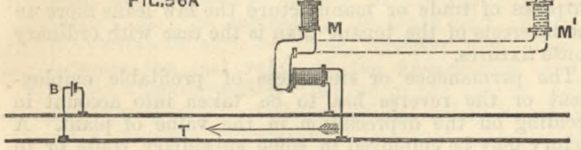
THE CHICAGO RAILWAY EXPOSITION.

No. VI.

Most American railways are very badly provided with signals, though with characteristic readiness to grasp new ideas, most elaborate forms of block signalling are being rapidly adopted, and the exhibit of signals was consequently very large, and excited much interest among American railway men, and seems likely to lead to a very considerable improvement on the crude, imperfect, and dangerous appliances now in use. No regular system of signalling or interlocking is yet in general use, though the frequency of facing points on both double and single lines, drawbridges, road crossings, and of railways crossing one another on the same level, render interlocking even more necessary than on some English lines where the trains

FIG. 36A



are more numerous. It is probable, however, that the next few years will witness a great improvement in the working of the signals in use on American railways, and therefore the interlocking and automatic electric signal systems exhibited may be regarded as most important in their influence on the safety and regularity of American travel in the future.

FIG. 37

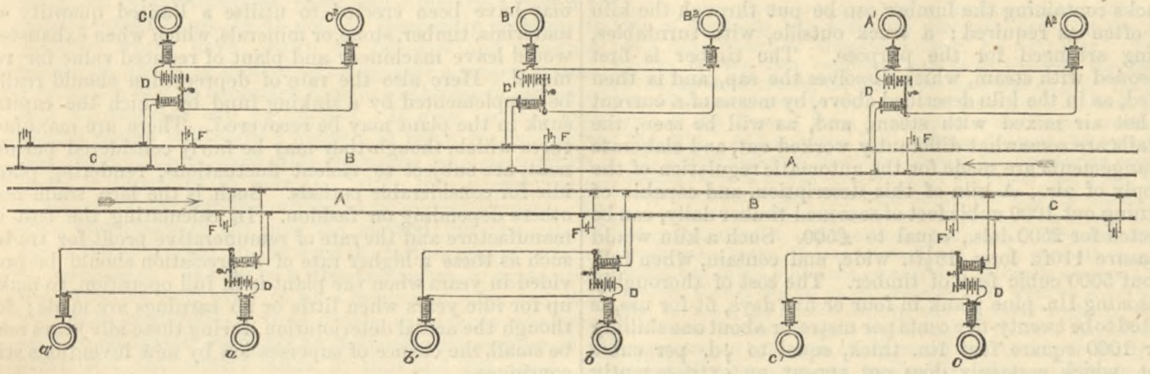
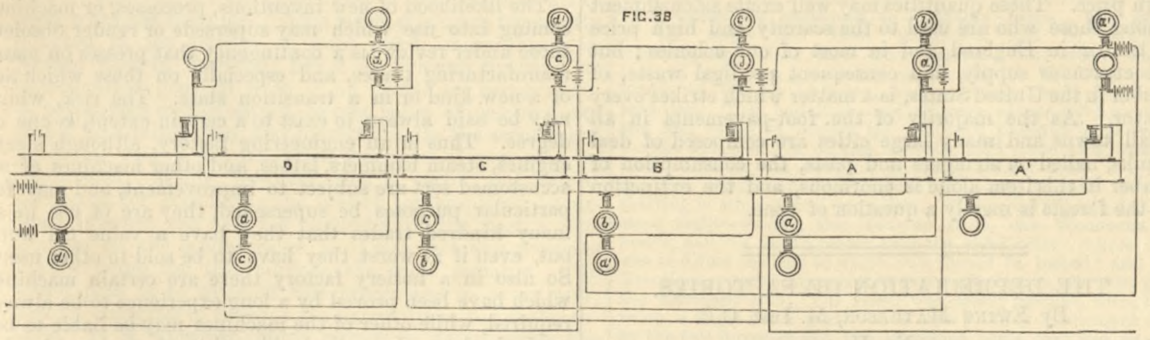


FIG. 38



It is somewhat singular that the question of uniformity of signals should have received so little attention in the States, where many railways have combined to adopt standard interchangeable axles, wheels, axle-boxes, &c. In this country the semaphore signal was superseding all other forms when the block system was first introduced, but the widest and wildest diversity prevails in America, and the advent of improved methods of signalling has even intensified the evil by introducing fresh varieties of spectacles, discs, diamonds, &c. Most of these signals are so small and badly placed that they can scarcely be seen when they indicate danger, and when turned edgeways to an advancing train to denote safety are practically invisible, and give no positive signal. The best signalling appliances are of little use if the form of the signal itself is ambiguous or cannot be clearly distinguished, while the principle that the absence of any danger signal signifies safety has been found by experience to be faulty, and semaphore arms are now generally made to give permission to proceed by falling to an angle of 45 deg. or 55 deg. from the horizontal, instead of dropping out of sight behind the signal post. It is always possible that a signal which cannot be seen may be rendered invisible by a failure of the operating mechanism, and hence signals should always give positive indications of safety or danger. Our American cousins hardly seem to have paid sufficient attention to these fundamental principles of signalling, but have endeavoured to further improve the block system by rendering it automatic, or, in other words, have substituted mechanical for human agency, and thus endeavoured to eliminate one set of chances of error by introducing others.

The Exposition contained several different systems of automatic signalling in which the passage of the train itself worked protecting block signals without the intervention of a signalman. In some systems the rails and in others complete systems of wires were used as electric conductors. Both closed and open circuits were used, the presence of an electric current in the one case keeping the signal at safety, and the interruption of the current causing the signal to fly to danger. On the other system the presence of the train on the section completes the circuit, and the current changes the signal to danger from its normal position of safety. The former system is adopted by the Union Switch and Signal Company, of Pittsburg, and the latter by the Hall Electric Signal Company, of Meriden, Conn. The utilisation of the rails as conductors confers certain obvious advantages, but it is said to be somewhat uncertain, and is liable to damage when the track is lifted or relaid. Both systems are being largely adopted, and the railway manager in the United States has now the choice of all that English experience has approved and American ingenuity recently devised in the matter of signals.

The Pennsylvania Steel Company exhibited a full-sized railway yard worked by an American prototype of Saxby and Farmer's interlocking apparatus with sidings, cross-over roads, &c., and some good and simple yard points moved by hand for shunting or marshalling when the main line is clear, but capable of being locked from the signal-box when a through train is due. Semaphore signals were almost exclusively used in this exhibit, which was distinguished by common sense and simplicity, and in many points resembled good English practice.

The most complete collection, however, of signalling apparatus was shown by the Union Switch and Signal Company, Pittsburg, Pa., which in addition to automatic electric signals showed no less than four totally distinct forms of interlocking gear, including Saxby and Farmer's interlocking, Sykes' electric interlocking, and hydraulic and electro-pneumatic interlocking apparatus of American invention. As the former methods are well known in England, we propose only to briefly describe the latter, which are of recent introduction and will repay examination.

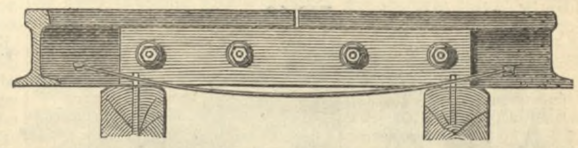
The Union Switch and Signal Company's automatic method of working the block system by an electric circuit is illustrated by Fig. 36A, in which T represents a block section, a mile or less in length, the rails of which are properly connected to form electrical contact, and are insulated at the ends from the adjacent rails. A one-cell gravity battery is placed at B, one pole being connected to each rail, and an electro-magnet M is similarly connected at the other end of the section. Thus a complete circuit is established from the battery, through the rails and magnet back to the battery again. The electric current follows the path of least electrical resistance, and does not materially leak off to the ground, but keeps the magnet magnetised, holding the signal at safety. When, however, a train enters the section the current is short circuited, passing through the wheels and axles, which are better conductors than the small wire of the magnet. The latter being demagnetised releases the relay, and the signal O flies to danger, remaining in that position until the last pair of wheels has passed on to the next section. It will thus be seen that a broken rail or the presence of a runaway truck or trolley on the section will turn the signal to danger. Platelayers working on the track can dispense with the unsatisfactory plan of sending back a man with a red flag by simply laying a crowbar or rail gauge from rail to rail, thus short circuiting the current and putting the signal to danger.

As shown in Fig. 36A, but one signal is operated; but the system can readily be adapted to work several signals, or the signal O can be placed as shown in dotted lines in advance of the block section. The absence of a home or stop signal is, however, a disadvantage, and therefore the more elaborate system shown by Fig. 37—which represents the signals on three sections of a double line—is very generally adopted. The local battery D, which actuates the signals, has two signals in its circuit instead of one. It should be borne in mind that trains in America running on a double line generally keep to the right, as shown in this diagram. As before explained, the presence of a train on the section A short circuits the current produced by the single cell battery F, and through a relay throws out the battery D, the current of which keeps the signals A^1 and A^2 at safety. These signals fly to danger simultaneously, acting as home and distant signals, and remain at danger until the train has completely cleared section A. Directly the leading wheels of the engine enter section B, the signals B and B^1 also fly to danger, and the driver can thus see the signal abreast of him move by the action of his own train, and can thus assure himself of the proper working of the apparatus.

The length of block sections on lines worked on the automatic principle varies from a quarter to half a mile, and these very short lengths are adopted, even on single lines, to suit the American practice of running several trains on one schedule. In other words, when the traffic demands it, several trains are run in quick succession; any train coming in the opposite direction having to wait at the crossing place until all the extra trains have passed. It is important to reduce the period of waiting, by enabling the trains to follow one another as closely as possible; and therefore on some heavily worked single lines the automatic signals have been placed only half a mile apart, though the crossing places may only occur every five or ten miles. The small expense attending the use of these signals is very favourable to the adoption of short block sections. Capitalising the wages of the signalmen, a straight line box, worked day and night, represents an outlay of over £2000—rather too heavy an item to be spent on every half mile of road. The New York Central Railroad is, however, adopting boxes fitted with Sykes' electric lock, only a quarter of a mile apart for the first eighteen miles from New York.

The system as applied to a single line railway is shown in Fig. 38. Both home and distant signals are provided for trains running in both directions, the signals being always on the right-hand side of the advancing train. A train entering section A from A^1 puts the danger, the home, and the distant signals, a and a^1, in front of it, and b and b^1 behind it. The four signals, a, a, a^1 a^1, are all on the same circuit, and are worked as described above. This system ensures a proper distance being maintained between trains travelling in opposite directions; for when a train leaves section D and enters on section C, the signal c^1 in advance of the train and at the end of block A is

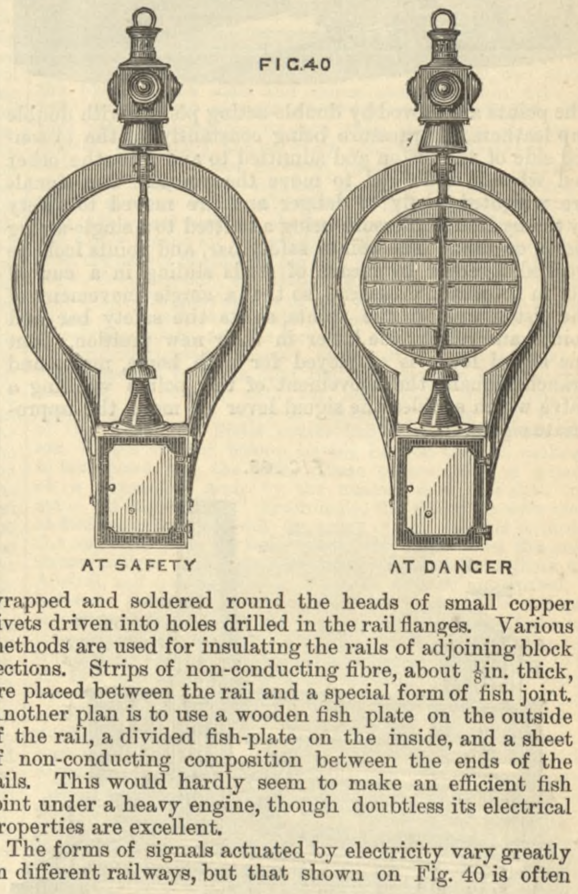
FIG. 39



thrown to danger in the face of the train on section A advancing on section B. Should the driver fail to stop his train in time and enter section B, the signals b^1 and b are shown against the train advancing from D and about to enter C. It therefore appears that, assuming the worst possible conditions, each driver sights a distant signal when he is the length of two block sections from the train advancing towards him.

Electric continuity throughout the length of the section does not depend upon the contact of the fish-plates with the rails, but is secured by connecting adjacent rails with wire, as shown in Fig. 39. The ends of this wire are

FIG. 40

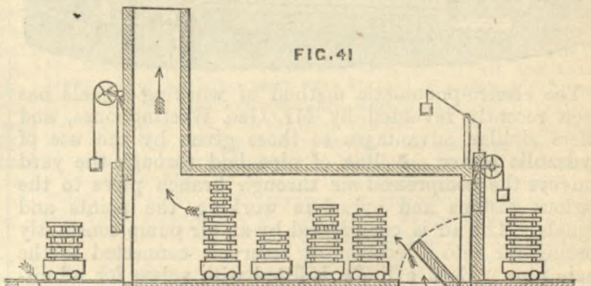


AT SAFETY — AT DANGER

wrapped and soldered round the heads of small copper rivets driven into holes drilled in the rail flanges. Various methods are used for insulating the rails of adjoining block sections. Strips of non-conducting fibre, about ⅛in. thick, are placed between the rail and a special form of fish joint. Another plan is to use a wooden fish plate on the outside of the rail, a divided fish-plate on the inside, and a sheet of non-conducting composition between the ends of the rails. This would hardly seem to make an efficient fish joint under a heavy engine, though doubtless its electrical properties are excellent.

The forms of signals actuated by electricity vary greatly on different railways, but that shown on Fig. 40 is often

FIG. 41



used. A cast iron box beneath the signal contains the operating mechanism, the details of which are somewhat complicated. The vertical spindle carrying the signal is made to revolve by the action of a stout spiral spring, which is wound up daily by hand. Two detents, operated by electricity, hold the signal to safety and danger respectively, the interruption of the current releasing one detent and permitting the signal to make a quarter revolution and indicate danger, where it is held by the other detent. An electro-magnet and armature arrests movement of one detent when attracted and arrests the other when unattracted, while the movement of the shaft restores the detent to a position where it is ready to engage. The spring when run down expands and strikes a catch which locks the signal to danger, thus guarding against the neglect of the attendant to wind up the spring.

