The Midland, Birmingham, Wolverhampton, and Milford Junction Railway Bill gives the capital of the company at £1,250,000. The railways are required to be completed within five years, and the company seek running powers over several lines already made. The Bill fixes the maximum charges for the conveyance of goods, a circumstance which will be much appreciated by traders. The scale for coal, coke, lime, ironstone, iron ore, pig iron, bar iron, and iron castings—not manufactured into utensils—&c., is 1½d. per ton per mile.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—In the iron trade and the various allied branches of industry in this district, although the year closes with less activity than it began, it has on the whole been one of considerable activity. So far as the engineering trades are concerned, the year commenced well; and though subsequent operations have not been a realisation of all that was looked forward to from the weight of the original inquiries, still the results have been sufficient to give full employment generally to the important industries of the district. Locomotive builders have been exceptionally busy all through the year. Rolling stocks abroad had been allowed to work down, and almost simultaneously nearly every railway company in Europe seemed to arrive at the conclusion that worn-out plant required replacing. India, the colonies, and South America have also been large customers, and for the home railways a considerable amount of work has been given out. Carriage builders, and manufacturers of other rolling stock, have also shared in the activity. The iron shipbuilding trade has been another branch of trade in which an abnormal state of activity has prevailed. This is still maintained so far as booked orders are concerned, but inquiries are falling off, and this has been brought about by the high prices which shipbuilders are now compelled to ask in consequence of the enormous spring which has taken place in wages. Cotton machinists have been fairly well occupied, some of the firms with specialities having been very busy, but in this branch of trade the demand is quieting down considerably with the close of the year, and some of the works have been put on short time. The boiler-making trade has been generally good. The heavy tool trade has been uncommonly active, and of foreign work especially there has been a great deal in hand, France having been a large customer in this direction. Light tool makers have also had plenty of work, and there have been a considerable number of orders given out in connection with electric lighting plant. The manufacture of gas motors, which appear to be in favour for driving purposes in connection with electric lighting, has been a growing trade, and promises to become an important branch of industry in this district.

Stationary engine builders have not been quite so fully employed as some other branches, but they have also had a very fair amount of work. The year closes with a falling trade generally, although not to an extent to cause any present alarm with regard to the future. As to the results of the year's operations, the men have certainly secured their full share of any advantage which has been derived from the activity of trade. Early in the year they obtained a return of what they lost in wages during the period of depression following 1878, and an advance of 2s. per week in wages extended through all the engineering branches of trade in Lancashire, whilst in the iron shipbuilding trades the men to a large extent have been able to command pretty near their own terms. The upward movement in wages has, however, not represented a corresponding improvement in the profits which employers have been able to realise upon the finished work, but was conceded rather on the basis of anticipations which have since proved to have been at least premature; with increased wages, the men have also had full work. The number of members on the books of the Amalgamated Society of Engineers in this district in receipt of out-of-work donation has not exceeded 2 per cent. for the whole twelve months, whilst the Boiler Makers' Society has paid no home donations whatever during the year, any member falling out of work being found employment elsewhere. The result has been that both these organisations representing the men have been enabled to accumulate considerable funds during the year, and in the case of the Amalgamated Society of Engineers it is estimated that this will amount to upwards of £30,000 of surplus income for the twelve months.

In the iron trade the year also opened with a brisk demand, and as this had been going on during the preceding November and December, makers had already so many orders on their books that they were indifferent about concluding further sales. Prices were then on the basis of 51s. to 52s. less 2½ for local and district brands of pig iron, and £7 per ton for bars delivered equal to Manchester, but a general advance upon these figures was looked forward to. During January large sales were made at advancing prices, and before the close of the month quotations got up to 52s. 6d. for Lancashire, 53s. to 54s. for Lincolnshire, and up to 55s. and 56s. for Derbyshire pig iron less 2½ delivered, whilst the quotations for finished iron, following the quarterly meetings, got up to £7 5s. per ton, and subsequently the wages of the finished ironworkers were advanced 7½ per cent. This was the highest point reached during the year, but to a large extent the top prices represented little more than fictitious values, as they were only actually realised by makers to an exceedingly limited extent. The large buying which had been going on for two or three months had so fully covered the requirements of consumers that they were under no necessity of coming into the market, and were certainly not inclined to give out orders in anticipation at the advanced rates. A complete lull in trade followed, which extended over the ensuing two or three months, until prices got down to a comparatively low point, which again induced buyers to come into the market. For a time makers were kept going with their contracts; but as these were gradually worked off without being replaced, a keen competition commenced for any business coming into the market. Lincolnshire and Derbyshire makers, who were underselling the local brands, got down to as low as 44s. 6d. to 45s., less 2½, and were able to secure the bulk of the orders which the low prices now tempted buyers to give out. During May and June a large business was done in district brands, and makers again attempted to realise better prices. Lancashire makers, whose prices had got down to 45s. and 46s., less 2½, only very slowly recovered the lost ground; but gradually they were able to fill up their order-books at the low figures, and ultimately to follow the upward movement in values. By gradual advances of 1s. and 1s. 6d. per ton district brands of pig iron got up during the second half of the year to 49s. and 50s. for Lincolnshire, and 52s. and 53s. for Derbyshire, less 2½, but it was not until about the commencement of November that Lancashire makers put up their quotations, when in one advance of between 4s. and 5s. per ton, they were raised to 50s. and 50s. 6d., less 2½ delivered. Business was again checked by the prices which makers were asking, and there was a repetition of the course of trade following the January advance. At the top figures very little iron was sold. November found makers easier in their prices, and in December a renewal of the downward movement was again inaugurated by the district makers, Lincolnshire brands being reduced to 47s. 4d. and 48s. 4d. less 2½, with some brands of Derbyshire offering at 48s. 6d. to 49s. Lancashire makers followed by bringing their quotations down to 48s. and 49s. less 2½ delivered equal to Manchester. With the close of the year orders to a moderate extent have been placed for district brands on the basis of the above figures, which has tended to give a somewhat better tone to the market and a more hopeful feeling with regard to the future.

In the finished iron trade prices during the first half of the year gradually gave way until bars touched about £6 2s. 6d. for delivery into the Manchester district; then followed a gradual stiffening in values until the September quarterly meetings got quotations up to £6 15s. per ton, but it was very soon found that this figure could not be maintained, and during October and November makers as a rule got down to £6 10s., at which they have since held, although orders have come in very slowly, and there has been underselling on the part of second-hand holders of iron.

As regards the general results of the business done in pig and finished iron during the year, they may be said to have been fairly satisfactory. Although the weight of an enormous production has persistently forced prices back whenever any material advance has been attempted, still a better average of values has been realised than in 1881. The volume of actual trade done has been large, and there has been a marked absence of speculation. Even with an increased output local makers have been able to find a market for their pig iron, and the forges have been kept mostly well employed for the whole twelve months. The market at Manchester on Wednesday practically brought the operations of the year to a close, but there was nothing doing to alter the prices I have already quoted, the market being much of a nominal character both as regards attendance and business. If anything, however, the less favourable character of the reports from Glasgow had a depressing effect upon the hopeful tendency towards improvement for the ensuing year which had been noticeable prior to the holidays.

So far as the coal trade is concerned the year opened unfavourably. During the preceding autumn consumers had laid in large stocks in anticipation of wages difficulties with the men, and the subsequent exceptional mildness of the winter enabled them in many cases to work on with these until well into the spring. The demand for house-fire purposes during the winter months was scarcely equal to the average summer requirements, pits had to go on short time, and stocks accumulated. Summer opened with heavy stocks on the hands of colliery proprietors, although the activity in the iron trade and other coal-consuming branches of industry had brought a good demand into the market for the lower qualities of round coal, and fuel supplies were so abundant that all round prices were forced down to a very low point. Yorkshire and Derbyshire coal also competed keenly in the district, and by gradual reductions, prices which in January were on the basis of 9s. 6d. to 10s. for best coals, 7s. 6d. to 8s. for seconds, 6s. 3d. to 6s. 9d. for common house-fire coals, 5s. 6d. to 6s. for steam and forge coals, 4s. 9d. to 5s. 3d. for burgy, and 3s. 9d. to 4s. 3d. for good slack, got down during the summer to 8s. and 8s. 6d. for best coals, 6s. to 6s. 6d. for seconds, 5s. 9d. to 6s. for common house-fire coals, 4s. 9d. to 5s. 3d. for steam and forge coals, 4s. 3d. to 4s. 9d. for burgy, and 3s. 3d. to 3s. 9d. for good slack. Extreme depression, mainly as the result of over-production, prevailed throughout trade all through the summer, and neither the protracted strikes in North Wales or St. Helens had any effect in improving values. With commencement of autumn the agitation amongst the miners for an advance of wages worked a wonderful change in the market. Consumers, as in the preceding autumn, again took alarm at the prospects of a strike, orders were rushed in to cover requirements in anticipation, and prices were steadily forced upwards, until, with the commencement of November, colliery proprietors in many cases had advanced 3s. to 3s. 6d. per ton upon their lowest rates, and generally the advance averaged from 1s. 6d. to 2s. per ton. With this an advance of 10 per cent. in wages was conceded to the men, but it soon became evident that the basis of the upward movement was a temporary inflation of the market, and not an established improvement in trade. Although a moderate advance has been maintained colliery proprietors have in most cases had to surrender the excessive advances which were put on. With the close of the year an improvement in the demand has tended to steady the market, and pit quotations average 10s. to 10s. 6d. for best coals, 7s. 6d. to 8s. for seconds, 6s. to 7s. for common, 4s. 9d. to 5s. 3d. for burgy, and 3s. 6d. to 4s. for good slack, but the course which prices will take is still very uncertain.

Barrow.—Very little of note has taken place during the week, owing to the Christmas holidays. New business is, of course, slack in consequence, but makers are very fully employed, and have sufficient orders to maintain a brisk activity for some time. The outlook for spring is good, and gives promises of seeing smelters busily engaged. Prices are a shade lower, Nos. 1, 2, and 3 being quoted at 55s. to 56s. per ton net at works, and No. 3 forge, 54s. The output of metal continues heavy. Steel makers are busy, but nothing of any moment to note in connection with this industry. Iron ore and coal steady. Shipping quiet.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

The Glasgow warrant market was closed from Friday till Tuesday afternoon for Christmas. Up till Friday the tone of business had been improving, chiefly on account of considerable speculative purchases of warrants having taken place; but on that day the market became disorganised through the failure of Messrs. Reiffenstein and Harmens, brokers, who had called a meeting of their creditors the same forenoon, having previously suspended payment. The results of the failure, as far as our market is concerned, were soon discovered not to be very serious, and it was hoped that a recovery of the small decline in prices which resulted would speedily take place. But, as I have said, the market was closed till Tuesday.

On Friday evening the Associated Ironmasters issued their report of the production and stocks for the year. We had received actual figures from nine-tenths of the owners of blast furnaces in Scotland, and had to make up an estimate of the remaining one-tenth, which can implicitly be accepted as correct for all practical purposes. The masters found that the production of pig iron, including hematite, for the year from Christmas, 1881, till Christmas, 1882, was 1,126,345 tons, and that the stock of pig iron in makers' hands, also including hematite, was at this date 226,421 tons. These figures showed that in the course of the year there had been a reduction of 49,655 tons in the production, and a decrease of 86,393 tons in the stocks held by makers. I stated the average number of furnaces in blast during the year at 107·5, and those presently in operation at 112. These figures, of course, were correct, but they did not include the consumption at home, the exports, or the imports, and consequently the annual report of the committee of the Glasgow Association of Iron Merchants and Brokers was eagerly looked for. It was issued on Tuesday afternoon, just as the market opened, and although it was highly favourable in almost every detail, the quotations of warrants speedily declined 6d. per ton. This was due partly to the disorganisation resulting from the failure above mentioned, and partly to the desire of some speculators to realise as soon as possible. The following table gives the Iron Merchants' statistics, with the figures of the preceding year added for the purpose of comparison:—

	1882.	1881.	1882. Increase.	1882. Decrease.
Production	1,126,000	1,176,000		50,000
Consumption				
In Foundries	288,000	180,000	108,000	
In malleable and steel works	297,000	217,000	80,000	
(Quantity of malleable iron and steel made — 1882, 474,000; 1881, 361,000)	585,000	397,000	188,000	
Exports.				
Foreign, 436,175—less English iron transhipped (estimated), 4000	432,175	356,115	76,060	
Coastwise	184,021	193,414	—	9,393
Railway to England, about	28,804	28,471	333	
Stocks.				
In Connal's stores	608,604	627,186	—	18,582
Quantity in makers' hands	227,396	312,814	—	85,418
	836,000	940,000		104,000

It will be observed that the only difference in the figures of production, as compared with those of the ironmasters, is that the brokers have struck off the odd 345 tons, thus arriving at round figures, and making the decrease 50,000 tons. There is a total increase in the exports of 67,000 tons, while a decrease of 18,582 tons in Connal's stocks added to that of makers, shows a total decrease of 104,000 in the stocks held, as compared with those at Christmas, 1881. This has arisen partly from a curtailment of production by 12½ per cent. during nine months of the year; but, as the above figures show, also very largely from increased consumption at home and heavier consignments abroad. The average price of mixed numbers of warrants during the year has been 49s. 4½d. per ton, against 49s. 1½d. in 1881. The price of warrants on 22nd December, 1882, was 49s. 7½d., and on the corresponding date last year 52s. 4d. On the 9th January last—the highest price of the year—53s. 1½d. was paid, and the lowest price—46s. 8d.—was touched on the 20th April. In the course of the year there were 345,000 tons of English iron imported by rail and water, against 420,000 in 1881, being a reduction of 75,000 tons. Of this amount 185,000 tons was consumed in foundries, and 160,000 tons in malleable iron and steel works.

Business was done on Wednesday at 48s. 11d. to 48s. 9d. cash. To-day—Thursday—transactions were effected at 48s. 10d. to 49s. cash.

The malleable iron trade is fairly active, and it has good prospects in connection with shipbuilding orders, but there is rather less pressure of fresh work coming to hand. Messrs. Dixon, Limited, in pursuance of a resolution adopted some two years ago, but which they could not conveniently carry out at the time, are withdrawing from the malleable trade, and giving up their malleable works both at Govan and Coatbridge. This will throw a large number of men out of employment, but other departments of trade are so busy that they should not be long in finding situations.