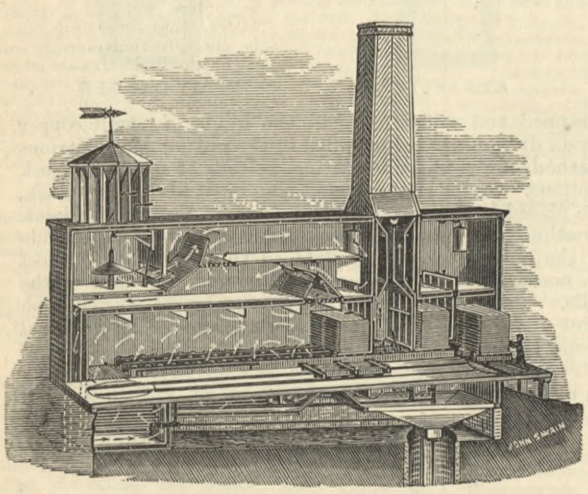
The signal itself is composed of a stout wire ring, accross which are stretched horizontal wires, on which swing freely light metallic slats. The signal can be easily turned, as the slats offer little resistance to the wind. The motive power being small, it is important that little force should be required to turn the signal. A lamp with red and white lenses is mounted on the top of the signal spindle and turns with it.

The Union Switch and Signal Company also exhibited hydraulic and pneumatic methods of working interlocked signals. Both are of recent introduction and as yet have not been extensively applied, but the latter is in use at East St. Louis, an important railway junction at the eastern end of the well known St. Louis Bridge. The hydraulic system saves the physical labour consumed in handling the levers moving the signals and points of a large yard. A set of small levers put in an interlocking frame works valves in the cabin, which admit and release water under pressure to pipes communicating to hydraulic cylinders which are directly connected to the various points and signals. Long lengths of rods, wires, &c., are thus entirely dispensed with, and the signalman has only to overcome the friction of the locking apparatus and to move the hydraulic valves.

FIG. 42.

The points are moved by double-acting pistons with double cup leathers, the pressure being constantly on the piston-rod side of the piston and admitted to and from the other end when it is desired to move the points. The signals are weighted to fly to danger and are moved to safety by the hydraulic pressure being admitted to a single-acting piston or ram. The points, safety bar, and points lock are worked together by means of studs sliding in a curved slot in the piston crosshead, so that a single movement of the piston unlocks the points, shifts the safety bar and points, and relocks the latter in their new position. But one signal lever is employed for both home, main, and branch signals, the movement of the points working a valve which enables the signal lever to move the appropriate signal.

FIG. 43.



The electro-pneumatic method of working signals has been recently invented by Mr. Geo. Westinghouse, and offers similar advantages to those given by the use of hydraulic power. A line of pipe laid through the yard conveys the compressed air through branch pipes to the various pistons and cylinders working the points and signals. The air is compressed by an air pump constantly forcing air into a receiver or reservoir connected to the main pipe. Each cylinder is fitted with valves for admitting or releasing the compressed air, these valves being moved by the making and breaking of an electric circuit. The electric currents through these circuits are controlled by small interlocked levers. It will be seen from even this brief description, which we hope to supplement shortly, that both systems of interlocking promise to effect a great saving, not only in the manual labour, but also in the time at present required to shift points and signals.

Messrs. Curran and Wolff, of Chicago, exhibited a large working model of a lumber dryer for the rapid seasoning of timber by artificial means. The kiln was shown at work, and specimens of different timbers—deal, maple, black walnut, and cedar—seasoned by this means in a few days, could be seen, and certainly appeared to be thoroughly dry and perfectly free from shakes or cracks, while the appearance of the timber was bright and clear, and no warp or twist was apparent. The engraving, Fig. 41, illustrates the action of the kiln. The timber to be dried is loaded transversely on trucks running on rails set at an incline of about 1 in 35. These rails extend the length of the kiln, which may vary from 50ft. to 150ft.; the width being determined by the length of the longest piece of timber which the kiln is intended to dry. Each plank is so loaded that a clear space for the circulation of air is left between each piece of timber. Underneath the wrought iron floor of the kiln are a series of coils of steam pipe, exposing some 6000 or 7000 square feet of heating surface to a current of cold air which enters at the end by which the kiln is fed; but, of course, at a lower level. When heated by its passage through the nest of steam pipes, the air rises through the floor by a damper at the back of the kiln extending the whole width of the floor, and permitting the hot air to pass through the lumber on its way to the chimney.

Some live steam is allowed to mix with the heated air, and checks the tendency of the timber to dry too quickly and superficially. The heat necessary for the proper working of the apparatus is not very great, ranging only from 150 deg. to 200 deg. It is found that the hotter air requires a swifter circulation, and a free admission of steam to prevent a seasoning which affects the surface only, and leaves the heart of the timber untouched. The time usually taken in seasoning pine 1in. thick is five days; from ten days to a fortnight being required for harder timber and for greater thicknesses. When hard and soft woods are being seasoned at the same time, the former, after passing through the kiln, must be brought back and entered at the front end again.

Figs. 42 and 43 show other kilns for the same purpose. Mr. C. Wilcox, of Minneapolis, Minnesota, exhibited a model of a kiln for dealing with work of this kind. The trucks containing the lumber can be put through the kiln as often as required; a truck outside, with turntables, being arranged for the purpose. The timber is first seasoned with steam, which dissolves the sap, and is then dried, as in the kiln described above, by means of a current of hot air mixed with steam, and, as will be seen, the details are somewhat differently worked out, and elaborate arrangements are made for the automatic regulation of the supply of air. A kiln of this description, and capable of turning out 1000 cubic feet of seasoned timber daily, can be erected for 2500 dols., equal to £500. Such a kiln would measure 110ft. long, 16½ft. wide, and contain, when full, about 5000 cubic feet of timber. The cost of thoroughly seasoning 1in. pine plank in four or five days, fit for use, is stated to be twenty-five cents per metre, or about one shilling per 1000 square feet 1in. thick, equal to ¼d. per cubic foot, which certainly does not appear an extravagantly high price. These quantities may well excite astonishment among those who are used to the scarcity and high price of timber in England and in most of our colonies; but the enormous supply, and consequent prodigal waste, of timber in the United States, is a matter which strikes every visitor. As the majority of the foot-pavements in all small towns and many large cities are composed of deal planks, nailed on stringers and posts, the consumption of timber in this item alone is enormous, and the extinction of the forests is merely a question of time.

THE DEPRECIATION OF FACTORIES.

By Ewing Matheson, M. Inst. C.E.

No. II.

Before dealing in detail with the various kinds of property in a factory, and attempting to set up a mode of treatment and rate of depreciation appropriate to each, there are certain preliminary questions that need attention. First, the value of any building, plant, or apparatus, or aggregation of them, may be largely affected by circumstances outside of their physical condition, and it may be convenient at the outset to separate such circumstances from those which result from actual use. Such secondary circumstances are the tenure under which the factory is occupied; the permanency or steadiness of profitable employment which may be anticipated; the likelihood of new inventions, processes, or machines coming into use which may supersede and render obsolete those whose value and depreciation are in question; or vicissitudes and catastrophes which cannot be provided for by ordinary insurance. Conditions and contingencies such as these, if they are to be estimated and provided for, may be said to demand a reserve or sinking fund, rather than a rate of depreciation, and in some cases it is found desirable and possible to so isolate them in the accounts; but whatever be the precise method of doing it, they must be duly considered.

In regard to tenure, if the factory be only rented by the occupier, as occasionally happens where large factories are divided into separate tenements or workshops, then the sum to be provided for depreciation will depend upon the conditions of tenancy, and if the rent covers fair wear and tear the occupier need only keep the plant in working order for his own purposes. A more usual tenure is that under which the premises are built by the occupier on land held on lease with the usual condition that the buildings and fixtures become the property of the ground landlord at the end of the term. In such a case the provision of a sinking fund sufficient to give back the capital expended by the tenant becomes a matter of great importance. If the lease be for a long term the annual charge, if it begin with the lease, will not be found burdensome, 3s. 8d. invested every year for eighty years at 4 per cent., as with an insurance company, procuring a return at the end of that time of £100, or an eightieth part may be written off annually. Moreover, such an annual rate must not all be considered as due to the tenure, because a freeholder would incur a considerable proportion—even if repairs be duly attended to—to compensate for the reduction in value due to time and use, such a rate being at least half of what would repay the full value at the end of eighty years. But as the landlord will, under most leases, not only take possession of the land and buildings, but of all improvements and fixtures added by the tenant or his predecessor in title, the sinking fund for these will be onerous, according to the period at which such additions were made. But as under these circumstances the tenant will feel under no obligation to give up more than his lease compels, he will, while maintaining the factory to the end of the term in sufficient order for his own purposes, abstain from replacing obsolete fixtures by improved ones, and in regard to portions which are seldom used, may even let them wear out before the lease ends. If the occupier is to deliver up the factory in good tenantable condition it does not follow that the repairs shall have been effected with so liberal a view to the future as the occupier might have done as owner, nor does it follow that fixtures fairly worn out in the work of the factory shall be replaced by new ones. Therefore, as against his sinking fund he will, in the last years of his term, save in the cost of maintenance. Without going into the legal question of what constitutes landlord's fixtures, it may be said that in the case of fixtures added to a building for purposes of trade or manufacture the law leans more to the interests of the tenant than is the case with ordinary house fixtures.

The permanence or steadiness of profitable employment or the reverse has to be taken into account in deciding on the depreciation in the value of plant. A factory may be employed in some subsidiary trade or in supplying some other undertaking which is not certain of continuing; or a patent, or a privilege, or a contract for a term of years may be soon to terminate. Owing to causes of this sort, which are too various to enumerate, the advantages of the past may be liable to serious alteration or may be entirely terminated, and it is obvious that a much higher rate of depreciation should be written off the plant, so as to bring down its nominal value to that which it will have under the anticipated contingency. Or a factory may have been erected to utilise a limited quantity of materials, timber, stone, or minerals, which when exhausted would leave machinery and plant of reduced value for removal. Here also the rate of depreciation should really be supplemented by a sinking fund by which the capital sunk in the plant may be recovered. There are manufactures which, though they may be fairly considered permanent, are subject to violent fluctuations, rendering plant idle for considerable periods. Such is the lace trade and others depending on fashion. In calculating the cost of manufacture and the rate of remunerative profit for trades such as these a higher rate of depreciation should be provided in years when the plant is in full operation, to make up for idle years when little or no earnings are made; for though the actual deterioration during these idle years may be small, the chance of supersession by new inventions still continues.

The likelihood of new inventions, processes, or machines coming into use which may supersede or render obsolete those under review, is a contingency that presses on many manufacturing trades, and especially on those which are of a new kind or in a transition state. The risk, which may be said always to exist to a certain extent, is one of degree. Thus in an engineering factory, although steam engines, steam hammers, lathes, and other machines of an accustomed sort are subject to improvement, and may for particular purposes be superseded, they are of use in so many kindred trades that they have a value till worn out, even if at worst they have to be sold to other users. So also in a hosiery factory there are certain machines which have been proved by a long experience to be always required, while other of the machines may be liable to become obsolete. In a trade like that of steel-making by modern processes, where radical alterations and improvements are made from time to time in plant which must be of a special kind, most of it useless for any other purpose, it would be unsafe to write off for depreciation the mere loss by wear and tear. As new inventions are generally directed towards a saving in labour and an improvement in the product, special plant, when once superseded by such inventions, may prove unsaleable as second-hand plant, except in so far as it may have a piece-meal value, because no reduction in price or capital cost would compensate for the expenditure in labour its use would involve, or for the inferiority of its productions. Contingencies such as these should encourage an ample reduction of nominal value in the early years of working, so as to bring down the book value of the plant to a point which will allow even of dismantling without serious loss. In trades such as these, profits must be large enough to allow for a liberal and rapid writing off of capital value. The same result is attained by the constant addition of new and improved machinery out of revenue, and undertakings in which the profits of prosperous times have been applied in this way to renew the plant rather than in the distribution of high dividends, have a considerable advantage, when trade becomes dull, in competing with rival undertakings burdened with a relatively large capital.

There are other contingencies to be provided for in certain trades before the net earnings can be fairly treated as profit. Such are risks which demand an insurance fund, but for which the ordinary systems of insurance are inapplicable. For instance, in or about a mine or quarry, there may be a risk of flooding, which would render useless the machinery and plant; or in a factory, where highly inflammable or explosive articles are made, the risks may be so great or uncertain that no insurance company will underwrite them at any reasonable rate. But while as between a few partners it may be convenient to consider all these circumstances as part of one general system of depreciation, they may, in the case of numerous partners, or of a joint stock company, be more properly provided for by a reserve fund, stated in the accounts, and distinct from the depreciation by wear and tear. For as it is impossible, by a mere annual writing off, to exactly balance uncertain contingencies, the grouping of all together may tell unfairly in either direction on those who have only a fleeting interest in the undertaking, or who cannot afford to postpone their claim to a future day. To those who are concerned in the management, and who know the basis on which a general rate has been arrived at, the name by which the provision is stated may be a matter of indifference; but to partners who are unaware of the circumstance, a separate reserve fund will allow of a juster appreciation of the facts, and of a fairer valuation of their property; and in case of a change or termination of the partnership, or of a cessation of the business, there is then a specific fund to be dealt with, which may render a valuation unnecessary. Those who are responsible for the management sometimes prefer to include what is really a reserve or insurance fund in the depreciation rate, so as to disguise the economy they are practising, and avoid the claims of shareholders, who would prefer to divide and appropriate an undiminished income.

There is a reverse side to the contingencies just enumerated. Not only may there be an absence of secondary risks, but there may be an obvious and increasing prosperity. Thus the value of the site on which the factory stands may be increasing in value by the growth of the town and neighbourhood, or the demand for the products of the factory may be increasing at a greater rate than the competitive supply, or the reputation of the factory may be increasing its trade and profit. But circumstances such as these, however much they may increase the real value of the undertaking, and may justify a corresponding valuation in the case of change in partnership or sale of shares, cannot safely be set against actual physical depreciation of the plant. The latter, as a distinct and unavoidable circumstance, should be dealt with on its merits, and improvements in another direction be left to a subsequent valuation, when the necessity for it arises.

In order to estimate correctly the alteration in value which the capital sunk in a factory undergoes from year to year, it is necessary to have some record of the original value or cost as a starting point. If the factory has been bought the price forms this basis; if it has been built and equipped by the occupiers, there will either be a record of capital expenditure, or if not, as frequently happens in factories which have grown up by slow and irregular additions, and it be desired to inaugurate a proper system, a valuation will be necessary, to which subsequent estimates and adjustments can be applied. It may be that each annual review will show a growth of value by extensions and improvements, even after deducting for deterioration; but it is important to take the latter into account, so as not to allow the nominal capital to be unduly swelled. In some undertakings, not only the method, but the rate of depreciation is fixed in the deed of partnership or articles of association. It may be a wise precaution to agree upon the principle, and even to fix a minimum rate; but it is obviously impossible to thus decide in advance what can only be estimated correctly as it arises. Sometimes it is prescribed that deterioration by time and use are to be met by applying a fixed proportion of the profits to make good what has been lost. This method is more frequently adopted in the articles of joint stock undertakings in France than in England; but it is obviously unsound, as deterioration goes on even if no profits are being made. A percentage on the output or cost value of the products would be a fairer plan, and by referring to the accounts of preceding years a fair rate from this point of view may be established. While, however, this is useful, and indeed necessary, for estimating the cost of contemplated operations, it is not the best for dealing with the past, a percentage on the capital value as it was left at a previous review being for this purpose the most suitable. The sound plan is to write off this percentage in every year, besides charging to revenue the expenditure for maintenance. It is, however, quite proper in determining the rates to be written off for any year, to take into account the activity or slackness of certain departments, and also to give due weight to expenditure for maintenance.

The great diversity of practice renders a comparison between the system in different factories difficult. In one the greatest attention will be paid to repairs; renewals and even extensions will be effected out of revenue, and little or nothing written off for depreciation. In another there may be apparently an ample provision made in the capital accounts for depreciation; but repairs may be neglected and a too liberal addition be made to capital for so-called new works, which, in that they merely replace old plant and do not increase the earning capacity of the factory, should be charged to revenue.

RIVER POLLUTION.—At the meeting last week of the Sanitary Institute of Great Britain, a paper was read on "River Pollution," by Henry Robinson, M. Inst. C.E. The author said "when the Rivers Pollution Prevention Act was passed in 1876, hopes were entertained that it would result in stopping the pollution of our rivers. If, however, the working of the Act up to the present time is considered, it must be admitted that it is practically inoperative. It is a dead letter, and that unless it is amended it will remain inoperative. I do not go so far as to say that it has been a useless piece of legislation. It served for a time as a rod to be held over individuals and local authorities who were offenders, and to some small extent it caused inquiry and action where indifference had previously existed. The total effect, however, is inappreciable. The rivers continue as before to receive the pollutions which were sought to be abated. Not one certificate has been given to a town that the best practicable method has been employed to remove polluting sewage matter. It appears to me that one serious defect in the Act which has contributed as much as anything else to its being inoperative is this:—The onus of initiating proceedings against offending persons or authorities is largely cast upon the individual riparian, or other, owner, which involves the assumption that such individual is able and willing to undertake the duty of enforcing the Act, or where the sanitary authority is relied on to enforce the Act, it presupposes that it will move in the matter, whereas in regard to sewage pollution, the authority itself is the offender. I think that the burthen of enforcing the Act should not lie with individuals or local authorities alone, as if the question were purely local. It is a public grievance which it was sought to be removed by the Act, and requires to be treated in a broader manner than has been done. In my opinion an alteration in the Act is imperatively called for, and I suggest as a necessary change that the initiation of proceedings under this Act should be entrusted—in addition to the authorities and individuals—to public inspectors who should be entirely independent of local authorities, and who should be responsible to a Department of State. The establishment of such a *modus vivendi* would secure the co-operation of the public, and the existence of causes of pollution would soon be made known voluntarily by residents and others who would be unable or unwilling to enter upon the tedious, costly, and uncertain course of procedure under the Rivers Pollution Prevention Act."

LEGAL INTELLIGENCE.

WRECK COMMISSIONER'S COURT.

(*Before* Mr. H. C. ROTHERY, *Wreck Commissioner, with Assessors.*)

THE AUSTRAL.

ON Saturday judgment was given in the inquiry into the sinking of the Austral in Sydney Harbour, last November.

Mr. Howard Smith (with him Mr. Mansel Jones) appeared for the solicitor to the Board of Trade (Mr. W. Murton); Mr. Bucknill, with Mr. Baden-Powell, was for the owners; Mr. Israel Davis, for the chief engineer; Mr. T. H. Nelson, for the captain; and Mr. Batham, for the chief officer.

The COMMISSIONER said the Austral was a screw steamer, 5580 tons gross, 3289 net, fitted with engines of 1000-horse power, built in 1882 at Govan by James Elder and Co., and was the property of the Orient Steam Navigation Company, Limited, Mr. James Anderson, Fenchurch-avenue, London, being the managing owner. She was in every respect a first-class steamer, built under special survey, both of Lloyd's and the Board of Trade, and was in every respect worthy the high reputation of her builders. After one voyage from London to Sydney and back with passengers and cargo, she again left London on September 7th, 1882, for Melbourne and Sydney, with a crew of 195 hands, about 500 passengers, and about 900 tons of general merchandise, of which 283 was dead-weight, and 600 measurement goods. She called in at St. Vincent and the Cape to coal, and soon after leaving the Cape some defects were found in her machinery, which caused her to proceed under canvas for eighteen hours, during which she made from seven to eight knots an hour. She in due course discharged at Melbourne 100 tons dead-weight, some passengers, and goods. She arrived at Sydney on the 3rd of November, and was, by direction of the company's agent there, moored at the circular quay. Next day, Saturday, the 4th, passengers and luggage were landed. Instructions having been given to the master before leaving London that he was to coal through the ports at the side, an instruction given in consequence of a suggestion of the master himself, orders were given by the master to open the ports on each side, eight on the starboard, and seven on the port. According to the chief engineer, instructions were at the same time given to empty the tanks. There was some dispute as to when the orders were given, but that was of no importance. The emptying of the tanks was under the complete control of the master, and none would be emptied without his authority. The evidence of the two engineers was clear that by the Saturday evening, at all events, the after port tank was empty. On Sunday the Woonoona came to coal, and was lashed to starboard, the port side of the Austral being to the quay. She began coaling after midnight. At 6 a.m. she had discharged about 220 tons of coal. The officers and crew were then aroused for discharging cargo. On coming on deck it was observed that the vessel had a list, more or less, to starboard, and directions were given that the coaling should be stopped for trimming coals and emptying a starboard tank aft. They thus righted, and then unloaded cargo. They also filled the fresh-water tanks, 70 tons forward and 111 in the bottom. As the vessel had taken a list, the captain was naturally anxious that the coaling should not go on on one side. He went on shore and saw Mr. Johnson, the agent's deputy, and obtained authority to move the vessel to the company's moorings in Neutral Bay, so that he might coal on both sides at the same time, it being obviously impossible beside the quay, and coaling with steam colliers, to coal on both sides. On Tuesday morning she was moved to Neutral Bay, where she continued to discharge cargo. The pumping of the tanks had been continued, and by Wednesday morning, the 8th, they were empty. The cargo was discharged with the greatest promptitude, for Thursday was the Prince of Wales's birthday, and no work would be done on that day. They had discharged all cargo except 183 tons of iron, and had taken in, besides the coal still unburnt on arrival and the 220 tons taken in on the Monday, 1216 more tons, total 1621 tons. Nothing was done on Thursday after 8 a.m. On Friday morning officers and crew turned out early to land 10 tons of shafting in which there was a flaw. This lasted till mid-day. The same night—Friday, the 10th—at 10.45, the Woonoona came beside, and the fourth officer told the chief officer, whose duty it was to direct the side to which she should be lashed; and by his directions, or with his sanction given afterwards, she was sent to the starboard side. The vessel was nearly upright, with, if anything, a slight list to port. Soon after 11 they commenced coaling by the two foremost and two aftermost ports, that was to say, in the pocket bunkers aft, starboard of the engine-room, and the thwartship bunker forward. In the meantime the captain, who had been ashore, came off at 11.30 p.m., saw the collier, and hearing the chief officer, whose duty it was to arrange the collier's coming alongside, turned in at 12, but being disturbed by the noise got up at 1.30, was three or four minutes on deck, saw the coaling going on on starboard, and turned in. The chief officer, who had turned in at 10 or 10.30, after being roused by the fourth officer, had, with Lowman, the watchman, covered up some new paint, and at about 1.20 a.m. turned in, leaving the collier on the starboard, coaling, and leaving with Lowman, the watchman, what he said were the usual directions. At about 3 a.m., said Haddon, the foreman coal-trimmer, at the inquest, the vessel had a slight list to the starboard, but not enough to excite apprehension. The coaling continued. Whether the list increased after 3 Haddon did not say, but about 4 a.m. it was found that the after ports on the starboard were under water, and the water flowed in. An alarm was given, and the officers and crew escaped to the Woonoona and a lighter which was lashed to the port side. In fifteen or twenty minutes from the alarm the vessel sank, righting, however, either on touching, or before touching, the ground. On mustering the crew, five were missing, the engineer of the refrigerator, the purser, and three Lascars. Three months afterwards she was raised, cleaned, and temporarily repaired, and came home by Cape Horn, reaching Glasgow August 3rd this year. She is now being thoroughly overhauled. There were three important questions:—(1) Was the vessel stable? (2) What was the cause of the casualty? (3) Was anyone—and who?—to blame? First as to stability. It seemed she was desiged by Mr. Shepherd, then naval architect to the Orient Company, and since manager to John Elder and Co. He said he had designed the Orient, and she was supposed to be the finest vessel in the world, and that the Austral was intended to be an improvement, having 2ft. more beam. He had superintended the building from first to last, she was a first-class ship; that was confirmed by Mr. Pearce, the sole partner in John Elder and Co., as well as by the surveyors of the Board of Trade and Lloyd's, who inspected her throughout the building. Nothing could probably have been better than her structure. Before her departure, however, Mr. Shepherd had not inclined her, and no measures had been taken to test her stability. He had made some calculations sufficient to satisfy himself, but no curve of stability. The builders were pressed to deliver her, and he did not think, knowing the style of ship, that it was necessary to do so. It was not till her return after the accident that the calculations were made by Mr. Elgar, a gentleman of considerable knowledge on this subject, for the way in which he gave his evidence showed they could place the utmost reliance on his evidence, and it was the only evidence the Court had as to her stability. He inclined her in Queen's Dock, Glasgow, on August 6th, by moving 10¼ tons across her promenade deck, and found by calculation that when the weight was 19ft. 6in. from the middle line she inclined 1·1 deg. The vessel had then over and above the weight of her hull, machinery, spars, &c., 1350 tons distributed in the manner stated to the Court. Mr. Elgar said that when he made his observations on August 6th, the vessel had 7200 tons total displacement, and drew 20ft. ½in. forward, 21ft. 6½in. aft, mean 20ft. 10in. The height of her metacentre was 21·3ft., centre of gravity 19·707, a metacentric height of 1·593. Mr. Elgar from these elements calculated what her metacentric height would be when quite empty. He found total displacement 5850 tons, mean draught 17ft. 6in., the height of metacentre 21·37ft., height of centre of gravity 21·17ft., giving her a negative metacentric height of ·8ft. Further, Mr. Elgar said that supposing under these conditions all the water tanks were filled, including the two fresh water tanks, in all 785 tons, her total displacement would be 6635 tons, mean draught 18ft. 8½in., metacentric height 21·37, height of centre of gravity above top of keel 20·208, giving her a positive metacentric height of 1·162. But Mr. Elgar still further calculated the metacentric height under other conditions. At the time of the accident the total displacement, with the weights she had in her, would be 8070 tons, draught forward 20ft. 9in., aft 23ft. 10in., mean 22ft. 3½in., and with that the metacentric height would be 21·37ft., height of centre of gravity 20·094ft., and metacentric height + 1·276. Mr. Elgar also said with a view of testing her stability, that assuming the vessel to have had all her cargo spaces filled with a homogeneous cargo of 100 cubic feet to the ton (1542 tons), and all her bunkers full (2530 tons), fresh water (180 tons), stores (65 tons), men and their effects (20 tons), she would have 10,188 tons total displacement, mean draught 26ft. 6in., and metacentric height 1·26ft. He further said, assuming that all her coal, and all her stores and water were consumed, her total displacement would be 7412 tons, draught 21ft. 3in., metacentric height — ·4 Then if the tanks were filled, giving her 8197 tons total displacement, and 22ft. 6in. draught, her metacentric height would immediately become positive from negative at 1·16. Under two conditions alone, therefore, would she have a negative metacentric height, *i.e.*, when totally empty (– ·8), and when her cargo space was filled with a homogeneous cargo, with no stores, no water, no coal (– ·4). But these were conditions which it was almost impossible to fulfil. With the homogeneous cargo her metacentric height would immediately be raised to positive by filling the tanks. Nor did a vessel necessarily become unstable because in certain conditions she had a negative metacentric height, because Mr. Elgar said he had known vessels of good standing with a negative metacentric height of 2ft., and those vessels were perfectly fit to go to sea. Nor, on the other hand, was it certain that a vessel was stable because when empty she had a negative metacentric height, because the case of the Daphne, &c., showed that vessels may begin with a positive height and lose all stability at a moderate heel, and though the stability increases to 30, and is also positive at 90, they might have an intermediate dangerous point. It was necessary, therefore, that Mr. Elgar should furnish curves of stability, and he had given certain data on which the Court had no difficulty in reaching a correct conclusion. The first curve was that under the conditions existing at the time of the accident. Then her angle of maximum stability was 61 deg., her righting moment 23,242 foot-tons, and even at 90 deg.—literally, not metaphorically, on her beam ends—13,800 righting moment. At the Court's suggestion, he gave the Court two further curves, one with the centre of gravity raised to the height of the metacentre, and with the same cargo and draught as at the accident, her angle of maximum stability would be 57½ deg., righting moment 14,350 foot-tons, and her righting moment at 90 deg. 3500 tons. A third curve showed the reduction of stability on the starboard side, caused by a heeling moment sufficient to incline her 12 deg. With the same cargo, and distributed as at the accident, her angle of maximum stability would be 62½ deg., righting moment 22,100 foot-tons, and at 90 deg. 13,800 foot-tons. Under the conditions of having her cargo space filled with homogeneous cargo—1542 tons—and with coals, water, and stores, her righting moment at 90 deg. would be 10,300, and assuming the whole of the coals and stores consumed, but with tanks full, the righting moment at 90 deg. would be 12,640. It was thus utterly impossible to deny that the vessel was, in every respect, and under almost every conceivable condition, a very stable vessel. One fact, however, was to be observed, that by these curves of stability the righting moment did not increase very rapidly at first. It was only when the heel was between 20 and 30 that it increased rapidly. At first the increase was but slow. She was under almost all conceivable conditions perfectly stable, and from the curves of stability her stability would increase to a 60 deg. angle, the maximum, and even at 90 deg. it would have a righting moment. The observations of the captain, that in his opinion at 12 deg. the vessel was unstable, appeared to the Court to be ludicrously inaccurate, and the fact that the vessel when she touched the ground righted, strongly confirmed the calculations. The master seemed to think that the bottom made her upright, but touching the bottom with her keel would only diminish the moment; still she righted. Secondly, what was the cause of the casualty? Strict orders had been given by Mr. Anderson to the master before leaving London that no coaling was to take place over the deck. These orders were in pursuance of a suggestion made by the master, that over-deck coaling made the vessel dirty. Accordingly, the directions were renewed at Melbourne by Mr. Yuill, the agent of the line. It seemed that the coal came from the Bulli mines, sixty miles down the coast, in steam colliers, and was discharged direct from colliers to the Austral, and not, as Captain Murdoch said he anticipated, from lighters. So long as the vessel remained at the circular quay it would be impossible for her to coal on both sides, if she coaled from colliers, for a collier could not come between ship and quay while cargo was discharging. Hence the captain applied to move the ship to moorings. The agent acceded, but not till after the vessel had listed on the Monday. After removal the two colliers arrived alongside and coaled simultaneously from the two sides. Then one collier came and put in coal on one side, then shifted to the other side. The last coal put in before the night of the disaster was on port-side, on Thursday. She was then nearly upright, with, if anything, a list to port. This was the case when the Woonoona came alongside on the Friday night. Mr. Shepherd and Mr. Elgar said that the coal ports were 27ft. 9in. from the bottom of the keel, and that with 420 tons of coal additional put into her the after-sill of the lower ports would be 5ft. 3in. above the water; with 120 more they would be 5ft. above. The fore ports would be 1ft. 6in. to 1ft. 8in. higher, she filling by the stern. The carpenter and officers seemed to have thought that on Friday evening, before the 120 tons came, she drew 19ft. 6in. forward, and 22ft. to 23ft. aft, and that the lower sills of her after ports were 4ft. out of water, which was impossible. The Court accepted Mr. Elgar's statement in preference. Mr. Elgar said that with the after sills 5ft. out of water, an inclination of 12 deg. would put them under. He also said that 120 tons of coals, the centre of gravity of which was 7ft. 2in. from the side, would incline the ship 12 deg.—in other words, put the sills under water. Of course, if the centre of gravity were nearer the side the sills would come sooner in. According to the foreman coalman's evidence, they filled by the two foremost and two aftermost ports first; they continued till, having filled the after bunkers, they left. Whether they left the two aftermost or only the one quite aftermost, it was clear they left the quite aftermost port which opened into the starboard bunker beside the engine-room. Haddon, the foreman coal-trimmer, noticed a slight list at 3 a.m., and at that time the bottom of the ports was only about 2ft. from the water. He did not say which ports he meant, and, unfortunately, he had not been present for the Court to examine him. If then he meant the fore ports, the after ports would have 4in. or 6in. out, and every ton put in would tend to sink her bodily, and so bring her after-ports in without being seen by the men who were working forward. A coalman, named Geene, said in his depositions taken by the coroner at Sydney, that at 3.25 a.m. he heard a noise of water between the two ships. He looked, and saw that the Austral's ports were out of water. Perhaps, however, he only looked at the forward ports. The practice was to shoot coal through the ports on to a shoot which landed them 6ft. 6in. from the side on the steel deck. In the pocket-bunkers the total width was 14ft. 6in., and with perfectly level trimming the centre of gravity would only have been 7ft. 3in. at the outside from the skin of the ship. In the cross-bunkers, if the coal had been properly trimmed, the centre of gravity might have been carried further. But it was quite possible the coal was shot in through the ports close to the side without the inner shoots being used. It was not an improbable supposition that the whole 120 tons of coal had its centre of gravity within 7ft. 2in. from the side. If so, that would be a sufficient explanation how the vessel filled. Probably, seeing that they first filled the after pocket-bunker, where they could not possibly get the centre of gravity more than 7ft. 3in. from the side, that would put the vessel down by the stern. When they left off work probably the water was not up to the sill, but by 3 a.m., when Haddon had seen the water within 2ft. from the forward ports, it was within 4in. or 6in. of the after. By 3.25 a.m., when Geene heard the water, it was then probably that the water was running into the after ports unperceived by anyone on deck. There could be no doubt that the cause of the casualty was the sinking of the after ports below the water and the water running in. With regard to the third main question, it was admitted that the owners sent the vessel to sea without having inclined her or taken any steps to obtain her curves of stability. Ought they to have done so? Mr. Martell said that seeing the vessel was intended for a passenger vessel, Lloyd's would not have, knowing her construction, required her curves to fix her load-line or have required her to be inclined. He, however, admitted, as did Mr. Shepherd and Mr. Elgar, that it was desirable these valuable vessels were not sent to sea till after their curves of stability had been drawn and measures taken to ascertain what cargoes they were capable of carrying under varied conditions. Mr. Shepherd said he should have inclined her had they not been so anxious to deliver her. None of the witnesses doubted the propriety of calculating the metacentric height, &c.; the only question was what use was to be made of the calculations. The question was of so much importance, affecting not this case only but the mercantile community generally, that he must make some observations. There seemed to be an impression on the mind of some that the question of stability was one with which the Court in general did not concern itself. A more erroneous impression, as Mr. Bucknill had rightly said, could hardly be entertained. It showed profound ignorance of the proceedings of the Court. The first occasion in which the question was brought prominently before the Court was in the now famous case of the Marlborough. The owner had been a builder of small cottages, and became an amateur shipbuilder. Out of his own consciousness he produced a design on which he had his ship built. She went to sea with a 5ft. load-line. To every one's astonishment she returned. The load-line was then raised to 4ft. 6in.; she returned; it was raised to 4ft. She then disappeared. The Court had to inquire, and in its judgment remarked on the absence of a check on the stability of vessels that builders did not trouble themselves, &c. (The learned Commissioner here quoted at some length from his original judgment; we append a shorter extract.) "With regard to her stability, the builders received instructions to build her of the dimensions supplied to them. . . . The builders' manager repudiated any responsibility, and the Court had not the security of the builders that she was or was likely to be stable. Taking her dimensions, they showed considerable instability. She was so unstable that the extra quantity of water shipped on deck would be sufficient to overturn or swamp her." That was on March 23rd, 1880. Two days afterwards the case of the Kensington came before the Court; and the Court observed on the practice as to making no calculations of stability. The Court said—our quotation is again from the *Times*' abbreviated report:—"Neither the builders nor the owners seem to have taken the smallest trouble to ascertain whether the vessel when launched was stable or not. Mr. Walton, agent for the owners, said he had never considered her stability. That gentlemen should invest from £30,000 to £50,000 in a vessel without having the least idea whether she was fit to carry or not seemed incredible, especially when at the slight expense of about £25 accurate calculations could be made as to her stability, and thereby instructions given to captains as to what depth they could load." In the Rathmore case the same year he made similar observations concluding:—"Mr. Esplin"—the consulting engineer under whom the ship was built—"said he did not think the stability of a ship was ever calculated, and that he never calculated it. Mr. Parker, one of the principal surveyors of Lloyd's, said he had seen the vessel but had not the least idea as to her stability or where the load-line should be. Owners should, before sending ships to sea, take some means of ascertaining their stability." (The *Times*, July 24, 1880.) In the Saxon Monarch case, in February, 1882, the Court said:—"Mr. Warne, the chief draughtsman to the builders, and the gentleman who designed the ship and under whose superintendence she was built, told us that he considered her to be a stiff vessel, but that he had never made any calculation of her stability. It certainly does seem to be a very extraordinary thing that owners should send a valuable vessel, laden with a valuable cargo, to sea without having ever calculated the stability of the vessel with a view to ascertain what descriptions of cargoes she could safely carry, or to what depth she could be laden. The expense would be very small; and yet case after case comes before us in which we find builders turning out vessels, and owners filling them with cargo, without any attempt having been made to ascertain the vessel's stability, or to relative positions of her metacentre and centre of gravity." (Official Report.) In the Pelton case, 25th April, 1882, the Court said:—"We asked the designer whether he had ever calculated the vessel's stability, and he gave the answer, which we usually receive in these cases, that he had never done so. And it certainly does surprise us that owners should send valuable ships with valuable cargoes to sea without knowing whether they are or are not stable."—Official Report.