The coal trade is gradually recovering from the derangement caused by the recent stormy weather.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

THE Cleveland market held at Middlesbrough on Wednesday last was thinly attended, as might naturally have been expected. Many habitual attenders were away holiday-making, and those who were present seemed more disposed to spend the time in friendly conversation and seasonable congratulations than in buying or selling. The tone of the market, such as it was, was decidedly flat. News of a depressed feeling at Glasgow tended to confirm and increase this, and buyers generally held back. No. 3 g.m.b. was quoted at 43s. f.o.b., and No. 4 at 42s. Warrants were virtually unsaleable.

The manufactured iron trade was no better than that in pig iron. Plates were quoted at £6 10s. free in trucks, less 2½ per cent. discount, but buyers would not give the price, and nothing was done. Bars and angles might be had for £5 10s., subject to the same terms. Steel rails have been sold as low as £5 12s. 6d. where the section is a desirable one and the order worth having. Light sections still command from £5 to £5 5s.

The Cleveland market will be held on Wednesday in the new year's week, as in the Christmas week, instead of Tuesday as ordinarily.

A partial trial of the electric light was made at Messrs. Bell Bros., Page Bank Colliery, on Wednesday, the 20th inst. Several lamps were lighted at and about the bottom of the two shafts, and were found to be far more powerful as illuminators than the lamps which had previously been in use.

The shipbuilding trade continues to be very brisk on the Tees and at the Hartlepools. Returns have been issued showing the number of vessels built during the present year. The tonnage is considerably in advance of that turned out last year. Messrs. Richardson, Duck, and Co., of South Stockton, have built eight iron screw steamers, with a gross registered tonnage of 16,182 and 1799 nominal horse-power. At North Stockton Messrs. M. Pearse and Co. have launched eleven vessels of 17,696 gross tonnage and 1680 nominal horse-power. In 1881 Messrs. Richardson, Duck, and Co.'s output tonnage was 17,338, and Messrs. Pearse and Co.'s 15,971. Both these firms have in hand work which will keep them employed far into the new year. At Middlesbrough Messrs. Raylton, Dixon, and Co., have built during the year eighteen vessels of various kinds, with a gross tonnage of 27,249 and 2755-horse power. At Hartlepool Messrs. Wm. Gray and Co. have built twenty-one vessels during the year, the gross tonnage being 38,209, and the nominal horse-power 3598. This shows an increase of four vessels and upwards of 6000 tons over the previous year. Messrs. E. Withy and Co. have turned out twelve steamers, amounting to 21,905 tons and 1975-horse power, being an increase of one vessel and 4000 tons over 1881. At Messrs. Irvine and Co.'s yard six steamers have been built with a tonnage of 7253 and 660-horse power. The total tonnage built at the Hartlepools during 1882 is therefore 67,367, as against 56,541 last year. In 1879 the total was only 27,644.

It is said that Mr. Edward Withy, of the Middleton Shipyard, Hartlepool, intends to try the experiment of employing females in his drawing office.

The associated employers connected with the North of England Board of Arbitration have of late been considering at their meetings the alterations which they think it desirable should be made in the rules of the Board. It is admitted by both masters and men that considerable change is needed, as difficulties are continually arising which the Board is unable to deal with. The working expenses under the existing arrangement are also far too heavy, and many abuses exist. The employers have issued the following propositions for the consideration of the Iron-workers' Association:—"Suggestions for a joint Arbitration Committee of employers and operatives for the manufactured iron trade of the North of England: (1) The committee to be composed of six from each side, members of and selected by the Employers' and Operatives' Associations respectively. (2) To be presided over by an independent person mutually selected. (3) The expense of paying representatives, officials, and all similar charges, to be borne by each side separately. Joint expenses, such as arbitrations, joint committees, accountant, and shorthand writer, to be shared equally between the employers and operatives. (4) The recognition of employers class and operative class only, or mainly, through their respective associations. (5) The enforcement of joint decisions and the awards of arbitrators by the full power of both associations. (6) To meet joint expenses one penny per man per four weeks to be deducted, the employers contributing an equal amount. The money to be banked in the names of two treasurers—one from each side. Any surplus remaining at the close of the year to be divided equally and paid over to the funds of the Employers and Operatives' Association respectively."

The standing committee held a meeting at Middlesbrough on Friday, the 22nd inst., to consider the above, but no definite conclusions were come to. The rule most objected to by the operatives is that by which the Board would consist of only six employers and six employés. Under the present arrangement the men have twenty-three representives, viz., one from each works.

It is not unlikely that the above rule will be withdrawn, and that the representation will be allowed to remain as herebefore. At the same time the duties and mode of payment of the operative delegates will be strictly defined, and it will be no longer possible for them to make a living out of their fees and without working. As much as £7 to £8 per week has hitherto been received by some of them for adjusting grievances and attending meetings!

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

THE great tin-plate failures of the winter of 1882 will long be remembered. I fear we have not seen the end of them, but even up to the present the list is a grim one; 28 works stopped, 20,000 people thrown out of work or impoverished, and a decrease in make of 150,000 boxes of tin-plate of all kinds weekly. This is a different form of arriving at a limitation of make from that comtemplated by makers. The results, however, are the same, and prices are beginning to stiffen. I shall thoroughly expect to see a good spring trade. Large consignments of tin-plate continue to be made. Speculation is active as to the resuscitation of the closed works. Possibly one or two may resume, under new direction; as regards the mass, liabilities and expenses will eat them all up.

The iron trade generally is satisfactory. Over 5000 tons iron and steel left Cardiff last week, and the supply of foreign ores has been well kept up.

During a reeent dearth of arrivals from Bilbao, consequent on the stormy weather, the possibility was discussed of Welsh ore coming into use again under the Thomas-Gilchrist patent. This would only be resorted to in great need, and when ores of Bilbao and Elba were not to be had. The Welsh ore, with its 23 per cent. to 27 per cent. of iron, would entail an expensive process and show poor results at the best.

I look forward confidently to a brisk rail trade in the new year. Indications are good, and the market is firm with upward tendency. Business during the last few days has been quiet, principally on account of Christmas time.

Great expectations exist about the projected railways, though it is thought that the modified tariff of the Taff Vale will seriously affect the Barry scheme. So far we have on the carpet the Barry scheme, the Treherbert and Swansea Bay, and the Newport and Rhondda, which may be regarded as accomplished facts, the Great Western and Rhymney connection with Merthyr, which is also decided on, and the South Wales, and London and Monmouthshire Valleys and Cardiff, which will come on early in the session. One of the largest portions of the Newport and Rhondda Railway, now in course of formation, is the bridge spanning the Taff. This has been a great hindrance, but I am glad to see that the chief difficulties have been mastered. The viaduct on the new section of the Great Western to Merthyr will be a formidable undertaking.

There is now a rush on pitwood; 18,000 tons came last week, and prices are easier.

Maenclochog Railway, Pembrokeshire, is to be closed for general traffic in January.

The Neath Commissioners announce the construction of a lock to their new dock and the change of present channel.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

WORK generally ceased for the Christmas holidays on Saturday, and during the week the artisans have been mostly at "play." Next Tuesday the works will again be in full swing, but, so far as I can learn, there will be no great bulk of orders to carry forward to the new year. Manufacturers have been aiming at clearing off their orders as far as possible; and there has been no great influx of work during the closing months of the year. Advantage is usually taken of the holidays to make repairs and alterations to machinery, and boiler-makers have a busy time of it.

The leading coalowners of Lancashire have been joined by a considerable number in Yorkshire, Derbyshire, and the surrounding district, and formed an association under the Limited Liability Act, to establish a coal exchange. The association has obtained a special licence from the Board of Trade to omit the word "Limited" from its title. There will be a library and reading-room, with other accommodation, in which persons engaged in the coal and kindred trades, in Manchester and the neighbourhood, may meet for the transaction of business, and to promote the interests of the coal and other industries.

The Claycross colliers do not take kindly to the new safety lamp arrangements. At first 200 miners declined the lamps, and struck against their use. At a recent meeting, the chairman said he was fully convinced that the use of the safety lamp was disadvantageous to the men. There ought, he said, to be 3d. per ton advance for the use of the lamps, and another 3d. per ton for wedging where shots could not be fired. Another speaker said there were men in the pit to whom the safety lamps would mean a reduction of from 2s. to 2s. 6d. per day. A resolution that the company be asked to withdraw the lamps did not find a seconder, but another resolution was passed declaring the men entitled to an advance of 3d. per ton on the present tonnage in all pits where the lamps were used.

Mr. Thomas Hampton has retired from the firm of Messrs. Steel, Tozer, and Hampton, Limited, steel rail manufacturers, Phœnix Bessemer Works, The Ickles, Rotherham. Mr. Hampton's interest, I believe, has been acquired for the existing partners, the company being in every sense, except that it is under the Limited Liability Act, a private concern. For rails during the closing months of the year, the Argentine Republic has been the principal foreign customer.

At Dronfield the people, hoping against hope, will not believe the steel works are to be removed to Workington. They have heard that Messrs. Charles Cammell and Co. contemplate another movement, namely, to retain the Dronfield Works and remove the Penistone establishment, "because the lease at Penistone is on the point of expiring." There is no ground whatever for this idea. The premises at Penistone are freehold, and Dronfield may rest assured that by the 31st of March the steel works will be taken away root and branch.

During the last year our Government have been important customers for plates of all kinds. Armour-plates, on the compound system, have been supplied for the Collingwood, Majestic, Conqueror, Imperieuse, Colossus, Edinburgh, and Rodney. Steel plates have also been made at Sheffield for the Agamemnon, the Ajax, Warspite, and the Howe, building at Chatham. Compound armour, it is expected, will also soon be required for the Admiral Benbow, for which ship the Thames Shipbuilding Company have taken the contract.

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.

19th December, 1882.

6048. SEWING BRAIDS, &c., into HATS, J. H. Johnson.—(*C. H. Wilcox, New York, U.S.*)
6049. WATER-CLOSETS, R. H. Leask, Dublin.
6050. REGENERATIVE HOT-BLAST STOVES, E. A. and C. E. Cowper, London.
6051. SEWING MACHINES, S. Dixon, Salford.
6052 MAKING PAPER BAGS, E. K. Dutton.—(*F. W. Leinbach and C. A. Wolle, Bethelem, U.S.*)
6053. BOTTLES for MEASURING LIQUIDS, J. Chaillet and T. Rougnon, Paris.
6054. SADDLE-BAR, J. Pearse, Cheltenham.
6055. CAR COUPLINGS, A. Boult.—(*C. Mack, Flint, U.S.*)
6056. EXTRACTING GOLD from PYRITES, J. Plaisted, London.
6057. DRYING SALT, &c., S. Pitt.—(*R. G. Starke, Montreal.*)
6058. TREATING ALKALINE SALTS, C. A. Faure, Paris.
6059. DISTILLATION of COAL, E. Drew, Bayswater.
6060. DISTILLING COAL TAR, &c., E. Drew, Bayswater.
6061. TREATING FIBROUS MATERIALS, T. Routledge, Sunderland.
6062. FOUNTAIN PENS, W. H. Davies, London.
6063. TRICYCLES, &c., E. Marshall, Birmingham.
6064. CALCINATION of REGULUS, &c., J. W. Chenhall, Morriston.
6065. MICROSCOPES, W. E. Hancock, Halifax.
6066. WATERPROOF, &c., TEXTILE FABRICS, W. R. Lake. (*D. M. Lamb, New York, U.S.*)
6067. ELECTRICAL GAS-LIGHTING APPARATUS, S. E. Pattison.—(*W. A. Drysdale and C. W. Bailey, U.S.*)
6068. OPEN STOVES, &c., E. R. Hollands, London.

20th December, 1882.

6069. SAFETY-VALVE, J. Williams, London.
6070. PRESSING HORNS and HOOFS, D. Stewart, Aberdeen, N.B.
6071. CARRIAGES, &c., J. Dakers, Aberdeen, N.B.
6072. ARTIFICIAL HORIZON for QUADRANTS, &c., W. E. Gedge.—(*S. Pattee, U.S.*)
6073. STOPPERS for BOTTLES, H. Vollmer.—(*Messrs. Gomperty and Meinrath, Hanover.*)
6074. AUTOMATIC RAILWAY COUPLING, E. N. Brereton, Liverpool.
6075. INCANDESCENT LAMPS, L. Groth.—(*A. Bernstein, Boston, U.S.*)
6076. TREATING GOLD ORES, L. A. Groth.—(*Campbell Mining and Reducing Company.*)
6077. TIPS for BOOTS, &c., L. A. Groth.—(*L. Loeser and J. Kyeser, New York, U.S.*)
6078. WINDOW BLINDS, L. A. Groth.—(*H. Olausen, Christiania.*)
6079. PROPULSION of SHIPS, F. H. F. Engel.—(*G. de Laval, Stockholm.*)
6080. PIPE COUPLINGS, J. Chapman, Nottingham.
6081. SEPARATING HAIR from COTTON, C. Harrison, London.
6082. HAND SHEARS, E. Nunan, London.
6083. ELECTRO MOTORS, L. Milne and L. B. Miller, London.
6084. REGULATORS for STEAM ENGINES, E. Edwards.—(*A. Zalm, Amsterdam.*)
6085. TELEPHONIC APPARATUS, W. R. Lake.—(*M. F. Tyler, Newhaven, U.S.*)
6086. BANJOS, &c., W. R. Lake.—(*F. H. Chase, U.S.*)
6087. CONSERVING COMESTIBLES, F. Wirth.—(*H. Maehler, Germany.*)
6088. ROTARY KNITTING MACHINES, W. Cotton, Loughborough.
6089. TREATING FERMENTED LIQUORS, A. G. Salamon, Clapham Park.
6090. LEGGINGS, &c., F. W. Hemming, London.
6091. FURNACES, E. Bennis, Bolton.
6092. VESSELS for LIQUIDS, W. Lake.—(*A. Gay, Paris.*)

21st December, 1882.