Mr. Howard Smith.—There was also the Ballina.

The Commissioner.—Yes, and a great number of other cases. Owners could not plead ignorance of these judgments and say that a recent case had taken them by surprise. Although the Court had called attention to the fact, there were only two cases in which the Court had ever been furnished with materials to decide whether the vessel had stability. In the Escambia it was furnished by the underwriters; in this by the owners. Although they were also asked as to stability, they could only answer at a guess by seeing what her behaviour had been on previous voyages. In most of the cases the vessel had disappeared. There were people who said, he believed, that in these cases the Court ought to suspend its judgment, and require the fullest information as to stability before deciding whether the foundering was due to want of stability or to overloading. But they could have little knowledge of the time which would be required to make out the curves of stability for vessels which had disappeared. The Court sat not only in London, but also at Newcastle, Swansea, &c. If every case were adjourned for calculations of stability, to return to Newcastle, for example, three months afterwards would be impossible. Moreover, the information in many cases did not exist. The building yards had been burned down, plans could not be found, or the plans which existed had been modified during building, &c. If, however, measures were taken to calculate the stability of every vessel before leaving, and the curves sent to Lloyds' or the Board of Trade, there would be something for the Court to go upon. And now they came to the point on which, with great deference, they differed from Mr. Martell, Mr. Shepherd, and Mr. Elgar. Those gentlemen approved of curves being made before vessels left, but they objected to their being given to captains, because, forsooth, captains might not be able to understand them, and then they would be misleading; and, as Mr. Martell said, "a little knowledge is a dangerous thing." Old saws and sayings had done a great deal of harm in their day, but few more harm than this. He was old enough to remember that it was a stock argument against teaching boys and girls to read. If Mr. Martell meant that a little knowledge is not so good as a great deal, the Court would agree, but if Mr. Martell meant that a little knowledge was worth less than none, the Court differed. It was a saying of Lord Palmerson's, in answer to a complaint that Civil Service examinations would merely give us stuffed bottles—"Well," said Lord Palmerston, "I would sooner have a stuffed bottle than an empty one." It was admitted that calculations should be made for the owners. Would the owners pigeon-hole them? Then for whose benefit should they be made? Surely for those who had in foreign ports to see to the loading of the ships, in whose discretion it was left to load them — the skilled and, he was happy to say now, educated officers of the British mercantile marine. It was said that these gentlemen would not be able to make use of the information. He was told that experience of a clean-swept hold would not apply to a vessel immersed, and that distribution of cargo affected stability; that there was great pressure now, that the stowage must be varied to keep the weights at a reasonable height, that dead weight came in late, &c. Those were the very reasons why curves of stability were wanted, and of course for the person who had the control in foreign ports. It was an insult to a body of educated men like the captains of our large merchant vessels to say that these calculations would be of no use. You might as well say they must not have lunar observations lest a mistake should be made. Taking the present case, supposing Captain Murdoch had been furnished with the curves and calculations, would it not have warned him that at a small angle of heel the vessel did not gain greatly in righting moment, and that consequently there was great damage in loading her with ports open, for that a slight heel might bring the ports down to the water? Captain Murdoch had in this case to his cost found that a little knowledge was a dangerous thing. His knowledge was formed from the behaviour of his ship at sea, which taught him she had a large moment when she heeled at a large angle, but not—what the curve would have shown him —that a slight heel did not supply the like remedy. At any rate, he would have been warned of the danger of loading without careful supervision. The Court, therefore, could not think that the owners were right in sending the vessel to sea as they did without calculating her curves of stability, and furnishing them to Captain Murdoch, as they ought to have done. It was charged against Captain Murdoch that he emptied the tanks. He gave his reason—that knowing the vessel was going to coal from colliers, it was necessary to raise the ports so as not to lose coal. He said that this was the more necessary, because as the colliers discharged, the vessel herself sank; that if the vessel had been coaled, as he expected, not from the colliers direct, but by lighters alongside, it would have been unnecessary to empty the tanks. That raised an important point in the case. Why was the vessel coaled from the colliers? It was said that the coal was brought sixty miles down the coast; but why was it not then put into lighters? Mr. Yuill might have given some information on the point, but he was away; nor had Mr. Anderson been called, though he might have been unable to give information. The additional expense of lighterage was a trifle compared with the safety of the ship. That the captain was not responsible for the way in which she was coaled appeared from the regulations of the company, which subordinated the captain to the managers and superintendents. It was clear the captain had nothing to do with the coaling, which was in Mr. Yuill's hands. The Court thought the captain perfectly justified in emptying the tanks to load her. It was then said that he ought to have taken warning by experience on previous occasions of the vessel's tendency to list. On the previous voyage, when coaling over deck, she had taken a list; so at the Cape, when loading at one side; and on the Monday morning in Sydney she listed. The master answered that from her behaviour at sea he believed her a very stiff vessel, and this view was confirmed by Mr. Anderson's remark that she might sail without her ballast tanks being filled—of course, not perfectly empty, but laden as she usually was. That was quite true, as appeared not only from the curves, but because she actually was in that condition in the Suez Canal. There was, however, something *lâche* on the captain's part in not taking warning from the three occasions on which she listed, and there was some want of vigilance on his part. The question was put by the Board of Trade whether the master was justified in leaving the deck without a certificated officer, and, in effect, whether the chief officer kept a proper watch. It seemed to be the practice on the ship at Sydney when she was at the quay and cargo was being discharged that two quartermasters kept watch, but at moorings in Neutral Bay, that there should be only one man, a watchman, no doubt a good man—Lowman—selected by the chief officer, but only an able seaman. The Court put out of question the two stewards and the donkeyman whose duty it was to see that the fire was kept burning. Practically, however, she had only one seaman as the watch on deck. Was that the right thing? Both the captain and the chief officer said it was not, and there ought to have been a certificated officer in charge of the deck. The Court was referred to article 17 of the company's regulations. It appeared to the Court that the article rather seemed to warrant the practice which prevailed at Sydney and to hold it sufficient for the watchman, without an officer, to keep watch. It was asked, if the captain and the chief officer knew an officer ought to be there why did they not see one was there? Their answer was that they had not enough officers for the purpose. The subordinate officers had a hold each to look after, and the chief officer had the deck all day under his care; and on the previous voyage, when they were at Sydney only five days, the officers never took their clothes off. It was quite impossible, said both the chief officer and captain, to make an officer keep watch at night. The Court agreed that the men could not work night and day. It was necessary, in the opinion of the assessors, that more than four officers should have been on board both in port and at sea. A vessel 456ft. long, with 1000-horse power, and great burden, ought to have had always two officers on watch even at sea—one officer on the bridge, another available in case of any occurrence, as a man overboard, &c. The vessel ought not to have had less than six officers, and so far there was some excuse for the captain and chief officer not seeing there was a certificated officer on deck. At the same time, neither master nor chief officer was altogether free from blame. The master came on at 11.30, and saw the collier to starboard. He came again on deck two hours later, and saw her still coaling on the starboard. This, with his previous experience, should have excited his suspicions. He ought, at any rate, to have inquired of the chief officer whether it was not time to shift the collier to the other side. The chief officer was also to blame. He turned in, leaving the deck in charge of Lowman, after she had been coaling two hours; and although he said he was not aware that the tanks were empty, he knew that on the Monday, when it was left to the coalmen, the Austral had taken a list. The two were not free from blame, but there was much in extenuation. Against the chief engineer it was alleged that he was not, nor had an officer, in the bunker. But the Court would ask, How could he have had an officer there if he was ignorant of the collier coming alongside? How was it possible for him to have done otherwise? Nobody expected that the chief engineer would have had one of the engineers in the bunkers to see when a collier came alongside and when it would be necessary to interpose. He did have a man—one Morris—in the bunkers to see the coal was properly arranged. He turned in, and knew nothing at all of the collier being there. The Court did not think that any blame attached to the chief engineer. It was true he might have asked the chief officer to call him when the collier came alongside, but the chief officer did not think it necessary for himself to remain on deck, although it was his duty to shift the collier whenever the vessel took a list, and *à fortiori* he would have thought it unnecessary for the chief engineer to be called. The Court must call attention to a remark made by learned counsel for the Board of Trade that in the engineer's log-book there was a column left for the draught of water, which did not seem to have been entered. He invited the Court's attention to that. The Commissioner had carefully gone through both the log-books, and could safely say he had never seen log-books so admirably kept in every respect as these log-books of the engineer. He presumed the learned counsel did not mean him to enter the draught *de die in diem*. All that would be required would be to enter it when she arrived and when she left. But it was a work of supererogation. The tanks were under the control of the captain; the captain was to decide when they were to be filled or emptied. But the Commissioner did find in one of the books that the chief engineer, besides an immense mass of other matters, had entered the draught on no less than four different days. No charge whatever could be made against the engineer for the way in which the books were kept. On the contrary, the Court were glad their attention had been called to the subject, for they were able to say that these were the best kept log-books which the Court had ever seen. Passing to the question whether every possible effort had been made to save life, the learned Commissioner gave the highest credit to the master and chief officer for having returned to the vessel and saved a Lascar who was grated in by prizing up the bars and rescuing him. There was a great deal of truth in what Mr. Nelson had said, that this unfortunate accident to a vessel worth upwards of £200,000, and the loss of five lives, was due to a series of small mistakes. It was a mistake in the owners sending her to sea without calculating her stability, and supplying the captain with the information. It was a mistake to send her to sea with only four certificated officers. It was a mistake of the captain not to have taken warning from the three previous lists, and to have turned in without satisfying himself that the chief officer was vigilant and attentive to his duties. It was a mistake on his part not to have seen what the list was when he came up at 1.30. It was a mistake of the chief officer to leave the ship in charge of Lowman, the watchman, and to turn in himself. There was a series of small mistakes. Looking to the high character both of Captain Murdoch and the chief officer, their past services, and the fact that they were placed in an exceptionally difficult position owing to the want of harmony between Captain Murdoch and the company's agent at Sydney, the Court would certainly not deal with their certificates.