6093. LOOMS for WEAVING, J. Laird, Forfar.
6094. DOUBLE-DRIVING TRICYCLES, S. Lee and M. Stodart, London.
6095. SHEARING PILE FABRICS, &c., C. D. Abel.—(*La Société A. Labrosse et G. Richard, Paris.*)
6096. PENCIL-HOLDERS for COMPASSES, H. J. Haddan.—(*G. Schönner, Germany.*)
6097. SOLES for FOOT COVERINGS, G. H. Jones and H. Hemsley, Kettering.
6098. SEWING MACHINES, B. J. B. Mills.—(*C. Vernay and F. Roux, Lyons.*)
6099. COAL VASES, J. T. Beston, Birmingham.
6100. CULTIVATING LAND, D. Greig, Leeds, and G. Greig, Edinburgh.
6101. DIES for ROOFING, C. Major, Bridgwater.
6102. INSULATOR for TELEGRAPHIC WIRES, A. G. Bossomaier, London.
6103. ADMINISTERING MEDICINE to HORSES, P. Fonnerau and W. Fielding, London.
6104. COCKS, &c., G. Teideman, London.
6105. ELECTRIC METERS, F. H. Varley and J. R. Shearer, London.
6106. SELF-ACTING CLUTCHES, J. S. Taylor and S. W. Challen, Birmingham.
6107. HAT LININGS, W. H. Knowles and J. Faulkner, Denton, R. I. Metcalfe & W. R. Raines, Dukinfield.
6108. VELOCIPEDES, R. C. Fletcher, near Preston.
6109. OVENS HEATED by GAS, W. A. Crommelin, J. Lees, H. Spain, and W. H. Thompson, Leeds.
6110. CUSHIONS for PERMANENT WAY, W. P. Thompson.—(*J. L. Bopp du Pont, Paris.*)
6111. EVAPORATING SACCHARINE, &c., W. P. Thompson.—(*A. Gilain, Belgium.*)
6112. SAFETY BOAT, E. Edwards, London.—(*A. Le Briton Dulier, Lille.*)
6113. ARMOUR PLATES, J. H. Johnson.—(*Messieurs Marrel Bros., France.*)

22nd December, 1882.

6114. PHOTOMETRIC APPARATUS, S. H. Emmens, London, and J. Munro, West Croydon.
6115. COUPLING CARRIAGES, J. Anderson and J. Darling, Glasgow.
6116. STEERING APPARATUS, J. Imray.—(*J. Lake, U.S.*)
6117. CUTTING JEWELLERY, J. Imray.—(*E. Roude, Paris.*)
6118. RECEPTACLES of SECONDARY BATTERIES, G. Binswanger, London.
6119. DISH COVERS, A. G. Hewett, Sheffield.
6120. EDUCATIONAL APPARATUS, A. J. Boult.—(*P. E. Lamberet and A. M. Billoud, France.*)
6121. WATER-CLOSETS, W. R. Lake.—(*C. F. Pike, Philadelphia, and E. Z. Collings, New Jersey.*)
6122. GAS FIRES, &c., W. T. Sugg, London.
6123. FOLDING COT CARRIAGES, T. Trotman, London.
6124. COLOUR BOXES, T. Foxall, London.
6125. COMBING WOOL, W. Terry and J. Scott, Bradford.
6126. WARMING ROOMS, E. Hopgood, Ryde, and E. Jenner, London.
6127. RAILWAY FOG SIGNAL APPARATUS, J. Coleman and I. Henson, Derby.
6128. FASTENERS for GLOVES, &c., H. Vollmer.—(*F. Fütemann, Lüdenscheid.*)
6129. INSERTING TYPE in STEREOTYPE PLATES, J. E. Taylor, P. Allen, W. Evans, & C. Scott, Manchester.
6130. GAS ENGINES, A. M. Clark.—(*V. Laurent, Paris.*)
6131. PRODUCING ENAMELLED GLASS, A. M. Clark.—(*J. Feix, Albrechtsdorf, Austria.*)
6132. MECHANICAL RETORT, J. Lyle, Highgate.
6133. PERFORATING DESIGNS upon PAPER, F. Squire, Hackney.

23rd December, 1882.

6134. PRESERVING ANIMAL and VEGETABLE MATTER, J. Townsend, Glasgow.
6135. KIERS, J. Dimmock, Over Darwen.
6136. MOTIVE-POWER ENGINES, J. A. B. Bennett, King's Heath, and B P. Walker, Birmingham.
6137. MACHINERY for PRINTING on both SIDES of a MOVING WEB, W. Conquest.—(*Messrs. R. Hoe and Co., New York, U.S.*)
6138. LUBRICATING PARTS of MACHINERY, E. B. Petrie and W. A. Entwistle, Rochdale.
6139. SHUTTLES, T. Brooks & T. Tweedale, Rawtenstall.
6140. TRACTION ENGINES, E. Foden, Sandbach.
6141. TIRES of WHEELS, T. E. Rigby.—(*J. Rigby, Cleveland, U.S.*)
6142. BURNING GAS for COOKING, &c., J. W. Plunkett, London.
6143. DISINFECTING COMPOUNDS, I. S. McDougall, Manchester.
6144. WATER HEATERS, &c., I. McDougall, Manchester.
6145. FLOUR-SIFTING MACHINES, H. E. L. Bauermeister, Hamburg.
6146. DYNAMO-ELECTRIC, &c., MACHINES, R. Matthews Hyde.
6147. TRICYCLES, &c., F. C. Glaser.—(*Hr. L. Blaes, Ensheim, Germany.*)
6148. KILN FURNACES, &c., J. Sawyer, Hoxton.
6149. EXTRACTING SACCHARINE MATTER from VEGETABLES, C. Ekman, W. Espeut, and G. Fry, London.
6150. AUTOMATIC ELECTRIC SIGNALLING APPARATUS, H. J. Haddan.—(*P. H. Fortin and J. J. Langlet, Paris.*)
6151. BILLIARD TABLES, J. M. Fletcher, London.
6152. ORNAMENTING LEATHER, J. H. Epstein, London.
6153. ELECTRIC, &c., LAMPS, J. M. Fletcher, London.
6154. BEDSTEADS, G. Gentle, London.
6155. MACHINES for CALENDERING, P. Jensen.—(*Messrs. Westphal Bros., Berlin.*)
6156. SASH FASTENERS, J. E. Cope, Birmingham.
6157. FASTENINGS for GLOVES, &c, G. Capewell, Birmingham.
6158. CARPETS, F. B. Fawcett, Kidderminster.
6159. LOOMS, J. Pemberton and R. Pearson, Preston.
6160. SEWING MACHINES, A. Guillaume and A. Lambert, Fosses, Belgium.
6161. HYGROMETERS, &c., F. H. F. Engel.—(*W. Klinkerfues, Göthingen.*)
6162. WATER-CLOSET APPARATUS, I. Rider, Bristol.
6163. REMOVING SMOKE &c., from TUNNELS, D. C Green, London.
6164. PRODUCING ELECTRIC LIGHT, A. M. Clark.—(*L. Gerard and W. V. Bonsor, Brussels.*)

Invention Protected for Six Months on Deposit of Complete Specifications.

6055. CAR-COUPLINGS, A. J. Boult, London.—A communication from C. Mack, Flint Michigan, U.S.—15*th December*, 1882.
6085. TELEPHONIC APPARATUS, W. R. Lake, Southampton-buildings, London.—A communication from M. F. Tyler, New Haven, Connecticut, U.S.—20*th December*, 1882.

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

5193. AXLES and SHAFTS, J. C. Evans, London, and J. W. Spencer, Newburn.—19*th December*, 1879.
2. FILLING, &c., SEED CASKS, B. Tydeman, Crossness.—1*st January*, 1880.
5252. SEWING MACHINES, A. Keats, Newcastle.—23*rd December*, 1879.
5257. STREETS, &c, J. Gowans, Edinburgh.—24*th December*, 1879.
18. ELECTRIC LAMPS, J. W. Swan, Newcastle-on-Tyne.—2*nd January*, 1880.
250. ELECTRIC LAMPS, J. W. Swan, Newcastle-on-Tyne—20*th January*, 1880.
5214. POINT RAILS for RAILWAYS, J. S. Williams, Riverton, U.S.—20*th December*, 1879.
5268. MOUNTING SADDLES of BICYCLES, N. Salamon, London.—24*th December*, 1879.
5271. SEPARATING CREAM from MILK, E. P. Alexander, London.—24*th December*, 1879.
11. TENONING MACHINE, S. Skinner, Eastbourne.—1*st January*, 1880.
5302. STEEL, IRON, &c., S. G. Thomas, London.—29*th December*, 1879.
105. CHECKING, &c., FARES, A. J. Aspinall, Liverpool.—9*th January*, 1880.
676. SHAFT BRACKET with BEARING, &c., J. S. Taylor & S. W. Challen, Birmingham.—16*th February*, 1880.
5226. DRIVING, &c., REVOLVING SHAFTS, C. J. Appleby, London.—22*nd December*, 1879.
5309. LUBRICATORS, J. Cassels, Liverpool.—29*th December*, 1879.
26. ANNEALING PLATE GLASS, W. W. Pilkington, St. Helens.—3*rd January*, 1880.
5254. POSTS for RAILWAY SIGNALS, &c., J. S. Williams, Riverton, U.S.—23*rd December*, 1879.
5270. OPERATING, &c., RAILWAY SWITCHES, &c., J. S. Williams, Riverton, U.S.—24*th December*, 1879.
5274. MOTOR GOVERNOR, H. J. H. King, Newmarket, —24*th December*, 1879.
5278. CAST IRON HOLLOW WARE, T. Holcroft, near Wolverhampton.—24*th December*, 1879.
5297. OPERATING RAILWAY SIGNALS, H. Johnson, Eccles.—27*th December*, 1879.

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

4524. PANTOGRAPH ENGRAVING MACHINES, W. R. Lake, London.—29*th December*, 1875.
4412. FORMATION of SKATING RINKS, J. Gamgee, London.—20*th December*, 1875.
150. PUMPING LIQUIDS, G. S. Hazelhurst, Runcorn.—14*th January*, 1876.
4480. EXCAVATING MACHINES, J. Dunbar, London, and J. Ruston, Lincoln.—24*th December*, 1875.
4515. METAL ROLLERS, &c., H. Wilde, Manchester.—28*th December*, 1875.

Notices of Intention to Proceed with Applications.

(*Last day for filing opposition*, 12*th January*, 1883.)

3924. PROPELLING TRAM-CARS, O. Mobbs and L. G. Moore, Northampton.—16*th August*, 1882.
3938. WASHING, &c, GAS, S. Holman, London, and C. Hunt, Birmingham.—17*th August*, 1882.
4940. CONNECTING INTERCHANGEABLE TAPPITS, J. Bywater and C. Bedford, Leeds.—17*th August*, 1882.
3946. RECEIVING, &c., SIGNALS, B. H. Chameroy, Maisons Laffitte, France.—17*th August*, 1882.
3958. CASTING and MIXING METALS, J. A. B. Bennett, King's Heath, and B. P. Walker, Birmingham.—18*th August*, 1882.
3977. MAKING AMMONIA, &c., D. Urquhart, London.—Partly com. from L. Playfair.—19*th August*, 1882.
3979. DRIVING MECHANISM of TRICYCLES, &c., W. S. Lewis, Wolverhampton.—19*th August*, 1882.
3984. TAILORS' MARKING INSTRUMENTS, H. Searle and T. J. Ironside, London.—19*th August*, 1882.
3990. FACILITATING LIGHTING of FIRES, E. Tomlinson, London.—19*th August*, 1882.
3994. MOTTLED SOAP, A. Hedley, Gosforth. — 21*st August*, 1882.
4000. RENDERING WALL-PAINTINGS WEATHER-PROOF, A. Keim, Munich.—21*st August*, 1882.
4002. KITCHEN RANGES, R. W. Crabtree, Leeds.—21*st August*, 1882.
4007. CONTINUOUS CENTRIFUGAL MACHINES, F. Wirth, Frankfort-on-the-Main.—A communication from C. von Bechtolsheim.—21*st August*, 1882.
4008. INDICATING POSITION of SUNKEN SHIPS, W. R. Lake, London.—A communication from M. Fernberg.—21*st August*, 1882.
4015. WORKING GATES at CROSSINGS, C. H. Lea, Stafford.—22*nd August*, 1882.

4017. Making Glucose from Starch, H. J. Haddan, London.—Com. from L. Virneisel.—22*nd August*,1882.
4024. Bottle-stoppers, I. Lippmann, Berlin.—22*nd August*, 1882.
4031. Heating Apparatus, W. R. Lake, London.—A com. from M. J. Walsh.—22*nd August*, 1882.
4032. Glass Bottles, T. Pyke, South Shields.—22*nd August*, 1882.
4040. Mechanical Stokers, J. Proctor, Burnley.—23*rd August*, 1882.
4042. Steel for Corsets, &c., J. S. W. Whitehead, Halifax.—23*rd August*, 1882.
4044. Telephone Receiving Apparatus, R. and M. Theiler, London.—23*rd August*, 1882.
4053. Sleeper Chairs, J. McL. Blair, Glasgow.—24*th August*, 1882.
4061. Covers of Cans, H. J. Haddan, London.—A com. from Schneider and Lemp.—24*th August*, 1882.
4062. Sewing Machines, H. J. Haddan, London.—A com. from J. A. Doering.—24*th August*, 1882.
4079. Secondary Batteries, L. H. M. Somzée, Brussels.—25*th August*, 1882.
4080. Electric Measuring, &c., Apparatus, S. H. Emmens, London.—25*th August*, 1882.
4087. Lighting Trains by Electricity, H. E. Newton, London.—A communication from the Société Universelle d'Electricité Tomasi.—26*th August*, 1882.
4127. Electric Indicator, &c., T. Wright, Malta.—29*th August*, 1882.
4203. Drying Waste Matter, J. F. Johnstone, London.—4*th September*, 1882.
4213. Loading, &c., Vessels, A. M. Clark, London.—A communication from J. Brown and J. Brown, jun.—5*th September*, 1882.
4328. Cock, W. Bright, Exeter.—12*th September*, 1882.
4393. Modification of Musical Sounds, J. Burnet, London.—15*th September*, 1882.
4458. Carbon Conductors, W. R. Lake, London.—A com. from E. Weston.—19*th September*, 1882.
4473. Bicycles, &c., C. Clarke, London.—20*th September*, 1882.
4487. Treating Phosphorites, J. Imray, London.—A com. from G. L. Dandenart.—20*th September*, 1882.
4520. Button-hole Attachment for Sewing Machines, I. Nasch, London.—22*nd September*, 1882.
4572. Apparatus for Making Gas, S. Chandler, London.—26*th September*, 1882.
4643. Converting Reciprocating into Rotary or Rotary into Reciprocating Motion, W. R. Lake, London.—A communication from J. J. Larroque.—29*th September*, 1882.
4683. Axles, W. Clark, London.—A communication from J. H. Huyler.—2*nd October*, 1882.
4745. Grain-dryers, A. M. Clark, London.—A communication from H., G. E., and C. F. Cutler, and B. T. Thompson.—5*th October*, 1882.
4765. Bushing Material, W. R. Lake, London.—A com. from G. F. Senter.—6*th October*, 1882.
4810. Dynamo-electric Machines, R. E. Crompton, London, & G. Kapp, Chelmsford.—10*th October*, 1882.
5048. Fastening Umbrellas, &c., H. H. Lake, London.—A com. from A. Iehl.—23*rd October*, 1882.
5112. Separating Glycerine from Fatty Matters, J. Imray.—A communication from C. F. E. Poullain, E. F. and E. N. Michaud.—27*th October*, 1882.
5287. Umbrella Frames, S. Scherer, London.—6*th November*, 1882.
5361. Washing, &c., Machines, R. P. Rothwell, Lytham.—10*th November*, 1882.
5504. Making Incandescent Electric Lamps, A. Swan, Gateshead.—20*th November*, 1882.
5505. Making Cocoa, S. P. Wilding, London.—A com. from G. Stollwerck.—20*th November*, 1882.
5546. Cooling Apparatus, S. P. Wilding, London.—A com. from G. Stollwerck.—22*nd November*, 1882.
5606. Taking Soundings, F. Sutcliffe, Liverpool.—25*th November*, 1882.
5659. Shearing Piled Fabrics, C. D. Abel, London.—A communication from Ed. de Montagnac et Fils.—28*th November*, 1882.
5667. Cutting Tubes, S. Goodby, sen., Wolverhampton.—29*th November*, 1882.
5717. Distilling Coal, G. E. Davis, Manchester.—30*th November*, 1882.
5727. Transferring, &c., Railway Wagons, G. Taylor, Penarth.—1*st December*, 1882.
5759. Small Fire-arms, T. Gilbert, London.—2*nd December*, 1882.
5916. Looms, W. Adam, Kidderminster.—11*th December*, 1882.

(*Last day for filing opposition*, 16*th January*, 1883.)

4006. Velocipedes, J. Stassen, London.—21*st August*, 1882.
4009. Barrels, &c., W. R. Lake, London.—A communication from F. Myers.—21*st August*, 1882.
4022. Rowlocks for Boats, S. S. Hazeland, St. Sampson.—22*nd August*, 1882.
4026. Skates, C. G. Beddoe, London.—22*nd August*, 1882.
4033. Carburetting Illuminating Gas, C. Crozat, Eastcheap.—22*nd August*, 1882.
4034. Generation, &c., of Electricity, J. S. Williams, London.—22*nd August*, 1882.
4041. Preparing Cotton, &c., W. Lord, Todmorden.—23*rd August*, 1882.
4043. Moulds for Casting Nails, S. Williams, Aston.—23*rd August*, 1882.
4058. Lace Boots, &c., A. C. Andrews, Birmingham.—24*th August*, 1882.
4072. Filtering Apparatus, J. F. C. Farquhar and W. Oldham, London.—25*th August*, 1882.
4075. Clogs, G. Glover, Liverpool.—25*th August*, 1882.
4083. Opening Bottles, D. Cole, Swindon.—26*th August*, 1882.
4086. Railway Carriages, &c., W. J. Bennett and C. H. Rosher, London.—26*th August*, 1882.
4115. Steam Pumps, J. F. Spencer, London.—29*th August*, 1882.
4117. Washing Lawn Tennis Balls, A. S. Openshaw, Birmingham.—29*th August*, 1882.
4119. Propelling Ships, &c., G. F. Harrington, Ryde.—29*th August*, 1882.
4120. Self-indicating Tea Urn, &c., R. W. Raphael, Balnamore.—29*th August*, 1882.
4128. Reducing Tin Stuff, &c., to Extract Metal, J. Toy, Helston, and S. H. Stephens, Sithney.—29*th August*, 1882.
4163. Filters, A. M. Clark, London.—A communication from W. Maynard.—31*st August*, 1882.
4210. Discharging Bilge Water from Vessels, A. M. Clark, London.—A communication from H. Cordes.—4*th September*, 1882.
4265. Washing Apparatus, W. B. Nation, London.—7*th September*, 1882.
4293. Multiple-cylinder Engines, F. Wynne, London.—9*th September*, 1882.
4368. Venetian Window Blinds, G. S. Marshall, Birmingham.—14*th September*, 1882.
4372. Cleaning Grain, J. and R. M. Davidson, Newcastle-on-Tyne, and A. Miller, Gateshead.—14*th September*, 1882.
4535. Dynamo-electric Machines, F. C. Glaser, Berlin.—A communication from C. Zipernowsky and M. Deri.—23*rd September*, 1882.
4538. Purifying Gases, H. Symons, Totnes.—23*rd September*, 1882.
4657. Brakes for Carriages, H. Downie, Corstorphine.—30*th September*, 1882.
4669. Steam Generators, W. Clark, London.—A communication from M. Hervier.—30*th September*, 1882.
4752. Intensifying Fluorescent Electric Lighting, R. Kennedy, Glasgow.—6*th October*, 1882.
4889. Developement of Electricity, J. Whitley, Leeds.—14*th October*, 1882.
4966. Wheels for Traction Engines, J. and H. McLaren and C. Morris, Leeds.—18*th October*, 1882.
4991. Secondary Batteries, J. E. Liardet, Brockley, and T. Donnithorne, London.—19*th October*, 1882.
5409. Electric Lighting, J. Muirhead and T. M. Collett, London.—A communication from G. A. Grindle.—13*th November*, 1882.
5503. Obtaining Motive Power, L. L'Hollier and G. Asher, Birmingham.—20*th November*, 1882.
5554. Colouring Matters, C. Lowe, Reddish.—22*nd November*, 1882.
5565. Preparing Extracts of Meat, F. Barff, London, and A. P. Wire, Leytonstone.—22*nd November*, 1882.
5645. Primary Voltaic Batteries, G. G. André, Dorking.—28*th November*, 1882.
5671. Colouring Matters, C. D. Ekman, London.—29*th November*. 1882.
5703. Sewing Machines, M. Gandy, Liverpool.—30*th November*, 1882.
5807. Metallic Inlaid Work, A. M. Clark, London.—A com. from W. C. Edge.—5*th December*, 1882.
5846. Rowlocks for Boats, C. M. Morris, Lowestoft.—7*th December*, 1882.
5874. Ring Spinning, &c., Frames, J. Young and E. Furness, Mellor.—9*th December*, 1882.
6055. Car Couplings, A. J. Boult, London.—A communication from C. Mack.—19*th December*, 1882.
6085. Telephonic Apparatus, W. R. Lake, London.—A com. from M. F. Tyler.—20*th December*, 1882.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 22nd December*, 1882.)

2983. Making Trowels, A. Reaney, Sheffield.—23*rd June*, 1882.
2985. Thrashing Machines, E. Foden, Sandbach.—23*rd June*, 1882.
2993. Preventing Incrustation in Steam Boilers, E. Field & W. L. Thompson, London.—24*th June*, 1882.
2995. Brewing of Beer, E. R. Moritz, London.—24*th June*, 1882.
2997. Oil Can for Lubricating Machinery, G. Cornut and A. Castelin, Paris.—24*th June*, 1882.
3000. Kitchen Ranges, G. Dawson and C. Butcher, Thorncliffe.—24*th June*, 1882.
3001. Corsets, &c., C. L. Reynolds, Landport.—24*th June*, 1882.
3004. Protecting Tapholes, L. J. Prosser, London.—24*th June*, 1882.
3010. Electric Lamps, W. E. Debenham, London.—26*th June*, 1882.
3017. Sorting Grain, &c., A. J. Boult, London.—26*th June*, 1882.
3023. Velocipedes, G. Moss, Barbican.—27*th June*, 1882.
3032. Safety Lamps, W. Jenkins and D. Morgan, Treorky.—27*th June*, 1882.
3033. Producing Carbons, F. S. Isaac, London.—27*th June*, 1882.
3037. Syringing the Leaves of Plants, J. A. Drake and R. Muirhead, Maidstone.—27*th June*, 1882.
3042. Incandescent Electric Lamps, F. L. Willard, London.—28*th June*, 1882.
3056. Removing Ingots from Moulds, T. Hampton, Sheffield.—28*th June*, 1882.
3057. Chucks for Turning Lathes, H. H. Lake, London.—28*th June*, 1882.
3072. Hyposulphite of Soda, G. W. von Nawrocki, Berlin.—29*th June*, 1882.
3075. Furnaces of Steam Boilers, W. Bell, Lancaster.—29*th June*, 1882.
3086. Printing Ink, F. Wirth, Germany.—30*th June*, 1882.
3088. Combing Wool, &c., J. W. Bradley and J. Wood, Bradford.—30*th June*, 1882.
3125. Carbonate of Soda, C. Wigg, Liverpool.—3*rd July*, 1882.
3136. Shackles, R. M. Ruck, Chatham.—3*rd July*, 1882.
3144. Barb Wire for Fences, F. C. Glaser, Berlin.—4*th July*, 1882.
3164. Still for Liquids Containing Ammonia, W. A. Barlow.—4*th July*, 1882.
3223. Filtering Water, J. H. Topham, Manchester.—7*th July*, 1882.
3229. Flushing Water-closets, U. Bromley, G. Crowe, and W. James, Chester.—7*th July*, 1882.
3247. Axles, &c., H. J. Haddan, Kensington.—8*th July*, 1882.
3274. Driving Gear for Locomotives, J. H. Johnson, London.—11*th July*, 1882.
3278. Boot Burnishing, H. J. Haddan, London.—11*th July*, 1882.
3372. Cocks, &c., J. W. Restler, Nunhead.—15*th July*, 1882.
3437. Cocks, &c., D. R. Ashton, Clapton.—19*th July*, 1882.
3474. Couplings for Shafts, H. Smith and C. Harrison.—21*st July*, 1882.
3491. Photographic Images, E. G. Colton, London.—22*nd July*, 1882.
3541. Producing Methylquinoline from Ortho-nitro-benzylidenacetone, J. Erskine, Glasgow.—26*th July*, 1882.
3620. Horseshoes, F. H. F. Engel, Hamburg.—31*st July*, 1882.
3783. Asphalte Apparatus, B. D. Healey, Brighouse.—9*th August*, 1882.
3842. Suspending Telegraph Wires, H. C. Jobson, Dudley.—11*th August*, 1882.
3864. Malleable Iron, W. S. Sutherland, Birmingham.—14*th August*, 1882.
3908. Combustible Gases, W. S. Sutherland, Birmingham.—16*th August*, 1882.
3922. Check Reins, A. M. Clark, London.—16*th August*, 1882.
4046. Electric Arc Lamps, J. K. D. Mackenzie, Halifax.—23*rd August*, 1882.
4256. Ornamenting Glass, &c., W. H. R. Toye, London.—7*th September*, 1882.
4364. Caustic Alkalies, &c , W. L. Wise, London.—14*th September*, 1882.
4386. Lead-holders, J. H. Johnson, London.—14*th September*, 1882.
4542. Pumps, J. S. Sawrey, A. Attwood, and H. Woodbourne, Ulverston.—23*rd September*, 1882.
4574. Hydraulic Machines for Shearing, R. H. Tweddell, London.—26*th September*, 1882.
4596. Measuring, &c., Electric Currents, S. Z. de Ferranti and A Thompson, London.—27*th September*, 1882.
4665. Electro-motor, M. Immisch, London.—30*th September*, 1882.
4706. Apparatus for Making Paper Bags, W. L. Wise, London.—3*rd October*, 1882.
4746. Starting, &c., Rotary Motion, C. D. Abel, London.—5*th October*, 1882.
4758. Obtaining Ammonia from Furnace Gases, J. and J. Addie, Glasgow.—6*th October*, 1882.
4768. Apparatus for Covering Wire, J. J. C. Smith, New York, U.S.—7*th October*, 1882.
4806. Harvesting Machines, J. Hornsby, J. Innocent, and G. T. Rutter, Grantham.—9*th October*, 1882.
4812. Incubator, T. Christy, London.—10*th October*, 1882.
4821. Vessel for Transporting Barges, &c., C. D. Abel, London.—10*th October*, 1882.
4853. Compound for Making Tight Joints, A. J. Scollick, London.—12*th October*, 1882.
5165. Gas Cooking Stoves, A. M. Clark, London.—30*th October*, 1882.
5217. Splitting Willow-withes, &c., J. Y. Johnson, London.—1*st November*, 1882.
5223. Lowering, &c., Ships' Boats, M. Bourke, Youngstown, U.S.—1*st November*, 1882.

List of Specifications published during the week ending December 23rd, 1882.

2183, 8d.; 2277, 4d.; 2310, 6d.; 2314, 6d.; 2327, 6d.; 2341, 2d.; 2342, 2d.; 2343, 6d.; 2344, 6d.; 2347, 2d.; 2348, 6d.; 2351, 2d.; 2353, 6d.; 2354, 2d.; 2355, 6d.; 2356, 8d.; 2357, 2d.; 2358, 6d.; 2361, 8d.; 2362, 8d.; 2364, 6d.; 2367, 6d.; 2368, 8d.; 2370, 8d.; 2371, 2d.; 2372, 2d.; 2373, 2d.; 2375, 6d.; 2376, 2d.; 2377, 4d.; 2378, 4d.; 2379, 2d.; 2380, 6d.; 2381, 6d.; 2382, 4d.; 2383, 2d.; 2384, 8d.; 2385, 6d.; 2386, 6d.; 2387, 8d.; 2389, 2d.; 2390, 2d.; 2391, 6d.; 2392, 2d.; 2393, 2d.; 2395, 2d.; 2397, 6d.; 2400, 4d.; 2401, 4d.; 2402, 2d.; 2403, 6d.; 2404, 2d.; 2405, 4d.; 2406, 6d.; 2408, 6d.; 2409, 2d.; 2412, 4d.; 2414, 4d.; 2420, 6d.; 2421, 2d.; 2423, 10d.; 2424, 6d.; 2425, 6d.; 2427, 6d.; 2431, 4d.; 2432, 6d.; 2434, 2d.; 2436, 2d.; 2437, 6d.; 2438, 4d.; 2439, 8d.; 2441, 6d.; 2442, 2d.; 2443, 2d.; 2444, 2d.; 2445, 6d.; 2446, 2d.; 2449, 2d.; 2450, 2d.; 2451, 2d.; 2453, 6d.; 2454, 6d.; 2459, 1s.; 2461, 6d.; 2464, 2d.; 2465, 2d.; 2466, 6d.; 2467, 6d.; 2468, 6d.; 2469, 6d.; 2473, 10d.; 2477, 6d.; 2480, 2d.; 2483, 10d.; 2487, 2d.; 2490, 2d.; 2496, 8d.; 2541, 4d.; 2556, 6d.; 2559, 6d.; 2608, 6d.; 2879, 10d.; 3025, 10d.; 4569, 4d.