THE FIRE RISKS OF ELECTRIC LIGHTING.*

By Mr. Killingworth Hedges.

There is a great difference between the electric currents which have been in constant use for telegraphic purposes and those which are to be supplied by the undertakers under the Electric Lighting Act. The latter can only be said to be free from danger when the heat generated by the current is utilised in its right place, and not developed in the conductors or wires which lead the electricity to the incandescent lamps. The Fire Risk Committee have already issued rules for the guidance of users of electric light; these can hardly be said to embrace all the salient points of the new subject, which can only be arrived at after years of practical work. The necessity of proper regulations has already been recognised by the insurance offices, both in the United States and Germany, and some of their special rules are given in this paper. The conductors must be properly proportioned for the current they have to carry; whatever resistance there is in the conductor will cause a corresponding development of heat, which will vary with the amount of electricity passing, and inversely as the sectional area. The material must be free from impurity, otherwise an impure section will increase the resistance. The extraordinary difference in the conducting power of a sample of "commercial" Rio Tinto copper wire, as compared with the pure metal, was shown in an experiment by Dr. Matthiessen—the conducting power being only 13·6 as against 99.95 for pure copper. The continued heating of an impure metallic conductor has a certain effect on its electrical resistance. With the sample just mentioned, the conducting power at 100 deg. Cent. decreased from 13·58 to 13·558 after the wire had been heated for three days. It does not always follow that there will be a decrease in the conducting power, as with alloys, the opposite effect is produced. A copper-silver alloy showed an increase of ·264, after having been heated to 100 deg. Cent. for three days, and a tin-copper alloy an increase of ·13.

As the temperature in Dr. Matthiessen's experiments was not increased over 100 deg. cent., the author has made some further experiments—heating the wires by the electric current from a secondary battery to within a few degrees of their melting point. The following materials were tried, the wires and foils having such sectional area, and so arranged that, on the current being increased by 20 per cent., they were immediately fused. The total length of each experiment was twenty-four hours, during which time the current passing through varied slightly, and the following is a mean of the results:—

Material.	Resistance before heating.	Resistance of leads.	Difference after twenty-four hours.
	Ohms.	Ohms.	
No. 1. Commercial tin wire	·815	·8	—·003
,, 2. Lead, soft	·835	·8	—·005
,, 3. Copper, soft	·81	·8	no change
,, 4. Pure tinfoil..	·86	·8	no change
,, 5. Tin and lead alloy	·87	·8	—·160
,, 6. Albo alloy, in foil	·835	·8	no change
,, 7. Aluminium and tin alloy ..	·82	·8	+·0008

The resistances were in all cases taken at the temperature of the air, which averaged 69 deg. The sign — shows that the metal decreased in resistance, and + that it increased after continued heating. Nos. 1 and 3, tin and copper, were found to scale when heated. A change has been noticed where high tension currents have been sent through a pure copper wire for some time —the wire in the armature of a Siemens' machine, which came under the notice of the author, appeared to be brittle, and gave a fracture unlike pure copper. The necessity of good electrical connections is very great, also special arrangements of switches and contact breakers which, when left in unskilled hands, are liable to cause dangerous heating or an arc. Short circuit is the danger which may be caused by badly arranged wires; most likely a conflagration will ensue unless the remedy suggested by the Fire Risk Committee and the Board of Trade is adopted—of having a cut-out or fusible plug in the circuit, which gives way when the current is in excess. These should be arranged to melt if the current is more than 10 or 15 per cent. of the working strength, otherwise absolute safety is not arrived at. Ordinary lead or tin wire cannot be used except for very small currents, as, on fusing, the metal is scattered in a globular form, when it is liable to cause fire. The plan adopted by the author is to take pieces of foil arranged like the leaves of a book; the thinness of the foil causes it to be almost volatilised when melted. The material found to be the most reliable is a special alloy of aluminium, termed Albo metal, which is extremely tough, and can be worked much nearer to its fusing point than tin or lead. The safety of an electric light installation is only insured by testing, which should be done by a current of higher electromotive force than it is intended to use. When the work has been properly supervised no trouble should be experienced, and the electric light may be said to be much safer than gas, as it is free from those accidents which are due to a servant's carelessness, or by leakage of the pipes. Whatever danger there is with electric lighting is entirely localised to the generating station, where the dynamos and engines would be under constant supervision.

The River Witham.—The flood report of Mr. Williams, C.E., was laid before the General Commissioners on Saturday at Boston. Mr. Williams states that the rainfall for twenty-four hours ending 9 a.m. on the 30th ult., was equal to 310 tons per acre. The Witham rose 11ft. in twenty-four hours at Bardney, and were it not for the extensive improvement works now well advanced, the previous maximum flood levels would have been exceeded, and disasters would have ensued.

* Abstract of a paper read before Section G of the British Association,

RAILWAY MATTERS.

THE Hatton—Ceylon—tunnel, which has been long in hand, is at length pierced, and the section will now in all probability be completed by the contract time, May, 1884.

THE authorities of the Burslem Tramways announce that they will be able to effect a reduction in rates so soon as new tramway engines now ordered can be put to work.

A SHOCKING steam tramway accident happened in Naples on Sunday. A train upset on entering the town down a steep incline. All the carriages were thrown off the rails. Five passengers were killed, and twenty-four had to be conveyed to the hospital. The management of these lines is said to be extremely bad.

THERE are now eleven railways on the Rigi cogwheel and rack system in Europe with a total length of 40 kilos.—nearly 25 miles. They are as follows:—Vitznau Rigi: Length, 7·10 kilos.; height, 1311 metres; cost, 244,105 marks. Arth Rigi: Length, 12·14 kilos.; height, 1332 metres; cost, 426,248 marks. Kahlenberg, Vienna: Length, 5·50 kilos.; height, 285 metres; cost, 696,000 marks. Schwabenberg, open: Length, 3·03 kilos.; height, 260 meters; cost, 342,000 marks. Drachenfels: Length, 1·52 kilos.; height, 225 metres; cost, 394,000 marks. Most of the remainder are in Switzerland and on the mixed system—adhesion and cogwheels. Those given are all cog and rack road.

THE last stroke of work on a big tunnel, 1650ft. long, under Messrs. Jones and Laughlin's Ironworks, Pittsburg, has been completed. The tunnel was constructed by the Vanderbilt, Pittsburg, McKeesport, and Youghiogheny Railway Co. Its cost will be £100,000. Over 600 men were employed on it for a year. "The tunnel is one of the engineering feats of the day. The roof is only a few feet below the top of the mill floor, where massive rolls, hammers, and hundreds of men are working. The mill is the largest single mill in the United States, and none of the buildings were injured, and work was not delayed an hour. The ground through which the tunnel passes was mill cinder and slag."

A BRIDGE now being built at Minneapolis, Minn., by the St. Paul, Minneapolis, and Manitoba Road, an American contemporary says, is one of the engineering wonders of the country. "It is composed of twenty-two arches or spans, standing on twenty-four granite piers, the foundations of which rest many feet below the surface of the seething waters of the river. To dig these foundations took a great deal of money and engineering skill. Coffer dams had to be built and the water pumped out before the solid masonry could be laid, which would bid defiance to the swift current of the Mississippi. It will be finished by the 1st of November, and will be double-tracked before snow flies. So massive is it that trains will run over it at full speed without causing a vibration." An explanation of the word vibration when used in this way is not given.

GEORGIA PINE is a timber which is being more extensively used every year in the construction of cars, especially, the *National Car Builder* says, in the South, where it is considered superior to oak in many respects. It is so filled with resinous matter as to be almost indestructible, and requires much less paint than the more porous woods. Although it is very solid and enduring, it is also heavy, and when used for car siding it makes a box car of the ordinary size weigh about 1500 lb. more than if sided with white pine, unless the former is put on thinner, which it is claimed by southern builders can be done without reducing the strength of the structure. For siding, it is necessary that Georgia pine should be free from knots, as these, under the heat of the sun, are apt to exude a good deal of crude turpentine and make a disagreeably sticky surface. Whatever drawbacks it may have, however, its consumption for car work in the Southern, Middle, and Eastern States is sure to increase in proportion as other desirable woods get more scarce and higher in price.

THE following is from a letter written from the city of Mexico by a correspondent of the Boston *Herald*:—"We are soon rumbling through a rocky gorge, and are now well among the mountains, crossing dizzy-looking trestle-works, and winding hither and thither as we steadily climb. The track is well laid, and an army of workmen are thoroughly ballasting it. The curves are sharp, but perfect in construction. At times the position of the train reminds one of a dog chasing its tail. . . . There is the great sheet of Lake Texcoco glistening in the sunlight, and near by is the capital in a vague, level mass of buildings. A ring of mountains walls in the plain, and above them all, on the opposite horizon in the south-east, towers snow-crowned Popocatepetl, so high that his head seems to be almost half way to the zenith. It gives one a new conception of mountain sublimity. Leaving this scene behind us, we enter a tunnel, and are soon out on the open divide, the highest point on the line, 3558 metres, or 11,673ft., above the sea level. Here it seems as if we might be in New England. Broad and gently undulating glades are bounded by dark pine forests, covering the surrounding summits, and standing, not open and park-like, as in the Rocky Mountains and in New Mexico and Arizona, but growing densely, as along the Appalachian chain."

THE trustees and shareholders of the Shoreham Harbour Company held a special meeting on Wednesday, to consider the construction of a new line of railway from London to Eastbourne, Brighton, and Shoreham. It had been intimated to the trustees that there was an intention to renew the application to Parliament in the ensuing session for a line of railway from Eastbourne to London, and that the promoters of the Eastbourne line would be willing to enter into an arrangement by which the line could be extended. Two resolutions were submitted to the meeting by the chairman and passed. The first empowered the trustees to promote a Bill conjointly with the promoters of the Eastbourne line for power to construct a railway, to be called the London and Southern Railway, on certain conditions providing for the extension of the line to the harbour, the acquirement of the interests of the shareholders at £125 per £100 share, to be paid for in cash or 4 per cent. debentures of the new company within twelve months of the passing of the Act for constructing the railway, and also providing that stations be made on the proposed line at West Brighton, and a central and east station in Brighton—the general course of the line to be from Shoreham to Hove, Brighton, and Lewes to the proposed line to Eastbourne, and thence to London, joining the London, Chatham, and Dover Railway at Beckenham. The second resolution authorised the attachment of the seal of the company to a petition for the introduction of a Bill into Parliament.

AN important meeting was held at the Victoria Station, Sheffield, on Tuesday afternoon. The purpose is to secure another line of railway to Sheffield, opening up the Trent Valley and reaching the sea with Sheffield products, either at Goole or Stockwith. One party being favourable to Goole and the other—the promoters of the Rotherham and Bawtry and Bawtry and Trent Railway and Docks Act—inclining to Stockwith. The capital authorised under the Consolidated Act is £810,000. The effect of such an undertaking, which would simply be the extension from Rotherham of lines already authorised though not commenced, might be felt in reduced rates to and from the coast. This, of course, would only be accomplished if the line was kept in independent local hands. Railway companies, when they find competition oppressive, promptly come to an understanding with each other. On Tuesday there was a fairly influential attendance, and a resolution was passed for the appointment of a committee to confer with the conveners of the meeting, with the Chamber of Commerce, and the manufacturers interested in the project. The tone of the conversation did not hold out much hope of the proposed new line being very enthusiastically taken up by the Sheffield people, who are not anxious at present to invest capital in fresh railway undertakings, which may be vigorously opposed by existing confederations. It is contemplated to proceed with the Rotherham and Bawtry line this season, and it is possible that the Bawtry and Trent may also be pushed forward. This would open up a fine country, and develope hitherto unworked fields of minerals.

NOTES AND MEMORANDA.

IN London last week 2387 births and 1252 deaths were registered, or 219 and 208 below the average of the last ten years. The annual rate of mortality which had been 17·0 and 16·6 in the two preceding weeks, declined to 16·5.

AT the Royal Observatory, Greenwich, the mean reading of the barometer last week was 29·63in. The mean temperature was 47·7 deg., and 6·3 deg. below the average in the corresponding week of twenty years. The coldest day was Wednesday, when the mean was only 44·9 deg., and 9·1 below the average.

IN some notes on Aberllefenny Slate Mine, by Mr. C. Le Neve Foster, it is stated that the principal vein worked at Aberllefenny has a thickness of 57ft. to 63ft., and about 60ft. on an average. Its strike is from 34 deg. to 44 deg. E. of N., true, and the dip is about 70 deg. to the S.E. Owing to the fact that the sides of the valley rise up to a height of 700ft. to 800ft. above the brook in the bottom, the vein can easily be attacked by adit levels.

IT would seem that a very little will upset the nice adjustment of a roller mill. The coefficient of expansion of cast iron may be taken as but 0·000005, yet the *Roller Mill* says: "If your bran rolls get to cutting your bran up, instead of flattening it out, see if they are not warm at the ends from some cause. This will often cause the bran passing between the expanded ends to be cut up, while that in the middle goes through in fair shape."

IN a memoir on induction, recently read before the Academie des Sciéncés, by M. P. Le Cordier, the author adopts the theory of a continuous and incompressible medium, by the translations and pressures of which are produced electric currents and electrostatic phenomena. Electromotor and electrostatic effects of induction are calculated approximately for a hollow sphere forming an insulated conductor, homogeneous, isotropic, and non-magnetic, turning with a constant angular velocity round a fixed axis in a uniform and permanent magnetic field.

THE causes which operated in the destruction in Java were manifested on the shores of Ceylon. On August 27th the sea round the eastern, southern, and western coasts suddenly, the *Colonies and India* says, receded from 10ft. to 12ft., leaving the shore bare, and then returned with such violence that a number of vessels in the Colombo harbour had their moorings broken. The rise and fall occurred repeatedly during the afternoon of the day named, though no shock or tremour was felt. The inrush of the sea breached the sandbank which forms the bar to the harbour at Batticaloa.

PERSONS who fancy that wetting coal increases the heat in the furnace may be interested to know that a series of tests was made recently at Bochum, Germany, to determine the values of wet and dry bituminous coal in making steam. According to the American *Mechanical Engineer*, washed slack, holding 18 per cent. of water and 9·9 per cent. of ash, evaporated 5·7 lb. of water per pound of fuel; while the same coal, with only 3 per cent. of water, made from 8 to 8·5 lb. of steam. Making due allowance for moisture by reducing to a standard of like quantities of coal from moisture, there is found to be a direct loss, by using wet coal, of 14 per cent.

AT a recent meeting of the Paris Academy of Sciences, a paper was read on the possibility of increasing the irrigating waters derived from the Rhone by regulating the discharge from the Lake of Geneva, by M. Ar. Dumont. The author dwells on the great benefits likely to be conferred on the southern departments of France by the project recommended by the Geneva Commission. This project, which might be carried out at an expenditure of about £180,000, involves the creation of a hydraulic installation of 7000-horse power, by which the level of the lake at high water might be reduced by at least 0·60 m., and the minimum discharge of the Rhone at the outlet increased by 80 mc. per second.

IN London, during the week ending the 6th inst., 2399 births and 1257 deaths were registered, or only 14·2 and 7·5 per hour respectively. The births were 211 and the deaths 137 below the average in corresponding weeks of the last ten years. The annual rate of mortality, which had been 16·6 and 17·0 in the two preceding weeks, declined to 16·6. At the Royal Observatory, Greenwich, the mean reading of the barometer last week was 29·51in. The mean temperature was 57·1 deg., and 1·5 deg. above the average in the corresponding week of twenty years. The mean was below the average on Sunday and Saturday, whereas it showed an excess on each of the other days of the week. The lowest night temperature was 42·1 deg. on Sunday, and the highest day temperature in the shade 69·7 deg. on Wednesday. The extreme range in the week was, therefore, 27·6 deg. The next weekly record shows a remarkable difference.

JAPANESE miners have some curious customs which sadly depreciate the value of their work. They do not appear to appreciate the fact that "time is money." An engineer who has just returned from the mines of that country tells the *Engineering and Mining Journal* that they light them in a peculiar manner. Every man entering the mine carries with him a large bundle of from 5ft. to 6ft. of bamboo cane, slightly beaten before use. This cane is used as a torch. It burns fairly well for a few seconds, until a knot is reached, when the light nearly goes out, and the ashes must be knocked off, a process which must be repeated every half-minute. Every six or seven minutes a new cane must be lighted, so that a good share of the miner's time is occupied in keeping his illumination in a fairly satisfactory condition. Unfortunately, Japanese miners are, besides, great smokers, and they use a pipe having a bowl the capacity of which is equal to that of an ordinary thimble. It takes two whiffs to finish it, when the process of filling up and lighting it must be gone through. Every one has probably had occasion to watch the great deliberation with which an average Irishman, when at work, will fill his clay bowl when the foreman's gaze is not on him, but imagination simply shrinks from the task of picturing the rapid progress of work intrusted to a smoking Japanese miner.

THE following description of the road paving of Bury was given recently in a paper read before the Association of Engineers and Surveyors by Mr. Cartwright:—After the removal of the old Haslingden setts the underbed is excavated to the depth required. First is laid a layer of roughly broken stone and shingle about 3in. in size; upon this a layer of cement mortar mixed in the proportion of one to five with clean sharp gravel; and upon this a second layer of broken stone passed through a 2in. riddle; the surface is then beaten with large flat iron beaters until the whole is thoroughly incorporated; then another layer of cement mortar, and upon this a layer of stone which is beaten as before, and so on until the requisite height and curvature are obtained; a thin coating of cement mortar being thrown over the surface, which is beaten and left smooth to stand for about eight days until thoroughly set before the setts are paved upon it. The proportion of gravel and stone to cement was as ten to one. The joints are filled with pea gravel, and run with prepared pitch. The cement was the best Portland capable of being sifted through a 6000 gauge mesh. The setts were 5in. deep, 3¼in. wide, and from 4in. to 6in. long; they were from the Welsh Granite Company and from the Darbishire Granite Quarries, Penmaenmawr, and the samples before them were practically limitless in wear. The following estimate of the cost of the different forms of paving was made, the data being the same in each case:=First cost, granite, 12s.; Haslingden rock, 7s.; sand grit, 6s. 6d. Maintenance per year, granite, 2d.; Haslingden rock, 1s.; sand grit, 1s. Cost per year over thirty years, first cost and maintenance, granite, 7d.; Haslingden rock, 1s. 7d.; sand grit, 1s. 9¾d. Taking the first cost of granite at 12s. per yard, first cost, minus 1s. 6d. for the old material taken up, gives 10s. 6d. per yard, which might be borrowed at 3¾ per cent., and 7 per cent. would in twenty years repay principal and interest; 7 per cent. on 10s. 6d. = 9d., with 2d. for repairs, 11d. per year for twenty years, as against 1s. 7d. in perpetuity for Haslingden rock, and after this the granite would still be in good repair, the whole money repaid, and would last another twenty years, with an extra 2d. per yard per year, instead of 1s. 7d. for ever.

MISCELLANEA.

THE tides from the 17th to the 20th inst. are expected to be very high.

THE next meeting of the Institution of Mechanical Engineers takes place on Thursday, 1st November, in the Birmingham and Midland Institute Hall, Birmingham.

THE Gas Light and Coke Company and the South Metropolitan Gas Company have each contributed £100 to the funds of the National Smoke Abatement Institution.

THE authorities of the Turin Electrical Exhibition, which is to take place next year, announce that the period for the applications for space has, with a view to the convenience of the exhibitors at the Vienna Exhibition, been extended to the 31st October inst.

IN excavating at Suresnes, at the extremity of the Bois de Boulogne, the remains of a lake, or rather river, dwelling have been found. They consist, according to a correspondent of the *Rappel*, of piles and an enormous quantity and variety of bones, but at present no trace of iron or bronze has been discovered.

MESSRS. ALLHUSEN, or the Newcastle Chemical Company, are making satisfactory progress with their salt-boring operations on the north bank of the Tees, and will probably reach salt at one boring this week. The second hole has now reached a depth of over 500ft. Other four bore-holes are to be put down by this firm.

THE School of Art Wood-carving has reopened after the usual summer vacation, and we are requested by the chairman of the committee, Colonel Donnelly, R.E., to state that some of the free studentships, both in the day and in the evening classes, which the committee are enabled to offer, in consequence of the aid afforded to the school by the City and Guilds of London Institute are at present vacant.

THE works constructed by Mr. Henry Robinson, C.E., for the water supply of Bradford, Wilts, which we described at length recently, were formally opened on the 3rd inst. by Sir Charles Hobhouse, Bart., the chairman of the Town Commissioners. A general holiday was observed in the district, the town being gaily decorated on the occasion. A banquet took place in the Town Hall in the evening.

AN experienced engineer, the *American Miller* says, has made a belt last him ten years, by each Saturday evening turning the inner side out, washing it well with warm water and soda, scraping and oiling it, and then going over the same operation Monday morning before starting the machinery. By doing this and keeping his pulley clean, he finds that they will run at full speed with 5 lb. of steam when the belts are on loose pulleys, while a larger engine alongside, to which no such attention is paid, cannot run with less than 38 lb.

IT is stated that the Austrian Ministry of Commerce has given permission to Herr Hobohn, civil engineer, for the preliminary works in connection with two lines of canals intended to join the Elbe with the Oder and Dneister, and the Elbe with the Danube. Both canals run together from near Prague to the Bohemian frontier at Trübau. At this point they separate, the Elbe-Oder-Dneister Canal passing through Olmütz and Prerau to Oderberg, touching Cracow in its further course through Poland, while the Elbe-Danube Canal takes its course from Trübau through Brünn and Lundenberg to Vienna.

THE Cleveland ironmasters' returns for September were issued last week. They show that 118 blast furnaces were at work, 83 making Cleveland iron, and 35 hematite, spiegel, and basic iron. The total quantity of iron produced of all kinds amounted to 223,114 tons, being 10,517 tons less than was made in August. The stock of pig iron in makers' hands and public stores amounted altogether at the end of September to 261,900 tons, a reduction of 13,298 tons for the month. There were 94,367 tons of pig iron shipped from the Tees during the month.

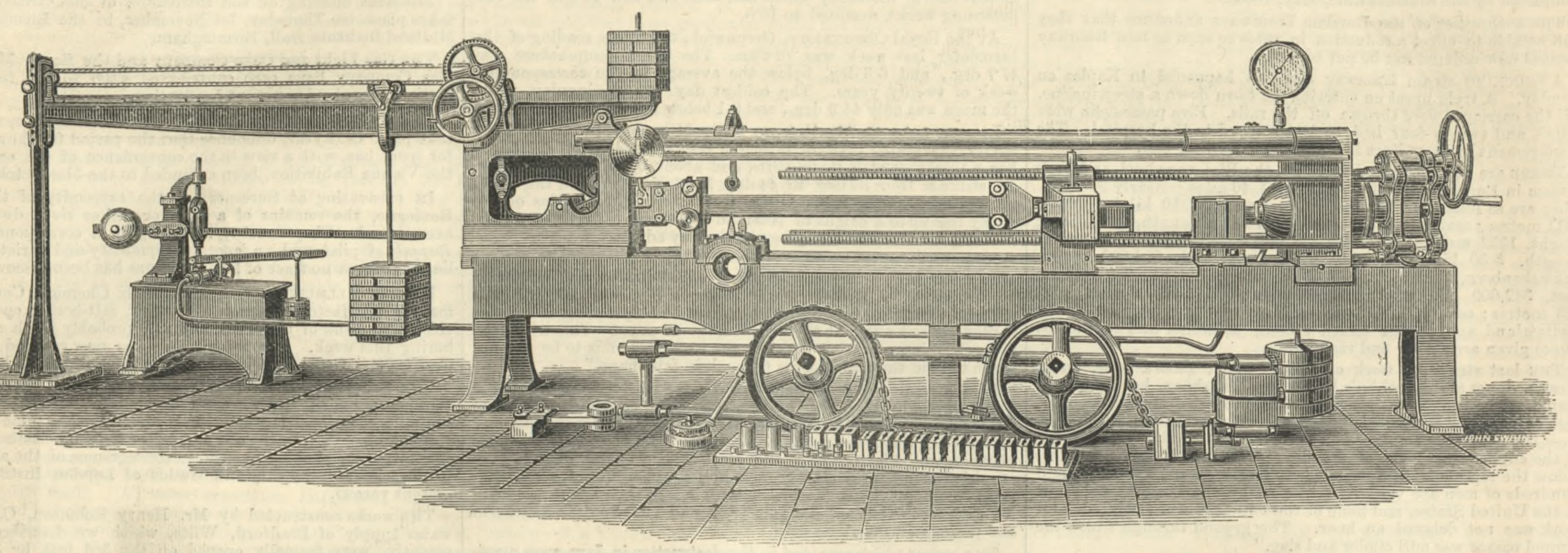
THE French Government contemplates during the ensuing financial year the following expenditure on harbour works and similar improvements:—Dunkirk, £160,000; Havre, £139,600, in addition to £104,000 for the regulation of the Seine between Havre and Tancarville; Dieppe, £72,000; Calais, £124,000; La Rochelle, £72,000; Marseilles, £60,000; Cette, £52,000; Bordeaux and Rochefort, £48,000. Amongst the canal works included in the Government estimate are the extension of the canal between the Marne and the Saone, £160,000; the Canal between the Oise and the Aisne, £120,000; and the improvements in the Canal de l'Est, £64,000.

ON Saturday, the 6th inst., the s.s. Cabo Verde, built by Messrs. Earle's Shipbuilding and Engineering Company, Limited, Hull, was taken on trial trips. The dimensions are as follows:—Length p.p., 310ft.; breadth, 37ft.; depth of hold to spar deck, 26ft. The gross tonnage is about 2300. She has accommodation for sixty first-class, thirty-two second-class, and 120 third-class passengers, the cabins and saloons being fitted out in the most complete manner throughout. Four hundred and fifty tons of water ballast is provided for in the main and after holds. The vessel is propelled by compound surface condensing engines indicating about 1850-horse power, steam at 80 lb. pressure being supplied by two double-ended boilers. The speed attained on the measured mile was 12 knots.

WE are in frequent receipt of new trade catalogues, many of them well illustrated and well got up. Most of those who take a great deal of trouble with their catalogues must have some wish that they should be preserved for reference by those who are at all likely to wish to know something of the manufactures described in them. Well got-up catalogues of representative machinery, tools, and other manufactures would, however, stand a much better chance of being preserved and kept in position for ready reference if they were of a nearly uniform size, instead of all the sizes that the formes of the printer will allow a fastidious taste or tasteless fastidiousness to range over. From 14in. by 10in. down to 4in. by 3in. we have received catalogues even recently. What is to be done with such a variety? They will not be put anywhere in particular, and must go everywhere. If manufacturers would by tacit consent make all their catalogues of crown octavo size, or about 9in. by about 6in., these and the catalogues of leading exhibitions could be kept decently and in order.

THE Lower Thames Valley Main Sewerage Board have obtained a report from Messrs. Mansergh and Melliss on the collection and disposal of the sewage by chemical treatment and precipitation. The district includes Barnes, Mortlake, Kew, Richmond, Isleworth, Hounslow, Petersham, Ham, Teddington, Hampton, Kingston, Surbiton, Molesey, Esher, and other parishes, the rateable value being £762,274. The engineers have come to the conclusion that it is better to have only one than several places for the treatment of the whole of the sewage of the district, and that the place selected must be on the Thames, the natural drain of the whole district. They propose to collect the sewage and subject it to deodorisation and precipitation by means of salts of alumina, iron, and lime. The effluent water will be passed into the tidal portion of the Thames, and the sludge put through filter presses, and sold as manure, or removed in boats to the low land on the banks of the river below Woolwich. At site No. 1 the cost of the works would be £276,647, and the annual charges £25,534, requiring a rate slightly over 8d. in the pound. At No. 2 site the works would cost £323,814, and the annual charges £28,112, requiring a rate at rather over 8¾d. At No. 3 site the works would cost £237,634, and the annual charges would be £23,597, requiring a rate at nearly 7½d. in the pound. Dr. Frankland's analysis and reports on the Thames waters continue to accord more and more with long experience and the opinions of others who have to judge by similar analyses, but taken in confirmation with biological considerations. His report for September admits that the waters delivered by the companies drawing their supply from the Thames were again unusually free from organic matter.