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

ABSTRACTS OF SPECIFICATIONS.

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

2183. Machines for Dressing Silk, &c., *A. M. Clark, London.*—9*th May*, 1882.—(*A communication from La Cie. Générale de Teinturerie et Appréts Système André Lyon, Paris.*) 8*d.*

The invention relates to a machine for dressing or stiffening silk or other fabrics in a uniform manner by causing the fabric to pass through the trough in which the dressing is contained in a state of tension, and spread out to the full width, so as to avoid creases and rents.

2275. Bedsteads, Couches, &c., for Invalids, *T. Welton, London.*—15*th May*, 1882. 6*d.*

This relates partly to the combination of a frame carrying a support for the person using the apparatus, with toothed racks and pinions or screws and hubs or their equivalents.

2276. Apparatus for obtaining Heat and Light from Gas, *A. H. Hearington, London.*—15*th May*, 1882.—(*Not proceeded with.*) 4*d.*

This relates to burners in which inflammable gas, such as ordinary coal gas, is used for the purpose of obtaining heat or light.

2277. Producing Pictures on Stone, Glass, Metal, &c., *H. J. Haddan, Kensington.*—15*th May*, 1882.—(*A communication from E. Godard, Paris.*) 4*d.*

This relates to a process of producing images in vitrifiable colours on glass, wood, marble, metal, and other surfaces.

2279. Pricking up Apparatus for Leather-stitching Machines, *J. Day, Stafford.*—15*th May*, 1882. 6*d.*

The invention comprises the use of a tool called a pricker which has a chisel-shaped edge, and is attached by devices to the vibrating arm of the stitching machine in such a manner that as work is moved along by the feeding device the said tool will "prick up" or divide the stitches from each other, will produce a mark adjacent to each stitch, or will imitate duplicate stitches, either or all of which operations will be performed more rapidly and efficiently than they can now be done by hand.

2280. Bottle Filling Machines, *C. M. Sombart, Germany.*—15*th May*, 1882.—(*A communication from O. Assmann, Holland.*) 6*d.*

This relates to the application of a bottle-filling machine to the self-acting bottle stopping machine described in patent No. 3615, A.D. 1881, so that bottles can be filled and corked in a self-acting manner.

2281. Fire-escapes, *J. Gordon, Leeds.*—15*th May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the use of springs, so as to balance the weight of the ladder, which is mounted in bearings on a suitable carriage.

2282. Velocipedes, *J. and H. J. Brookes and M. Green, Smethwick.*—15*th May*, 1882.—(*Not proceeded with.*) 2*d.*

As applied to tricycles the invention consists of a front driving wheel and two side wheels, the former being arranged so that it can be thrown out of the centre line at will. The frame is jointed so that it may fold up. An arrangement of differential gear is provided for ascending inclines. Other improvements are described.

2289. Manufacture of Metal Plates, Wire, &c., *T. Bowen and C. Jenkins, Glamorgan.*—16*th May*, 1882.—(*Not proceeded with.*) 2*d.*

The sheets, plates, or wires, as taken from the rolls, are annealed so as to soften the scale thereon, and are then pickled, by which means the scale or oxide is more easily removed.

2290. Winding Yarn or Thread, *B. M. Knox, Kilbirnie, N.B.*—16*th May*, 1882. 6*d.*

This refers especially to means for regulating the winding or "binding" of the thread on to the bobbins, and for automatically stopping the motion of any bobbin, and so prevent the breaking of the thread when there is undue tension on it. The thread passes over a long lever, and when the tension is too great the lever is depressed, and, through a suitable arrangement, shifts the belt from the fast to the loose pulley.

2291. Motive Power, *W. Anyon and J. Lund, Manchester.*—16*th May*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to utilise exhaust or waste steam to produce motive power, and it consists in causing the steam to act on an arrangement of cones similar to an exhaust injector, and thus force water into a closed vessel containing water and air at a pressure of several atmospheres, the air being utilised to force the water from the vessel on to a turbine or other hydraulic motor.

2292. Woven Fabrics, *E. Briggs, Bradford.*—16*th May*, 1882. 2*d.*

This relates to silk textile fabrics manufactured with warps made of thrown silk, and with silk in the gum, and a weft of spun silk and single thread, and not two or more folds, and it is made of Tussore or Turkestan silks.

2293. Improved Means of Insulating, Covering, and Coating Wires, &c., *A. Shippey, Ladbrooke-grove-road, London, and R. Punshon, Brighton.*—16*th May*, 1882.—(*Not proceeded with.*) 2*d.*

The inventors mix powdered glass and soda silicate in equal parts, and when moist coat the wires with the mixture. Asbestos paper soaked in melted paraffine ozokerit is next wound on, and after that a solution of gutta-percha dissolved in benzole is applied.

2294. Disintegrating Apparatus, *R. Prentice.*—16*th May*, 1882. 4*d.*

This relates to apparatus for breaking up lumps of material of a comparatively friable character, particularly such as are liable to become pasty when subjected to rubbing, and it consists of a drum mounted on an axis, and to which a number of spikes are hinged. The drum is enclosed in a case containing the material to be acted upon, and as the drum revolves the spikes are caused to stand out and act on the material.

2296. Compound Funnels for the Economical Utilisation of Heat, *F. Livet, Notting Hill.*—16*th May*, 1882.—(*Void.*) 2*d.*

This relates to the use of a metal pipe or funnel so constructed as to impart a rotary motion to the gases as they come from the furnace below, whereby their velocity towards the exit is retarded and more time allowed for their combustion.

2297. Utilising the Residues from Refining of Cotton Seed Oil, *J. Longmore, Liverpool.*—16*th May*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to utilise the "mucilage" precipitated when cotton seed oil is treated with caustic soda, and it consists in dissolving it in water and adding salt, whereby the soapy matter is separated from the colouring matter, and the latter is then precipitated by adding an acid to the liquor. The soapy matter is treated so as to form soap, and the colouring matter is utilised for any suitable purposes.

2298. Improvements in Apparatus for Operating Sewing Machines by Electricity, *W. R. Lake, London.*—16*th May*, 1882.—(*A communication from J. Kearney, San Francisco, U.S.A.*)—(*Not proceeded with.*) 2*d.*

This relates to the combination of batteries with conductors leading to electro-magnets having armatures, said armatures being connected to connecting-rods attached to the moving parts of the machine. When the current passes, motion is imparted to the armatures, and thence by the connecting-rods to the machine.

2299. Cabinet or Stands for Sewing Machines, &c., *W. R. Lake, London.*—16*th May*, 1882.—(*A communication from A. Fitz-Gerald, Fairfield, U.S.*) 6*d.*

This relates to tables or stands with revolving top portions upon which the machine is mounted, to afford means for concealing the same when desired.

2300. Preventing the Passage of Heat to or from Pipes, &c., *W. T. Whiteman, London.*—16*th May*, 1882.—(*A communication from J. L. Lee, New York.*) 4*d.*

This relates essentially to the use of lampblack for repelling moisture and acting as a non-conductor of heat.

2301. Fastenings for Gloves, Boots, Shoes, &c., *J Hinks, T. Hooper, and S. G. Moore, Birmingham.*—16*th May*, 1882. 6*d.*

A plate fixed to one side of the article to be fastened carries a hinged arm, which is thrown back and passed through an eyelet hole in the other side of the article. The arm is then turned on its pivot, and pulls the two sides together, the end of the arm being curved, so as to take over the outer end of the plate with a spring action.

2304. Washing Dishes, &c., *R. Bramwell, Bayswater.*—16*th May*, 1882.—(*Not proceeded with.*) 2*d.*

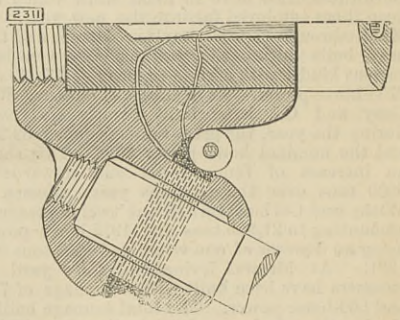
The apparatus consists of a cylinder provided with brushes and caused to revolve in a casing.

2310. Reversible and Combined School-desk, Seat, and Table, *W. R. Thomas, Peterborough.*—17*th May*, 1882. 6*d.*

It is proposed to construct the seat with a movable back, so arranged as to be readily adapted to form either a desk, board, or table as required.

2311. Improvements Connected with Submarine Cable Grapnels, &c., *Sir Jas. Anderson and W. C. Johnson, London.*—17*th May*, 1882. 6*d.*

This relates to improvements in cable grapnels, whereby when the cable is caught in the prongs of the grapnel, it can be acted on by means of induction, so



that signals can be exchanged through the cable with the shore end. The grapnel rope, as will be seen from the illustration, is provided with two insulated wires leading to a coil in the prong. The invention also relates to an improved swivel for grapnel lines.

2313. Tables, *G. W. von Nawrocki, Berlin.*—17*th May*, 1882.—(*A communication from L. Schnietzer, Germany.*) 4*d.*

The object is to render tables suitable for use as a desk, and it consists in hinging the top to the under frame, and providing suitable means whereby the other side can be secured in a raised position, so as to produce any desired degree of slope.

2314. Coverings for Carriages and Perambulators, *G. W. von Nawrocki, Berlin.*—17*th May*, 1882.—(*A communication from L. Schmetzer, Germany.*) 6*d.*

According to this invention the ribs are each made of three wooden parts, viz., a top part and two side parts, which are connected and held together by bent metal springs or strips. Other improvements are described.

2315. Marking Out the Lines on Lawn Tennis Courts, *W. Burrows and G. Dawson, Leeds.*—17*th May*, 1882. 6*d.*

A brush is caused to revolve in a trough of suitable marking composition by means of a travelling wheel of the frame of the apparatus, and deposits such composition on the marking roller, which also forms one of the supporting rollers of the apparatus.

2321. Memorandum and Letter Forms and Case, *B. C. Scott, Regent's Park.*—17*th May*, 1882.—(*Provisional protection not allowed.*) 2*d.*

This relates to a sheet of paper perforated a short distance from the edges, and gummed beyond, so that when the letter is written in the centre, and the sheet folded, the edges can be gummed together, so as to form a sealed enclosure. To open the paper the edges are torn off at the perforations.

2322. Steam Steering Engines, *G. Robson, Sunderland.*—17*th May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the construction of steering gear and of the controlling gear of other steam engines in such a manner that the action of the steam, instead of being controlled automatically by the engine operating the valves which admit steam to the cylinders, is controlled by manual power applied to a shaft, which is not affected by the working of the engine.

2323. Preserving and Cooling Beverages to be Drawn off, *W. A. Barlow, London.*—17*th May*, 1882.—(*A communication from H. Hohl, Switzerland.*) 6*d.*

The air which it is necessary to admit to the cask as the liquor is drawn off is not allowed to come in contact with the liquor, but is made to enter an elastic bag fixed in the cask. A refrigerator is provided to cool the liquor.

2324. Steam Boilers, *F. H. F. Engel, Hamburg.*—17*th May*, 1882.—(*A communication from A. W. Schultze and G. Meyer, Hamburg.*—(*Not proceeded with.*) 2*d.*

This relates to boilers in which secondary steam is produced by heating the water of the corresponding boiler by primary steam obtained by the directly firing of a main boiler, and it consists in forming the boiler of three concentrically arranged boilers and mantles, the inner one being heated by fire, and the middle and outer ones by steam from the first boiler.

2326. Driving and Steering Machinery, &c., *C. Truman, Birmingham.*—17*th May*, 1882.—(*Not proceeded with.*) 4*d.*

This relates partly to the use of a roller clutch for driving velocipedes; also to the means for steering the same, and farther to the bearings for axles or revolving shafts.

2327. Fixing Knobs and Handles to Spindles, &c., *T. H. P. Dennis, Chelmsford.*—17*th May*, 1882. 6*d.*

The knobs are attached to the spindles by means of a screw passing through the knobs to the spindles.

2329. Gas Engines, *W. B. Hutchinson, Islington.*—18*th May*, 1882. 8*d.*

This relates to gas engines in which the charge is drawn into the working cylinder by the up stroke of

...ited at atmospheric pressure, and it consists, First, in hanging the valve used to cover the inside face of the ignition port on two pins, so as to prevent all lateral movement; Secondly, in placing upon the air-admission duct, between the air valve and the opening of the duct into the cylinder, an automatic metal lift valve, so as to prevent the products of combustion coming into contact with the india-rubber air valve, and so destroy it. A similar plan is adopted to protect the gas-admission valve. The invention further relates to the ignition valve, the slide valve, and the combination of the parts forming the improved engine.

2330. Checking the Arrival and Departure of Employes, *W. B. Llewellin, Bristol.*—18*th May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to improvements on patent No. 2472, A.D. 1881, and consists, First, in providing a shoot to enable checks to be inserted from the opposite side of the wall to that on which the apparatus is situated; Secondly, in providing an open circular hopper to enable any number of checks to be passed in at once: Thirdly, in curving the bottom of the check-box so as to cause the checks to roll towards the circumference; Fourthly, in hinging the bottom and securing it by a catch. Other improvements are described.

2331. Combined Spring Mattress and Bedstead, *S. Isaacs, Birmingham.*—18*th May*, 1882. 6*d.*

This consists in fitting the bedposts directly to the spring mattress, so as to avoid the necessity of making a bottom or frame to the bedstead.

2332. Adjustable Reclining Chairs, *J. Cowan, Liverpool.*—18*th May*, 1882. 8*d.*

This relates to the use of a novel arrangement of parallel motion bars to enable the back to be set at any desired inclination to the seat.

2333. Cruising Canoes and Light Draught Vessels, *J. T. Grindrod, Liverpool.*—18*th May*, 1882.—(*A communication from E. Jackson, Manilla.*) 6*d.*

This consists essentially in hollowing out or concaving the bottom of the vessel.