TESTING MACHINE, KING'S COLLEGE.



METALLURGICAL DEPARTMENT, KING'S COLLEGE, LONDON.

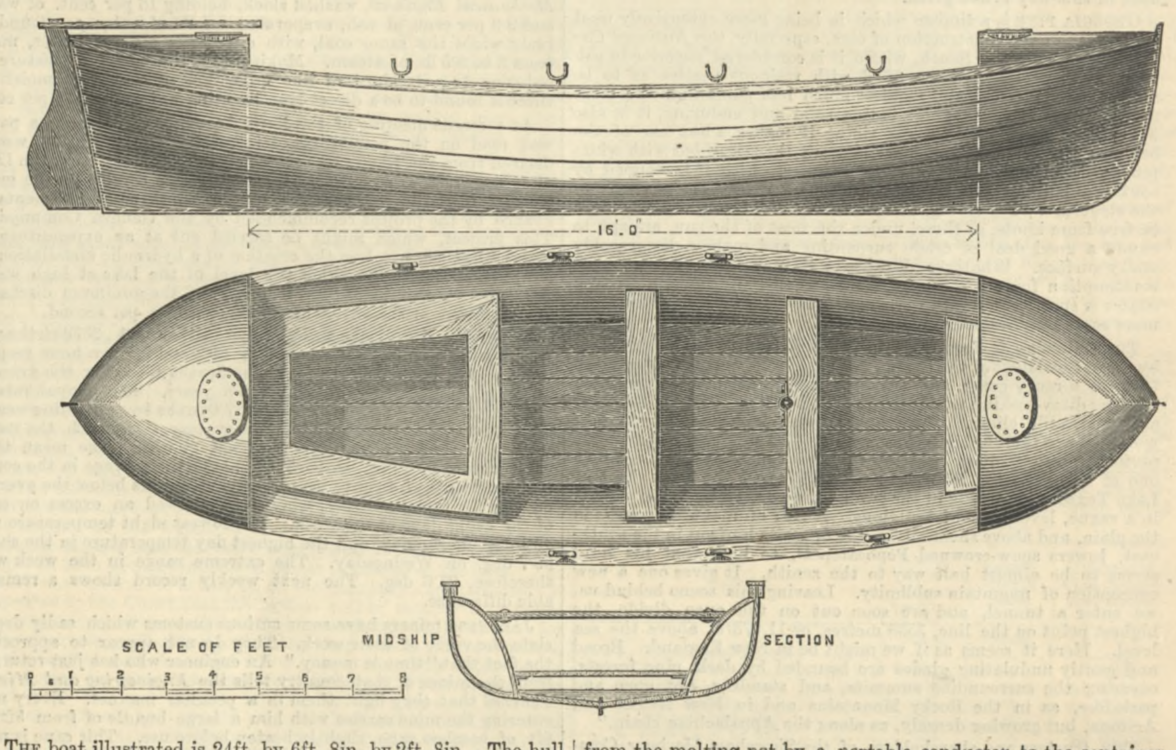
It is now four years since the above department was established, although it did not actually commence work until the following January. For some years the Engineering and Applied Sciences Department of this College had fully appreciated the importance of the study of metallurgy in any system of technical education; but, owing to want of funds for the purpose and the objections to increasing the fees of the departmental students, their views on the subject were not carried out until the year 1879, when the City and Guilds of London Institute was enabled, through the generosity of the Drapers' Company, to make a grant of a considerable sum of money towards the fitting up of a suitable laboratory, and also to endow a chair. The necessary funds having thus been obtained, the Council lost no time in establishing a metallurgical department, entrusting the arrangement and development of it to Mr. A. K. Huntington, the successful candidate for the post. The task undertaken by Professor Huntington was by no means an easy one, for there did not exist in this country, nor in any other, so far as we are aware, a laboratory having the scope and aim which he proposed to himself for this. The only metallurgical laboratory in England was that of the School of Mines, and there the work of the students was practically confined to assaying. A metallurgical laboratory attached to an engineering department, whilst not neglecting the assaying and analysis of minerals, should pay particular attention to the study of the properties of the metals and their alloys with special reference to their applications in the arts. These applications are daily increasing, and the demand for more systematic, and therefore more scientific treatment in the manufacture of metals has become very great within the last twenty years, being at the present time greater than ever by reason of the increased competition brought about by the facility of intercommunication.

In order that the properties of metals may be properly studied and investigated, it is absolutely essential that they should be examined mechanically and chemically *pari passu*. In order to fulfil these conditions, an autographic testing machine, the invention of Professor Thurston, of the Stevens Institute, America, was first acquired, its cost being very small as compared with others. This machine admits of comparative results being obtained with ease and rapidity; it is extremely useful in carrying out investigations. Professor Thurston's machine has already been described by us. For many purposes, however, in this line of work, one of the more powerful machines of the Kirkaldy or other analogous type is necessary. This want, requiring a considerable outlay, was supplied some two years ago by a grant made by the Clothworkers' Company, in their laudable desire to promote technical education and investigation. The grant was applied to the purchase of a machine of the Kirkaldy design, manufactured by Messrs. Greenwood and Batley. It will be found in detail in our last issue, and in perspective on this page, and is described below. This powerful machine has been placed under the joint control of the professors of general engineering and of metallurgical engineering, being available for the students of both departments, as well as for investigations either of a purely scientific or of a commercial nature. In addition to these appliances the laboratory is amply supplied with furnaces for all kinds of metallurgical work, including two hundred pound pot furnaces for casting alloys, also a lathe for turning up large test pieces.

As evidence of the want of such a department as that which we have just described, and of the good work it is doing, we may mention that several important investigations for engineering firms have been undertaken during the past year, and a process of dealing with refractory gold ores, and the necessary machinery for carrying it out have been perfected, and have met with a very favourable reception from those interested in mining and smelting.

The testing machine, which was constructed by Messrs. Greenwood and Batley, of Leeds, is of the Kirkaldy type. It is calculated to exert a strain of 50,000 lb., and may be used for tensile, transverse, torsion, or compression tests. The load is applied by means of a hydraulic ram, and determined by a steelyard and system of levers. The illustrations will suffice to explain the principles of its construction. Fig. 1, above, gives a general view of the machine as arranged for tension. In applying the apparatus to tensile testing, the piece is gripped by collar dies, fitting into the forks A and B, page 264, the former A being connected with the levers, the latter B rigidly fixed to a movable crosshead C, provided with nuts for the four screws D; these screws are attached to the ram-head E, and terminate in pinions, to which motion is imparted from a hand wheel F, through a pinion and spur wheel. By means of this latter arrangement the distance between the forks may be regulated to that required for the piece under test. The power is applied by the force pump G to the ram, extensions and sets being measured by the rod H, firmly clamped to the crosshead, and by means of a rack and pinion arrangement rotating a pointer upon a dial. The necessary increments of strain are applied by altering the position of the weights suspended from the graduated steelyard. The maximum length of test piece which the machine will take is 4ft., allowing for an extension of 30 per cent. during strain. In transverse testing—Fig. 6—the piece is bent over a knife edge on the block J by two knife edges K K—the distance between which may be varied from 10in. to 33·5 in.—bolted to the crosshead C, the connection between the single knife edge and the weight being made by the straps L pulling on the pins M. For compression the block J is reversed, the other side being fitted with a compression plate—Fig. 7—a similar plate P can be fitted to the crosshead C. When required for torsion the chain wheels Q are fitted in bearings, the test piece resting in the hollow bosses of the wheels, and secured in the centre by the rod R to the fork A; the ends of the chains are fastened to the crosshead C, and thus, by means of the pump G, the requisite torsional movement is given to the piece.

SKELTON'S STEEL LIFEBOAT.



The boat illustrated is 24ft. by 6ft. 8in. by 2ft. 8in. The hull is constructed entirely of Siemens steel, the frames and plates being all worked cold and afterwards galvanised. The frames are $\frac{3}{4}$ by $\frac{3}{4}$ by 14 b.w.g, spaced 12in. apart. The plates are all No. 18 b.w.g. The inner frames are rivetted to the outer frames at top and bottom, and the inner plates forming the air casing are flanged and rivetted to the outer plates on upper and lower edges. Strong wales of American elm are worked inside and outside of the upper edge of sheer strake and air casing, and fastened by through bolts, clenched on the inside. A capping piece is worked on top of gunwales, as shown on midship section. Bulkheads are fixed at a distance of 4ft. from each end, forming air-tight chambers. Manholes, with air-tight covers, are fixed on top of the air chambers at ends, and also on the insides of side air chambers. These side air chambers are further subdivided by transverse bulkheads.

The weight of this size boat, with all fittings, is 15 cwt., and the amount of buoyancy in the air chambers is 35 cwt. These boats are quite insubmergeable, and are self-righting. The formation of the air chambers renders them excessively strong, and being built of galvanised steel they are not affected by exposure to the weather in any climate.

LEAD PIPE MAKING MACHINERY.

Although the use of lead pipes is universal, it does not follow that everyone knows how they are made. Formerly they were all produced by drawing through dies, and this system is still followed. The method of "squirting," however, gives better results. It was first designed, we believe, for the production of rods of compressed lead in the manufacture of bullets. Messrs. Weems, of Johnstone, N.B., have, however, brought machinery of this kind to perfection, and we illustrate it on page 281. The special machinery for the lead trade made by this firm includes patent hydraulic machinery for the manufacture of solid block tin and block tin composition tubes, patent solid block tin-lined lead pipe, lead composition and tinned composition pipes, lead rods for bullets, window leads for glass, &c., all in long lengths.

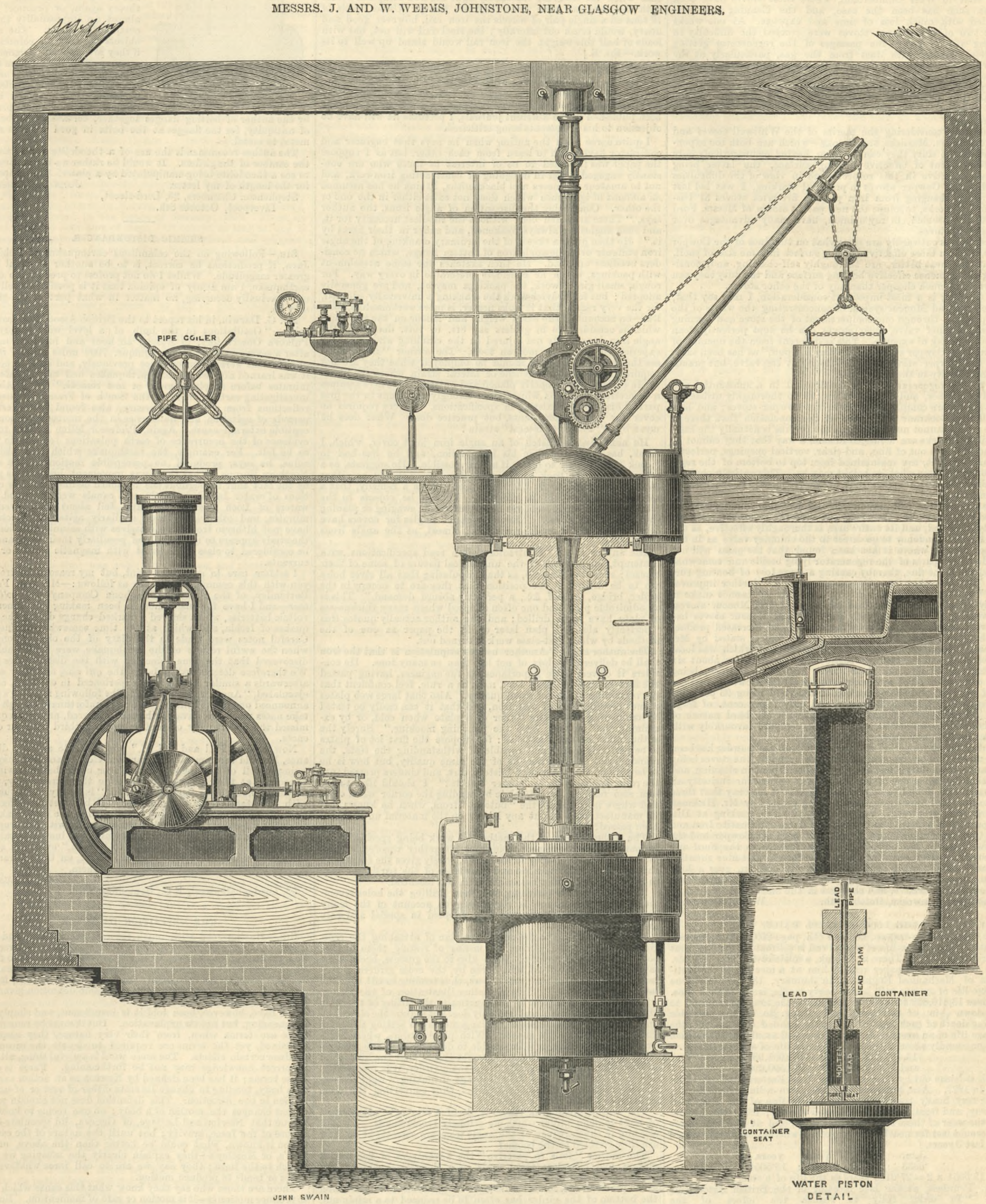
This patent hydraulic machinery consists of strong copper-lined hydraulic cylinder, ram, and crosshead, having a central opening, and supported by four wrought iron columns, bound to the hydraulic cylinder. The ram is fitted with a portable lead container, supported thereon, and to the crosshead is fixed a ram or plunger, within which is fitted a die for forming the outside of the pipe; the core for forming the inside of the pipe is fixed in the centre of the lead container. The molten lead is conveyed from the melting pot by a portable conductor to the container, and after being filled and allowed to set or solidify at a temperature of about 400 deg. Fah., the water ram being then forced up by the hydraulic pumps at a pressure of from 25 cwt. to 30 cwt. per square inch, raises the container, and presses the surface of the metal against the face of the lead ram and die, and the metal having no other means of escape, passes out through the aperture between the core and the die, resulting in the continuous formation of a solid pipe, until the metal in the container is exhausted, when the hydraulic return motion in connection with the pumps is put into operation, and the lead container returns to its original position, and is then refilled.

In the interior of the water ram is fitted a small intermediate ram, for the purpose of rapidly changing the cores without removing the containers, as was usually done on the old principle for making the different sizes of pipes; and by connecting hydraulic pipes from the pumps, the same is put into operation when desired. The machine is provided with a safety self-acting stop motion, whereby the container, when it has travelled the desired distance, opens the bottom valve, allowing the water to escape to the cistern.