2336. Improvements in Dynamo Machines and Apparatus for Lighting Railway Carriages by Electricity, *T. J. Handford, London.*—18*th May*, 1882.—(*A communication from W. A. Stern and H. M. Byllesby, New York.*) 6*d.*

This relates to the lighting of railway carriages, &c., by the combination of a generator, storage batteries, and switches for operating the same. The chief feature of the invention is an automatic circuit director, which provides a means of changing the circuit connections of the dynamo, so that the polarity of the field-magnet shall remain the same, and the current in the main line always flow in the same direction, no matter which way the armature may be revolved.

2337. Engines Operated by the Expansive Force of Air or Gas, *H. Guthrie, Manchester.*—18*th May*, 1882.—(*Not proceeded with.*) 2*d.*

This consists mainly in the employment of a combustion chamber, into which air and fuel are introduced and burnt under pressure, such chamber being connected with a cylinder in such a manner that the products of combustion passing from the fire are employed as the medium for driving the machinery, the object being to expand the air so used directly by the combustion of cheap solid fuel.

2341. Metallic Tubes for Steam Boilers, *W. E. Everitt, Birmingham.*—18*th May*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to give to the metallic tubes elasticity.

2342. Gas Engines, *W. Watson, Harrogate.*—18*th May*, 1882.—(*Not proceeded with.*) 2*d.*

In these improvements the inventor employs a cylinder constructed in a similar manner to that of an ordinary steam engine, and uses the steam chest as the mixing and igniting or exploding chamber. He also employs ports and slide valve similar to those on ordinary steam engine cylinders.

2343. Machines for Sewing Carpet, &c., *W. R. Lake, London.*—18*th May*, 1882.—(*A communication from G. Gowing, California.*) 6*d.*

This relates to sewing machines adapted to move upon a cable or rope along the edge of the material to be sewed as the stitches are formed.

2344. Hammerless Breech-loading Fire-arms, *T. Woodward, Birmingham.*—18*th May*, 1882. 6*d.*

This relates partly to improvements on patent No. 651, A.D 1876. The inventor claims, First, the combination of lock and cocking mechanism; Secondly, the use of an elongated lever pin; Thirdly, the use of a vertically sliding peg for retaining the hammers at full cock; Fourthly, the use of a strong spring other than the main spring to effect the cocking of a gun.

2346. Overmantles of Chimney Pieces, *G. H. Haywood, London.*—18*th May*, 1882. 6*d.*

This consists in making overmantels of metal with the back hollow, so as to make it as high as possible, and formed with recesses to receive mirrors, pictures, or panels.

2347. Adjustable Holder for Holding Candles in Candlesticks, *E. Edwards, London.*—18*th May*, 1882.—(*A communication from Messrs. M. Deetjen and Co., Berlin.*)—(*Not proceeded with.*) 2*d.*

This relates to an apparatus for holding candles of different sizes.

2348. Improvements in Incandescent Electric Lamps, *S. H. Emmens, Argyll-street.*—18*th May*, 1882. 6*d.*

This relates to the construction of electric lamps having carbon conductors rendered luminous in a vacuum. The improvements consist in enclosing in each glass bulb a series of carbons connected in various ways, the object being to give a better diffused light, and by means of switches and short circuiting to regulate the quantity of light.

2349. Improvements in Electrical Apparatus, *S. H. Emmens, Argyll-street, Middlesex.*—18*th May*, 1882. 6*d.*

This relates to a novel construction of the cores of electro-magnets. The cores are composed as follows: Insulated copper wires are laid side by side, and transversely on these are laid iron wires side by side; this double layer is then rolled up in a direction parallel to the iron wires, thus forming a magnet having its core imbedded in the exciting circuit.

2350. Horse Collars, *H. J. Haddan, Kensington.*—18*th May*, 1882.—(*A communication from R. Fesch and Co., Leipzig.*)—(*Not proceeded with.*) 2*d.*

The object is to make horse collars lighter than usual, and also adjustable.

2351. Saggers or Setters used in the Baking of Porcelain, &c., *A. J. Boult, London.*—18*th May*, 1882.—(*A communication from G. Heubach, near Cologne.*)—(*Not proceeded with.*) 2*d.*

This relates partly to the employment of a press similar to that used for copying writings.

2353. Water Conductors or Spouts, &c., *J. T. King, Liverpool.*—19*th May*, 1882.—(*A communication from G. K. Reber, Pittsburg, and T. W. Irwin, Allegheny, U.S.*) 6*d.*

This relates to sheet metal conductors or spouts secured to the sides of houses and other buildings for the purpose of carrying rain water from the roof to the ground, or to tanks or other receptacles. It further relates to attachments for securing the said pipes or conductors to the houses or buildings.

2354. Manufacture of Napped and Felt Hats, *H. Herauld and W. Harrison, Stockport.*—19*th May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates partly to an apparatus for rolling and scalding the hats after the nap has been applied to the hat body, in order to cause the fur to adhere thereto.

2355. Machinery for Cutting the Teeth of Files, *P. Evens, Cheltenham.*—19*th May*, 1882. 6*d.*

This relates to improvements on patent No. 181, A.D. 1878. Instead of fixing the tool-box which contains the cutting chisel and appliances for moving it so that the chisel strikes the blank always at one fixed angle, means are provided for varying the inclination, so that the angle can be suited to different sizes and characters of the teeth struck up by the chisel. For this purpose the tool-box A carrying the

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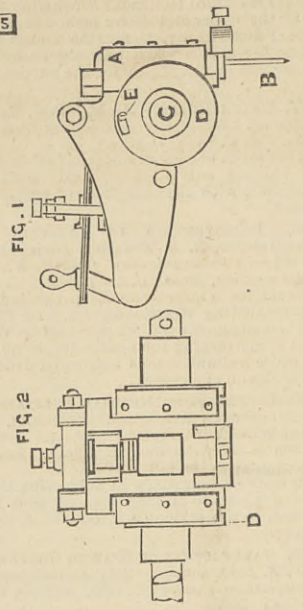

chisel B and its driving appliances is mounted so that it can be turned partly round on the main shaft C as an axis, flanges on cheeks D being provided with setting screws or nuts E, so as to hold the tool-box in the attitude to which it is turned, the direction of the chisel being thus adjustable as desired within a certain range.

2356. Slide Valves of Steam Engines, &c., *J. Emery, Erith.*—19*th May*, 1882. 8*d.*

The chief object is to neutralise the pressure on the back of sliding valves of steam or other motive power engines. The drawings show one arrangement. The

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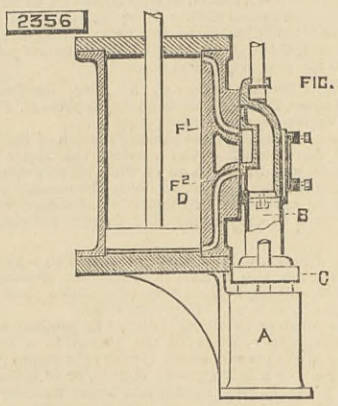
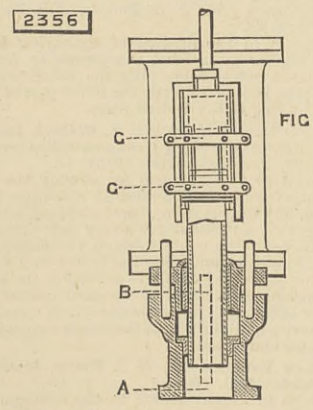


steam, after passing through an ordinary fixed steam pipe A, passes through the sliding steam pipe B to the slide valve D, and while so passing is prevented from escaping into the atmosphere by means of the gland or stuffing-box C, through which the sliding steam pipe moves backwards and forwards, the back of slide valve D being boxed over. The steam is distributed, as in other engines, into the ports F^1 F^2 alternately by

2356



means of the slide valve D, the inner portion of which acts precisely as an ordinary slide valve, and the outer portion by what is termed a movable valve chest. In order to keep the valve tight to its face and prevent any leakage of steam, its back is pressed upon by means of four set screws which work in the cross pieces G G, which extend over the back of the valve, and are bolted to projections cast solid with cylinder.

2357. Apparatus for Enabling Persons to Ascend High Places for Rebuilding, &c., *T. W. W. Barrett, London.*—19*th May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the employment of a balloon inflated with gas or air of sufficient buoyancy to raise a double cord over the top of the chimney or spire, each of the lower portions or ends of the cord being under the control of one or more men at a suitable distance apart.

2358. Strap or Belt Fasteners, *B. Marsden, Manchester.*—19*th May*, 1882.—(*A communication from P. Koch, Germany.*) 6*d.*

This consists in the use of two plates capable of being drawn together by means of a screw or screws.

2361. Velocipedes, *G. D. Macdougald, Dundee.*—19*th May*, 1882. 8*d.*

This consists, First, in the use of slides in connection with two bars or levers having pedals at one end of their extremities; Secondly, in a method of construction whereby the advantages of an open front to a three-wheeled machine may be obtained without the use of forks and heads. Other improvements are described.

2362. Engines or Pumps Operated by Steam or Water, *C. Woodward, Leeds.*—19*th May*, 1882. 8*d.*

This relates to apparatus mainly designed for use in connection with hydraulic engines for blowing organs.

2364. Improvements in Dynamo-electric Machines, *R. Werdermann, Princes-street.*—19*th May*, 1882. 6*d.*

This relates to a machine for producing currents of great magnitude. The armature is constructed with a core consisting of ninety-two parts iron and eight parts nickel in the shape of a ring. The central portion has a boss on which are fixed a series of discs and segments of wood placed between metal cheeks. The armature is provided with helices of insulated copper wire wound in a direction parallel to its axis, so as to form a series of small bobbins, the terminal wire of one bobbin being soldered to the terminal wire of the next. To every two bobbins a conductor is connected, and these conductors are arranged so as to form a disc, and are fixed either on the shaft or boss; they revolve with the armature, and a series of collectors collect the currents. The armature revolves between alternate magnet poles.

2365. Ceilings, *W. R. Lake, London.*—19*th May*, 1882.—(*A communication from J. Budd, Boston, U.S.*) 6*d.*

This consists essentially in constructing ceilings of ornamental glass, which may be tinted in any desired colour, or coloured to represent wood, marble, stone, or other material, and which, when dirty, can be easily cleaned.

2366. Preventing Explosions in Steam Boilers, Mines, &c., *T. Sheehan, Great Portland-street.*—19*th May*, 1882. 2*d.*

A case containing a mixture of hydrate of lime and finely-powdered charcoal is inserted in the upper part of the boiler, or in the mine or other place, and serves to prevent explosion by absorbing or decomposing explosive matters.

2367. Apparatus for Air-filtering or Dust-collecting, *J. S. Brandstaetter, Liverpool.*—19*th May*, 1882. 6*d.*

This apparatus consists of a chamber whose top, bottom, and all the sides, perpendicular to one plane, are formed of an endless band, so travelling on rollers that the two edges of the band are obliged by mechanism to travel at the same speed.

2368. Indicators for Steam Engines, *G. Hambruch, Berlin.*—10*th May*, 1882. 8*d.*

This relates partly to the manner in which the alternating or one-sided steam pressure in the cylinder is transmitted to the indicator piston and the pencil, and partly also to the transmission of the piston stroke to the diagram sheet.

2370. Improvements in Electric Arc Lamps, *J. Brockie, Brixton.*—19*th May*, 1882. 8*d.*

The First part of this invention relates to a method for preventing the too close feeding of carbons. This is shown in the figure. A is a differential solenoid which directly operates carbon holder B. When the core of A arrives at a certain point a tooth of escape wheel E will be permitted to escape, and carbon rod C will therefore descend a certain length; this will then cause the core to draw down the lower carbon and another tooth of the wheel E to escape, but this

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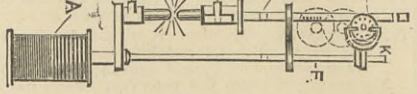

second escapement may represent a much smaller feed than the former by placing the teeth at different intervals. When the current ceases the anchor escapement K is taken out of gear altogether, and the top carbon descends till it meets the lower one. The Second part of the invention relates to improvements in double carbon lamps, and to various mechanical details in arc lamps generally.

2371. Velocipedes, &c., *L. H. Curtois, Loughborough.*—19*th May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to means of changing the relative velocities of the treadle shaft and driving wheels for the purpose of gaining power.

2372. Manufacture of Syrup from Date Fruit, *T. Webb, Clapton Park.*—19*th May*, 1882. 2*d.*

This consists in the manufacture from date fruit of a syrup, by the employment of which alcoholic spirit, beer, vinegar, and British wine can be made in less time and at less cost than is the case at present.

2373. Clump Soles for Boots and Shoes, *L. V. Patin, Paris.*—19*th May*, 1882.—(*Not proceeded with.*) 2*d.*

The clumps are made of wood covered with leather.

2375. Air Pumps, *C. N. Gimingham, Newcastle-upon-Tyne.*—19*th May*, 1882. 6*d.*

The object is to provide an air pump whereby a high vacuum may be obtained without the circulation of mercury.

2376. Preparation of Claret for Combination with Lemonade, &c., *J. Prosser, Upper Clapton.*—19*th May*, 1882.—(*Not proceeded with.*) 2*d.*

Claret is filtered and blended with ordinary syrup and sugar, and then put into lemonade, &c.

2377. Gullies, *H. Kelly, Hampstead.*—20*th May*, 1882. 4*d.*

This relates to a gulley in which the rain water and waste pipes discharge into one disconnecting and ventilating chamber which also prevents splashing.

2378. Composition for Preserving Leather, &c., *W. E. Gedge, London.*—20*th May*, 1882.—(*A communication from J. M. L. F. Granger, Paris.*) 4*d.*

This relates to a composition in which one of the principal elements is tannic acid.

2379. Consuming Smoke, &c., *H. C. Paterson, London.*—20*th May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the construction of the bridges.

2380. Velocipedes, *A. Phillips, Birmingham.*—20*th May*, 1882. 6*d.*

This relates to the construction of a double-driving velocipede or tricycle which will drive backwards or forwards, and with automatic disconnecting gear for steering purposes.

2381. Hot Blast Stoves, *E. A. Cowper, London.*—20*th May*, 1882. 6*d.*

The inventor claims the use of apparatus for cleaning the passages of regenerative hot-blast stoves, which is provided with means of adjusting the angular direction of the cleaning brush and its distance from the door on the side of the stove, and with means of working the brush from outside the stove.

2382. Axles for Carriages, &c., *J. Gordon, jun., Dundee.*—28*th May*, 1882. 4*d.*

The axle A of iron or steel is surrounded by a box made in two parts, the inner cylindrical sleeve B through which are bored a number of round holes each fitted with a plug P of antifriction metal or compound, such as metalline, and the outer sheath C,

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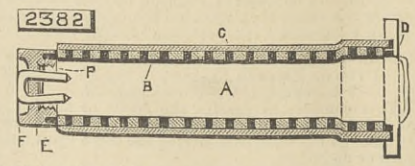

which is fitted tight on B after the holes are plugged. The collar D of the axle may also have metalline plugs inserted in holes in the end of the box presented towards the collar. The nut E, which is screwed on the end of the axle, has a number of the metallic plugs inserted in holes in its face presenting themselves towards the end of the box B. The nut is prevented from turning by means of a staple F.

2383. Cocks or Valves, *J. C. Mewburn, London.*—20*th May*, 1882.—(*A communication from E. Chatel, Paris.*)—(*Not proceeded with.*) 2*d.*

This relates to the construction of cocks or valves in such manner that their packing can be renewed while they are fully open.

2384. Improvements in Signalling Apparatus for Railway and other Purposes, *W. E. Langdon, Derby.*—20*th May*, 1882. 8*d.*

The object of this invention is to enable the signalman to bring into operation on the passing of a train at a given point an audible signal. To this end a wire is provided between the signal-box and the signalling point (the signal post or elsewhere), and connected at the latter to a relay; at the signal-box it is connected to a commutator and battery, by which the relay may be brought into use. The relay is used to bring into operation a local circuit. In this local circuit is provided a commutator actuated by the passing train, together with a gong, or a detonator or fuse, to give an audible signal. Where a signal post is employed the expression of this audible signal is dependent upon the position of the armature of the relay, the position of the signal, and the passing of the train over a given point.

2385. Hose and Pipe Couplings, *T. L. Daltry, Stretford.*—20*th May*, 1882. 6*d.*

This relates to a locking device for coupling hose and pipes together.

2386. Drawing Apparatus for Continuous Spinning Machines, *L. A. Groth, London.*—20*th May*, 1882.—(*A communication from R. Schrke, Berlin.*) 6*d.*

The object is the drawing the slubbings from the condenser rollers, and during such drawing to impart either a false twist, which is taken out again by the action of the spinning spindles, or a light preliminary twist, which is continued and completed by the

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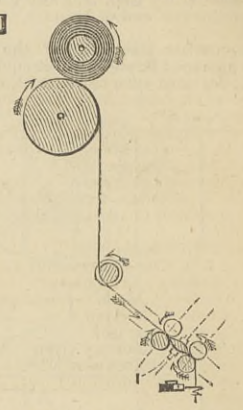


spinning spindles, and it consists in the use of the small toothed wheel I for this purpose, the axis of which may consist of several diameters of a cone or of a double cone with channels cut therein. This wheel may also be used for twisting several small threads together.

2387. Mechanical Cab, *N. D. Spartali, Liverpool.*—20*th May*, 1882. 8*d.*

This relates to the construction of a mechanical cab to be actuated by the feet and hands, either or both, of the occupant or occupants.

2389. Purses, Portemonnaies, &c., *F. Wirth, Frankfort.*—20*th May*, 1882.—(*A communication from P. Sternberg, Frankfort.*—(*Not proceeded with.*) 2*d.*

This relates to the construction of the frame, which is provided with a spring catch.

2390. Improvements in Apparatus for Lighting Lamps in Railway Carriages, *J. Binswanger, London.*—20*th May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the combination of batteries, induction coils, &c., so as to produce sparks which shall ignite the gas, &c., or the lamps are lighted by means of incandescent platinum.

2391. Improvements in the Construction of Secondary Batteries, *J. Pitkin, Clerkenwell.*—20*th May*, 1882. 6*d.*

This relates to improvements on the inventor's patent No. 5451, dated 18th December, 1881; and consists in an improved holder or frame to contain the lead turnings of which the electrode is made. This consists of laths of ebonite, wood, &c., fixed across the two sides of a suitable frame, the laths being placed obliquely and slightly overlapping one another—as in Venetian blinds—so as to leave interstices through which the liquid has free access, the laths being inclined inwards and downwards.

2392. Screws for Wagon-building, Shipbuilding, &c., *S. I. and A. Adams, Romford.*—20*th May*, 1882.—(*Not proceeded with.*) 2*d.*

The invention consists in a screw, of which the head or the upper portion thereof is removable from the shank in such manner that the head is only available for screwing the screw into the structure, but not for unscrewing it therefrom.

2393. Tricycles, &c., *F. J. Cocks, Yardley.*—22*nd May*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to improvements in the construction of the wheels and bands by which the transmission of the motion is effected.

2395. Fireplaces, *H. Greenhouse.*—22*nd May*, 1882.—(*Not proceeded with.*) 2*d.*

The sides, back, and hearth up to the throat of the flue are constructed in solid fire-clay.

2397. Improvements in the Application of Electricity as a Detector in the Safely Closing of Windows and Doors, &c., *B. Coyle, Dublin.*—22*nd May*, 1882. 6*d.*

Relates to means for giving alarm when a door or window is opened; and consists essentially in contact pieces, which close an electric circuit, in which are a battery and bell, when a door or window is opened.

2398. Compound Pumps for Air and Vapour, *H. Egells and W. A. Kux, Berlin.*—22*nd May*, 1882. 6*d.*

This relates to the compound pump for air and vapour described in patent No. 1801, A.D. 1881; and it consists in so constructing the operating mechanism that either of them may be operated independently of the other one.

2409. Improvements in Electric Accumulators, &c., *H. H. Lake, London.*—22*nd May*, 1882.—(*A communication from H. Lory, Paris.*)—(*Not proceeded with.*) 2*d.*

The inventor divides the space between the lead plates of an ordinary Planté accumulator into equal parts by a porous partition, and fills the two compartments so formed with lead turnings, &c., and then pours acidulated water into the vessel.

2413. Lawn Mowers, *R. Kirkman, jun., Leicester.*—22*nd May*, 1882. 6*d.*

This consists in propelling lawn mowers by means of cranks fitted with pedals, and attached to a driving shaft, from which rotary motion is conveyed to the cutting and travelling parts of the machine, and which cranks and pedals are actuated by the feet of a person sitting over the machine.

2414. Improvements in the Preparation of Insulating Materials, *Dr. J. A. Fleming, Hampstead.*—22*nd May*, 1882. 4*d.*

This has reference partly to the inventor's former patents, No. 1762, dated 23rd April, 1881, and No. 5309, dated 5th December, 1881. The First part of the invention relates to a method by which soiled wood (preferably English poplar) is desiccated in a vacuum or otherwise, and then impregnated under pressure with a mixture of melted bitumen incorporated with substances of the resin type, or of both the paraffine and anthracene types. The material thus prepared is then shaped to the required form. According to the Second part of the invention, finely divided wood or other vegetable fibrous material is used.

2425. Improvements in Incandescent Electric Lamps, &c., *J. J. Barrier and F. T. de Lavernède, Paris.*—23*rd May*, 1882. 6*d.*

The inventors claim the construction of an incandescent lamp with horizontal or vertical carbons,

admitting of supplying the lamp with a variable number of carbons, and of renewing them as desired, also of burning one or more carbons at a time, and in prolonging the burning of the lamp by using one carbon after another, more light being given by reason of the horizontal line of incandescence. Also the substitution of the vacuum by the production by means of suitable chemicals of phosphoric and sulphuric acid gas, which absorb the oxygen and thus preserve the carbons.

2428. Improvements in Telegraph Printing and Time Regulating Apparatus, *J. Imray, Chancery-lane.—23rd May*, 1882.—(*A communication from A. A. Knudson, Brooklyn, U.S.*) 6*d*.

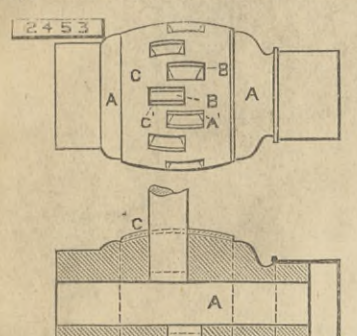
This relates to a combination of telegraph printing instruments with timepieces corrected and controlled in their movement so that a number of these instruments connected by conductors to a transmitter shall act in unison to print upon a moving strip at each station letters or symbols.

2429. Water-meters, *B. D. Healey, Brighouse.—23rd May*, 1882.—(*Complete.*) 4*d*.

This relates to improvements on patent No. 2081, A.D. 1881, and consists in the construction of water-meters with arrangements for reversing the valves.

2453. Hubs for Vehicle Wheels, *H. A. Bonneville, London.—24th May*, 1882.—(*A communication from J. Lajeunesse and E. Armant, Montreal, Canada.*) 6*d*.

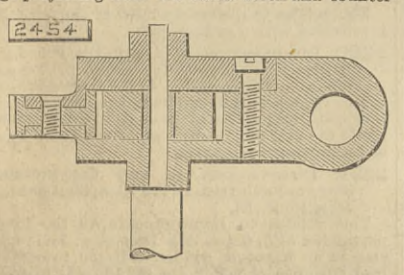
This consists essentially of the wooden hub A, having mortises B, and with circumferential metallic band C, provided with mortises C^1, one for each of the



mortises B, but larger than the same, so as to form ledges A^1 on the wooden hub at each mortise for the spokes to bear upon.

2454. Rotary Cutters, *H. A. Bonneville, London.—24th May*, 1882.—(*A communication from E. Saloman and E. Armant, Montreal, Canada.*) 6*d*.

The invention consists in substituting for a shaft, as a means for the cutter to revolve upon, a pair of eyes or lugs projecting from the cutter stock and counter-



sunk in said rotary cutter, so that they may not be more than flush with the sides of same, and in rotating said cutter by means of a gear wheel intermeshing with the teeth of said cutter. The drawing shows a transverse sectional elevation of the invention.

2457. Determining Geographically the Situation of Vessels at Sea, *P. M. Justice, London.—24th May*, 1882.—(*A communication from J. J. Oginaga, Madrid.*) 6*d*.

This relates to the method and apparatus employed for determining the position of a vessel while at sea by means of two observations taken of suitable heavenly bodies, which observations are subsequently utilised, and by means of an adjustable globe or sphere provided with suitable graduated bars or strips representing the meridian and equator, and an illumination quadrant, together with the requisite verniers, the geographical position of the vessel is determined.

2471. Manufacture of Blue Colouring Matters, *R. Meldola, London.—24th May*, 1882. 4*d*.

This consists in the manufacture of blue colouring matters by the reduction of the diazo colours formed from the various amidonaphthalene sulphonic acids in conjunction with dimethylaniline and other tertiary monomines by means of a sulphide, with or without the addition of zinc dust and the oxidation of the products thus formed by means of ferric chloride or other suitable oxidising materials.

2536. Securing the "Scales" to the Tangs or Blades of Cutlery, *H. H. and G. H. Taylor, Sheffield.—27th May*, 1882. 6*d*.

This consists of the method of securing the scales to the tangs or blades of articles of cutlery by means of metal poured while in a molten state through convenient openings into dovetailed or undercut apertures, or recesses formed in the inner faces of the scales, the metal in each recess of the opposite scales being connected through openings made in the tangs.

2544. Colouring Matters for Dyeing and Printing, *J. Erskine, Glasgow.—30th May*, 1882.—(*A communication from Dr. C. Koenig, Germany.*) 4*d*.

This consists, First, in the production of the trisulphonic acid of beta naphthol by sulphonisation of beta naphthol, and of its mono and di-sulphonic acids; (2) in the production of azo colouring matters by combining the trisulphonic acids of alpha and beta naphthol with aromatic diazo compounds.

2565. Improvements in Dynamo-electric Machines, *A. J. Jarman, London.—31st May*, 1882. 6*d*.

The improvements consist in a new form of armature comprising an outer or thin sheet iron cylinder inclosing an inner divided and separate cylinder of thin sheet iron, an annular air space existing between the inner and outer cylinders. The outer cylinder is continuous. The inner one is divided at its centre so as to form practically two short cylinders. The inventor claims the covering of armature and field with thin sheet silver or other good conducting metal; also the employment of two cylinders, so wound as to supply a tension or quantity current, or both together at the same time.

2630. Improvements in Dynamo-electric Machines, *A. J. Jarman, London.—5th June*, 1882. 6*d*.

The inventor claims the regulation of the current derivable from dynamo machines by causing the pole caps or pieces to advance or recede from each other and from the armature which they enclose; also the adjustment of such pole caps by means of screws.

2765. Printing Machines, *J. H. Johnson, London.—13th June*, 1882.—(*A communication from E. Anthony, New York.*)—(*Complete.*) 6*d*.

This relates to the delivery and folding apparatus of printing presses which print from two rolls, and in such a way that both the rolls are printed on alike, and that the same matter is printed on each side of a roll, and it consists, First, in the combining together of two webs after they are printed for the purpose of cutting them together; and Secondly, in bringing together any number of travelling sheets, the mechanism being adjustable to bring together sheets of any size.

2811. Lubricators, *B. J. B. Mills, London.—14th June*, 1882.—(*A communication from O. H. Jewell, Chicago.*)—(*Complete.*) 6*d*.

The object is to produce a lubricator provided with a small plunger that is reciprocated in a cylinder, and that operates like a pump to force automatically, by the action of the machinery, a certain quantity of oil with each stroke through one or several check valves placed between this pump and the part or parts to be lubricated.

3046. Abstracting Gold and Silver from their Ores, *R. Barker, Seacombe.—28th June*, 1882. 6*d*.

This relates to improvements in the methods of abstracting gold and silver from their ores by the combined action of electricity and mercury.

3156. Engraving Machines, *H. J. Haddan, Kensington.—4th July*, 1882.—(*A communication from J. Earle, Delaware, U.S.*)—(*Complete.*) 6*d*.

The First part relates to that class of engraving machines which are arranged to operate on the principle of the pantograph; Secondly, to the production of script letters by means of tracing with a diamond or other suitable point from a given pattern through an etching ground laid upon the surface of the plate to be engraved upon, and then subjecting the surface of the plate laid bare by the said point to the action of a suitable acid.

3282. Fastening for Lids, Covers, Furnace Doors, &c., *J. Ingleby, Manchester.—11th July*, 1882.—(*A communication from the Berlin Anhaltische Maschinenbau-Actien-Gesellschaft, Berlin, and G. Liegel, Stralsund, Germany.*) 6*d*.

This consists of a fastening wherein a lever catch pivotted to a hinged bridge-piece, carrying the cover, is made to engage with a fixed loop or eye in such manner that the opening or closing of the lid, cover, or door is effected by the single movement of the lever catch.

3489. Transforming Taffia and Rum into Cognac and fine Brandy, *H. A. Bonneville, Paris.—22nd July*, 1882.—(*A communication from D. Cornilliac, Paris.*)—(*Complete.*) 2*d*.

The inventor claims, First, the transformation of taffia and rum into cognac and fine brandy, either by reducing their degree of alcoholic strength or by maceration, and the incorporation of essence or ether of cognac; Secondly, the transformation of taffia and rum, and also phlegms and alcoholic juices, into cognac and fine brandy by distillation, and the incorporation of an essence or ether of cognac.

3519. Excavating Machinery, *W. E. Gedge, London.—25th July*, 1882.—(*A communication from Gabert Frères, Bridet, and Deruad, Lyons.*)—(*Complete.*) 4*d*.

The inventors claim the construction and use of a novel system of excavator permitting the opening of trenches or cutting sideways, endways, in flank or obliquely; having a pivotting shoot of special construction for the discharge or ejectment of the materials, and with platform permitting action or working in all directions.

3676. Sliding Gates, *W. P. Thompson, Liverpool.—2nd August*, 1882.—(*A communication from J. S. Sherwin, Battle Creek, U.S.*)—(*Complete.*) 4*d*.

This consists in combining with a gate of suitable construction an improved device for supporting it and allowing it to slide and be freely turned at will; a latch of peculiar construction, whereby the gate may be securely fastened; and in further combining, therewith a vertically adjustable guide-post for directing it in closing, and retaining it in a horizontal position.

3762. Apparatus for Utilising the Force of Fluids, Air, and Water, *E. E. H. Rousseau, Paris.—8th August*, 1882.—(*Complete.*) 6*d*.

The apparatus is formed either of one, two, three, or more similar planes, each consisting of a rigid frame bearing juxtaposed a series of contiguous blades, and supported like a door on hinges, or some equivalent, and turns on one of its four sides in a particular manner, which is previously determined by arranging the series of blades so that they are placed in front or rear of the axis which bears the next series of blades.

3872. Adjustable or Folding Chairs, *W. R. Lake, London.—14th August*, 1882.—(*A communication from F. G. Johnson, Brooklyn, and J. H. Hayward, U.S.*)—(*Complete.*) 6*d*.

This relates to the construction of chairs to be employed upon steamships.

3881. Improvements in Electric Lamps and Conductors therefor, *F. R. Welles, Antwerp.—15th August*, 1882.—(*A communication from C. E. Scribner and W. R. Patterson, Chicago, U.S.*) 6*d*.

This relates to improvements in the feeding of the carbons, &c. For this purpose an electro-magnet having its coils in the main circuit is employed, which acts as an armature wound with a coil by which the arc is shunted. The armature, by connection with a lever, carries a clutch in which the upper carbon is held. The conducting wires leading to the lamp are contained in a cable, which has a central conductor of fine copper wire cord surrounded by jute fibre. Copper wires laid over this form the second conductor, on which again is laid more jute, and over the jute, cotton. The whole is encased in a double tube of lead, in which steel wires are embedded.

3882. Improvements in Telephonic Apparatus, *F. R. Welles, Antwerp.—15th August*, 1882.—(*A communication from C. E. Scribner and W. R. Patterson, Chicago, U.S.*) 6*d*.

This relates to improvements in telephone circuits, switchboards, keys, plugs, &c. A Wheatstone bridge transmitting arrangement is claimed by the inventor amongst other things.

3896. Brewing, *L. Varicas, London.—15th August*, 1882.—(*A communication from J. F. Gent, Columbus, U.S.*)—(*Complete.*) 2*d*.

This consists in producing the wort from barley-malt, hops, and hulless maize malt.

3904. Bleaching, *C. Toppan, Salem, U.S.—15th August*, 1882.—(*Complete.*) 2*d*.

This consists in boiling the fabric in a solution of water and "sinapetroline" No. 2, then treating the fabric with a solution of chloride of lime and water, airing the same, then washing the fabric in a solution of hot water and "sinapetroline" No. 2.

3905. Setting and Intensifying the Colours of Dyed or Printed Fabrics, *C. Toppan, Salem, U.S.—15th August*, 1882.—(*Complete.*) 2*d*.

This consists in passing the goods or fabrics into and through a solution of warm water and "sinapetroline" No. 2, then calendering the same upon heated rolls or cylinders.

3920. Balances, *H. J. Haddan, Kensington.—16th August*, 1882.—(*A communication from F. A. Roeder, Cincinnati, U.S.*)—(*Complete.*) 6*d*.

This relates to improvements in the general construction of balances.

3959. Transom Adjusters and Locks, *G. J. Dickson, New York.—18th August*, 1882.—(*Complete.*) 6*d*.

This relates to automatic devices for adjusting and locking pivotted transoms or sashes.

3962. Under Coverings of Cylinders of Spinning Machinery, *B. J. B. Mills, London.—18th August*, 1882.—(*A communication from L. Cynit and J. Culty, St. Etienne, France.*)—(*Complete.*) 2*d*.

This consists in the introduction of a thread of cotton or other fibrous material adherent to the thread of india-rubber, in the manufacture of elastic fabrics intended to be used as under coverings for the cylinders or rollers of spinning machinery.

3944. Sash Fasteners, *G. J. Dickson, Albany, U.S.—17th August*, 1882.—(*Complete.*) 6*d*.

The objects are, First, to provide a fastening device that cannot be disengaged by means of a thin instrument inserted, from the outer side of the window, through the joint between the upper and lower sash; Secondly, to afford facilities for bringing the meeting rails of the upper and lower sashes into exact coincidence; and Thirdly, to provide means for securely locking the sashes when entirely closed, and when they are left slightly open for the purpose of ventilation.

3967. Watch Chains, *A. M. Clark, London.—18th August*, 1882.—(*A communication from W. C. Edge, Newark, U.S.*)—(*Complete.*) 4*d*.

This consists of a chain composed solely of links that have bulging out portions, said chain being flat throughout, with the exception of projecting ribs on its faces.

3982. Improvements in Electric Signalling Apparatus, *R. H. Brandon, Paris.—19th August*, 1882.—(*A communication from H. W. Southworth, Springfields, Mass., U.S.A.*) 6*d*.

This relates to improvements in needle instruments for transmitting electric signals, and consists in a novel arrangement of circuit-closing devices and means for governing the needle-deflecting current, so as to cause a simultaneous and equal deflection of all the needles on one circuit.

4039. Impregnating Mineral Substances or Compounds with Bituminous Products, *W. R. Lake, London.—23rd August*, 1882.—(*A communication from R. Michelet and L. Tescher, Berlin.*)—(*Complete.*) 6*d*.

This consists essentially in subjecting the stones or moulded pieces to be impregnated with bituminous products, to the action of intense heat, vacuum, and pressure.

4094. Manufacture of Starch, Grape Sugar, &c., *W. R. Lake, London.—26th August*, 1882.—(*A communication from W. T. Jebb, Buffalo, U.S.*)—(*Complete.*) 10*d*.

This relates to the manufacture of starch from maize and other grain; to the treatment of starch for the production of solid grape sugar and liquid glucose; to the subsequent treatment of the grape sugar for preparing it for consumption; and to the treatment of the refuse for preparing it to be used as food for animals.

4095. Umbrella, Parasol, and Sunshade Mountings, *A. C. Henderson, London.*—(*A communication from C. Grataloup and J. B. Leymarie, Paris.*)—(*Complete.*) 6*d*.

This consists, First, of a slide with an upper ring or rim having notches in it for the reception of the ends of the forked stretchers, so that these can be bound by one and the same binding wire; Secondly, if a second tube or slide adjusted in the first, having a cap with apertures, through which all the stretchers pass, and which cap covers the first piece.

4133. Pencil Cases, *W. R. Lake, London.—29th August*, 1882.—(*A communication from A. T. Cross, Providence, U.S.*)—(*Complete.*) 6*d*.

This comprises improved construction of the hollow screw for operating the carrier, the slotted tube arranged within the bore of the said screw, and the interior tubular carrier, whereby the unused piece of a lead or crayon is expelled from the carrier, and a fresh lead or crayon inserted therein for continued use.

4141. Reciprocating Pistons for Fluid-pressure Engines and Pumps, *H. J. Haddan, Kensington.—30th August*, 1882.—(*A communication from M. V. Schiltz, Cologne.*)—(*Complete.*) 6*d*.

This consists partly in a device to produce a slight and irregular rotation of the piston in a cylinder during every up and down stroke of a steam engine, gas, or other motive power engine, or of a pump, in order to obtain an equitable and round wearing away.

4155. Evaporation of Liquids, &c., *Adalbert, Baron of Podewils, Munich.—31st August*, 1882.—(*Complete.*) 8*d*.

This consists partly of an appartus for the evaporation of liquids at various degrees of pressure or vacuum by means of heating surfaces kept free from incrustation by fixed or elastic scrapers.

4249. Removing Bone-black from Filters, &c., *A. M. Clark, London.—6th September*, 1882.—(*A communication from J. O. Donner, New York.*)—(*Complete.*) 6*d*.

This consists in the method of conveying bone-black and similar granulated substances by forcing water into the vessel containing the substance and through a pipe connected with the lower part of said vessel and leading to the desired place.

4501. Embroidering Machines, *A. M. Clark, London.—21st September*, 1882.—(*A communication from J. A. Groebli, New York.*)—(*Complete.*) 1*s*.

This relates to a mechanism for moving the suspended fabric frame of embroidering machines automatically in any direction in the same plane, and for performing this movement for every new stitch or series of stitches to be made through the fabric, and it consists, First, in connecting the frame to a set of reciprocating slides; Secondly, to actuating the slides by hooks which, when lifted by jacquard needles, are actuated by levers, and impel beams which cause the slides to move; and Thirdly, to the means for connecting the beams and slides.

5387. Steam Engines, &c., *H. B. Young, London.—9th December*, 1881. 6*d*.

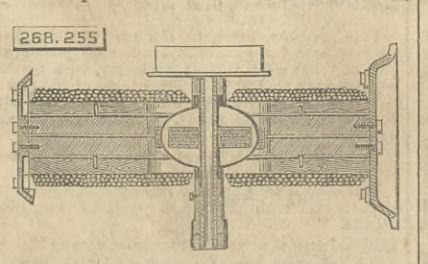
This relates to improvements in the arrangement and construction of steam engines and in driving dual propellers, the object being to economise space and fuel. It consists in placing the cylinders of two cylinder right-angled crank engines—compound or non-compound—end to end, and in the mode of communicating the motion from the pistons to the crank. A special valve regulates the exit of the spent steam from the cylinder to the condenser. To drive dual propellers two crank shafts are used and placed one above the other, the upper one actuated by the engine and the lower one connected by rods to it. On the upper crank shaft is a wheel gearing with another wheel on the tubular screw shaft. Upon a continuation of the under shaft the dual screw is fixed.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

268,255. Dynamo-electric Machines, *Richard H. Mather, Windsor, Conn.—Filed December 11th*, 1880.

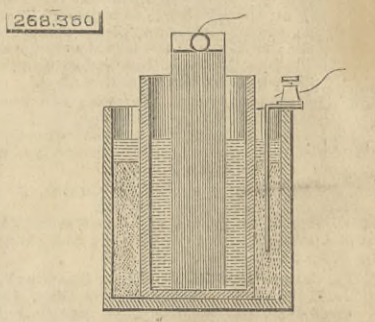
Claim.—(1) In a dynamo-electric machine, an armature core composed of a disc the thickness of which



does not exceed one-third its diameter, and having a substantially solid centre or interior, and having coils of insulated wire wound laterally thereon, substantially as described. (2) In a dynamo-electric machine, a disc armature core having peripheral mortices or sockets and coils of insulated wire wound into such sockets, substantially as shown and described. (3) In a dynamo-electric machine, a disc armature core having peripheral mortices or sockets and coils of insulated wire wound into such sockets, substantially as shown and described. (3) In a dynamo-electric machine, ture core, two or more ture coils, and a commutator having two parts of plates for each armature coil, respectively connected with the respective ends of the appurtenant coil, each of which plates extends substantially around one-third the circumference of the commutator all substantially as described and for the purpose set forth.

268,360. Secondary Battery, *Asahel K. Reese, Brooklyn, N.Y.*—Filed April 15th, 1882.

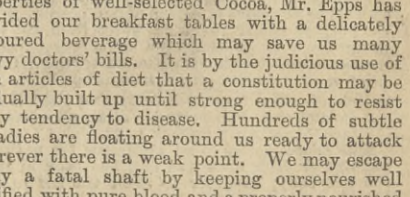
Claim.—(1) In a secondary or storage battery, the combination of a metallic element capable of being rendered electro-negative by the passage through it of an electric current in the manner described, an electrolytic solution of metallic salt, and a positive element composed of comminuted or powdered conducting material, as set forth. (2) In a secondary or storage battery, the combination of a metallic element capable of being rendered electro-negative by the



passage through it of an electric current in the manner described, an electrolytic solution of metallic salt, and a positive element composed of comminuted or powdered carbon. (3) In a secondary or storage battery, the combination of a negative element of lead, an electrolytic solution of metallic salt, and a positive element composed of comminuted or powdered carbon. (4) In a secondary or storage battery, the combination of a negative element composed of spongy lead, a solution of sulphate of copper, and a positive element of comminuted or finely-divided carbon, or carbon and metal, in a loose state, as set forth.

268,401. Machine for Sharpening the Edges of Ploughshares and other Plough Steels, *Edward S. Hartman, Allegheny, Pa.—Filed June 5th*, 1882.

Claim.—In a machine for bevelling ploughshares and other implements, the combination of a bed or anvil die having a bevelled face and a rocking die



having a bevelled face, the latter carried by a pivotted lever, and arranged above the bed die to coact therewith, substantially as and for the purpose specified.

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South Kensington Museum.—Visitors during the week ending Dec. 23rd, 1882:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 6586; mercantile marine, Indian section, and other collections, 1756. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 4 p.m., Museum, 1208; mercantile marine, Indian section, and other collections, 169. Total, 9719 Average of corresponding week in former years, 10,485. Total from the opening of the Museum, 21,539,331.