For making lead rods for bullets, lead wire, &c., the core for forming the inside of the pipe is dispensed with, and a die fitted into the lead ram of the diameter of the lead rod or wire desired. The hydraulic pumps may either be driven direct by a vertical or horizontal steam engine, water power, or from gearing, the driving pulley being provided with a clutch. These machines are in operation in the principal lead works of Great Britain, Russia, America, Spain, Mexico, Portugal, Peru, Brazil, &c., and for the production of lead rods for rifle bullets in the Woolwich Arsenal, as well as in the arsenals of foreign Governments and in various ammunition factories. The advantage claimed is that the core for forming the inside of the pipe being fixed in the container and surrounded by the metal travels with it, so that there is no actual frictional contact except at the point of escape of the exuding metal, and the pipe is produced while the body of the metal is at rest, and without giving rise to any frictional effect elsewhere. The lead container being open at the top affords every facility for removing the impurities of metal which float on the surface and are skimmed off, and the lubrication of the lead ram is easily effected at each change. No fire being required round the container, the expansion and contraction are equalised. The die requires no adjusting screws, as the core has a tendency to come true to the centre to make a pipe of equal thickness, and the metal being pressed at a reduced temperature gives a solidity and superior brilliancy of finish to

LEAD PIPE MAKING MACHINERY.

MESSRS. J. AND W. WEEMS, JOHNSTONE, NEAR GLASGOW ENGINEERS.



the pipe. Owing to the reduction of the frictional contact the lead container can be made larger, thereby increasing the size of the pipe and the quantity produced. The lead containers for the large and small pipes are easily removed and replaced, and the machine can be worked at the rate of from five to six charges per day, producing from about 25 to 30 tons per week. The latest improvements effected in this class of machinery are in the appliances for the production of tinned-lined lead pipe produced at one operation under hydraulic pressure of 200 tons per square inch, such as moulds, mandrils, &c., thereby producing an improved medium for the supply of pure water to dwellings, preventing lead poisoning of water and other liquids. Messrs. J. and W. Weems have long endeavoured to produce machinery which would turn out a pipe for domestic purposes entirely free from contamination with lead, and in this way they have produced the lined lead pipe. This pipe may be termed a combination pipe. It consists of a distinct pipe of pure tin protected by an outside covering of lead, and the two pipes are so united at their surfaces of contact as to be inseparable by any contortion to which the pipe may be subjected. In pliability it does not differ in any perceptible extent from lead pipe, as it is easily bent to any desired form or angle without in the slightest degree affecting the interior of the pipe, which comports itself physically as a part of the body of the lead pipe. It is stated that this pipe is so much stronger than lead pipe that a less weight is needed, and thus the cost of the two is the same. The Government of Brazil have recognised its value by stipulating for the use of this piping only for the entire service of the city of Rio de Janiero, and on the Continent several municipalities are using it solely.

Messrs. Weems had a curious experience in the attempt to produce brass tubing by hydraulic pressure. For this purpose they constructed a water press with a 33in. ram. It was found that when the brass block out of which the pipe was to be formed came to be subjected to a pressure of 4000 tons, the zinc left the copper, thereby producing a zinc pipe and leaving the copper behind. This result, which was surprising and unexpected, formed really a contribution to science, by proving that the atoms of the brass composition united together by fusion were only mechanically arranged, and not chemically combined, and practically demonstrating the truth of the atomic theory of Professor Tyndall, that in compound substances the component materials were held together by pressure, and could thereby be separated by pressure.

THE next exhibition of brewing plant, machinery, and the appliances, materials, and products of breweries and allied trades, will take place in the Agricultural Hall from the 15th to the 20th instant.

LETTERS TO THE EDITOR.

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

FIRE-BRICK HOT-BLAST STOVES.

SIR,—As I was inadvertently prevented from taking part in the discussion "On Recent Improvements in Cowper's Stoves" at the late meeting of the Iron and Steel Institute at Middlesbrough, perhaps you will permit me to make a few remarks in the columns of your valuable paper in reference to that discussion, and as to fire-brick regenerative stoves for blast furnaces—a subject which is of the greatest importance to all iron smelters, as these stoves are now rapidly superseding iron pipe stoves.

I think, Sir, that all iron smelters owe a deep debt of gratitude to Mr. Cowper for having introduced the fire-brick stoves, and for the ability and energy he has displayed in getting his stove so largely adopted, thereby contributing in a marked degree to the economical production of pig iron. There are several fire-brick stoves in the market claiming public favour, and I am sure many smelters will agree with me that it is not such an easy matter, after all, to choose which is the best, as Mr. Charles Cochrane, in his rather highly laudatory remarks on the Cowper stove, would like us to believe, and for the chief reason that while one stove is suitable and works satisfactorily in one district, where the deposit or dust from the gas is not difficult to remove, the same stove may not be so suitable for another district where the character of the materials to be smelted is different, and the deposit from the gas difficult to remove.

This is true particularly in regard to the Cowper stoves, and I know that in West Cumberland, where these stoves have been in use, such has been the case, and the cleaning has been attended with much loss of time and expense. At one works where two of the Cowper stoves were erected the difficulty in cleaning was so great—the passages of the regenerator getting completely choked with dust from the gas, particularly at the top, which the process of shooting with gun and powder, recommended for cleaning these stoves, could not remove—that no satisfactory work could be done until a third stove was erected, and it was of that much-abused description, Massicks and Crooke, which enabled the Cowper stoves to be taken off duty alternately for cleaning.

After fully considering the merits of the Whitwell stoves and those of Messrs. Massicks and Crooke—which are both too expensive for all the duty they can perform, having comparatively only a limited extent of effective heating surface, the latter being seriously defective in this respect—and in view of the difficulties attending the Cowper stoves in practical working, I was led last year, when changing from iron pipe to fire-brick stoves at Distington Ironworks, to adopt the new patent stoves of Messrs. Ford and Moncur, which, in my opinion, have many advantages over any existing stoves.

These stoves outwardly are somewhat on the lines of the Cowper stoves, contain more effective heating surface in same size of shell, regulate the heat better, are thoroughly self-cleaning, and, considering the immense effective heating surface and the duty they can perform, are much cheaper than any of the other stoves.

As cleaning is a most important consideration, I may say that, by the Ford and Moncur system of concentrating the whole of the blast pressure through one compartment of the stove and opening suddenly a relief valve, their stoves can be kept perfectly clean without a penny of expense. This is different from the opening of a valve in a Cowper stove and having a "puff," as has been said; for in the Cowper stove there is velocity at the valve, but practically no velocity in the stove itself.

As to the regenerator, it is constructed in a substantial and effective manner, and in such a way as to thoroughly utilise the space even more completely than in the Cowper stoves; and how Mr. Charles Cochrane can arrive at the conclusion that there is waste here I cannot understand, as the reverse is actually the case. The tiles or bricks are arranged in such a way that they cannot be displaced, or get out of line, and clear, vertical openings, perfectly true and straight, are maintained from top to bottom of the regenerator, no matter what its height may be. This entirely obviates the displacement of bricks that occurs frequently in the Cowper regenerator.

The gases having full play in a lateral direction round diamond-shaped stay bricks, the absorbing power of the regenerator is thus greatly increased, and its entire area is thoroughly effective, as the gases have no tendency to go direct to the chimney valve as in the Cowper stoves, where it has been found that the gases will not pass down the parts of the regenerator lying beside and somewhat behind the flame flue, thereby causing a large loss of heating surface. I notice that Mr. Cowper proposes a "further improvement" to obviate this, but still by even this he cannot make it wholly effective, as is the case in the Ford and Moncur stoves. The working at Distington with the Ford and Moncur stoves has been very satisfactory, and a saving of fuel and increased production has been effected quite equal to the figures stated by Mr. Cowper. The consumption of coke—one-sixth of which was local Cumberland, and the rest Newcastle and Durham—for about six months, the whole time these stoves have been at work, being 18·69 cwt., with ·82 of anthracite coal, in all 19·51 cwt. of fuel per ton of pig iron, and the proportion of the yield being 93 per cent. of first-rate 1, 2, and 3 Bessemer, and only 7 per cent. of forge iron. These figures, taken into account with the hard nature of Cumberland ores smelted, will, I think, compare favourably with the results from any other stoves.

During the above period and to date no gun and powder has been used, no brushes or scrapers, no time has been lost, the stoves being continuously on duty; not a penny has been spent in cleaning, and the other day when one of the stoves was opened for curiosity all the walls were found to be perfectly clean. I may say that three of the Ford and Moncur stoves are being erected by Mr. Hickman at Springvale Ironworks, Staffordshire, two are working at Distington with the above results, and the Barrow Hematite Iron and Steel Company, after long experience of both the Cowper and the Whitwell stoves, has now given the preference to the Ford and Moncur stove after a careful trial of one for the past nine months, and are erecting other four, which, in my opinion, goes a long way to prove the assertion of the patentees, that their stoves "are the best, most effective, and cheapest in the market.

Distington Ironworks, October 6th. Wm. McCowan.

THE LIFE OF STEEL RAILS.

Sir,—In The Engineer, October 5th, page 259, "Miscellanea," it is stated that "the life of a steel rail is estimated equal to that of three iron rails." There is I think, a mistake in this. As Mr. Price Williams—in a paper read by him at a meeting of the Institution of Mechanical Engineers, in January, 1877—puts it, the average life of an iron rail, under heavy traffic, is 17½ million tons. He gives 13,416,832 tons as the average traffic tonnage required to wear down $\frac{1}{16}$in. of rail head, and taking ⅜in. as the available wearing depth of each head of a double headed rail, he gets the tonnage life of an average Bessemer steel rail as about 161 million tons, or roundly about 9 times the average life of an iron rail—

$$13{,}416{,}832 \times 6 \times 2 = 161{,}001{,}984$$
$$\text{and } 17{,}500{,}000 \times 9 = 157{,}500{,}000$$

This is borne out by a report of the Great Eastern Railway Company in 1877. As a test they had put down a line of steel rails, under very heavy traffic, upon the centre line of the Blackwall Railway, and from January, 1874, to February, 1877, they found that the wear of those steel rails was $\frac{1}{12}$in., and at this rate these rails would last for nearly thirty years; whereas iron rails would only last 3 years.

$$\begin{array}{ccccccc} \frac{1}{12}\text{in.} & & \frac{3}{8}\text{in.} & & \text{years} & & \text{years.} \\ \cdot0833 & : & \cdot3750 & :: & 3 & : & 13\cdot5054 \end{array}$$

and 13·5054 × 2 = 27·0108 years as the life of a steel rail.

Mr. Brunlees, at the late meeting of the British Association said, "In order fully to realise the effect of the enduring qualities of steel rails, take a given section of the busiest portion of one of our leading railways, over which 7,000,000 tons of live and dead weight pass annually, and you would find that the life of a steel rail on that portion of the line would be 42 years if the traffic remained the same." Assuming the life of an iron rail as three years, this would make the life of a steel rail fourteen times that of the iron $\frac{42}{3} = 14$; or, putting the life of a steel rail at nine times that of an iron one, it would make the life of the latter 4·66 years—$\frac{42}{9} = 4{\cdot}66$. M. M.

October 6th.

[In this connection everything turns on the character of the iron rail. It may, perhaps, be new to our correspondent to hear that iron rails have endured a heavy main line traffic for twenty-five and thirty years. In steel rails there is little room for variation in those qualities on which wear and tear depend. It is before all things necessary that a rail should be homogeneous, and this a steel rail is certain to be. A near approach to homogeneity can only be obtained in iron by repeated heating and rolling, and careful selection of the materials put in the pile, both as to quality, shape, and mode of piling. For this reason, best quality iron rails must be very expensive. It is probable that an iron rail which would compare very favourably with a steel rail could be bought for about £12 a ton, but as this is much more than twice the price of steel, it is hardly necessary to pursue the argument further. We have said enough, however, to show that it is quite possible for three iron rails to last as long as one steel rail, or even longer. Another point to which sufficient importance is not attached is that when the loads are reasonably light the iron compares better with the steel rail than when they are heavy. Under loads of 19 tons on a single pair of wheels the iron rail, however good and heavy, would crush out laterally; the steel rail will not, but with loads of half this weight the iron rail would stand up well to its work.—Ed. E.]

DESIGNS, SPECIFICATION, AND INSPECTION OF IRONWORK.

Sir,—I have just seen the paper on the above subject read by Mr. Pendred before the Society of Engineers, and as it has now been published in the different journals, I presume he will have no objection to his statements being criticised.

I quite agree with the author when he says that engineer and contractor have much to learn from each other, but as I suppose the paper was intended to be of interest to those who are constantly engaged either in designing or constructing ironwork, and not to amateur engineers and blacksmiths, I think he has assumed an amount of ignorance which does not exist either in the one or the other. Concerning the disposition of angle irons, the author says, "These are often bent without the smallest necessity for it, and such angles are always weakened, and suffer in their fibres by it." He then gives a sketch of the ordinary cranking of the angle iron stiffener over the angle iron of bottom flange, which he considers needless and bad. He then sketches the same attachment with packings, which he considers preferable in every way. For rough, small girder work, the packings may be, and are generally adopted; but for heavier work the cranking is universally adopted, for the very reason that it looks neater, is more workmanlike, costs less—on account of the extra weight and labour on the packings, which is considerable in girders say 8ft. or 10ft. deep—and the angle iron is certainly not injured in the cranking when done by experienced men with modern tools. The author "never could see the reason why covers should be employed when they are not required to resist either tensile or lateral strain where the plates are in compression properly planed and butted." He here assumes a theoretical condition which he so strongly condemns in the first part of his paper as existing in specifications. Theory requires no cover for compression joints, but practice does. What does he mean by a "tensile or lateral" strain?

He next gives a sketch of an angle iron joint cover, which, I think, has only existed in his imagination, and he has had to "cook" the sketch to make it appear possible. He suggests, as a remedy, that the back of the angle iron cover should be either swaged or planed to fit the angle iron; or, as a remedy, that a special section should be adopted. Though he objects to the cranking of an angle iron, yet he advocates the swaging or planing the back of the cover. "Round-backed" angles for covers have been obtainable for as long a period, almost, as the angle irons themselves.

The author says: "Contractors often read specifications with contempt, on account of the unpractical nature of some of their clauses; such, for example, as that stipulating that all rivet holes are to be drilled in the position that they are to occupy in the girder, bridge, or roof, &c., a perfectly absurd demand." This is an admirable plan, and one often adopted where many thicknesses of plate have to be drilled; and the author actually quotes this "perfectly absurd" plan later on in the paper as one of the methods by which first-class work is turned out.

The author says: "Another useless stipulation is that the iron shall be delivered in lots of not less than so many tons. He considers it of very little importance, as the engineer, having passed the first or second lot of iron, may, as a rule, feel confident that the remainder will be of equal quality. Also that large web plates cannot be rolled out of bad iron, and that it can easily be tested by hammering down one corner of a plate when cold, or by examining the 'buttons' from the punching machine." Surely the author must be easily satisfied; for suppose the first lot of plates to be perfectly clean, and capable of withstanding the tests, the remainder of the iron may be of the same quality, but how is he to be sure of the absence of blisters, dirt, and cinders pressed into the rolls, laminations, or "other defects?" I should like to see him also test, say, a ⅜in. plate by bending the corner when cold; and where is he to get the "buttons" from, when he knows that no manufacturer will put any labour on the material until it has been passed?

The author objects to the method of work being specified; but in many cases the engineer, being not altogether theoretical, and knowing some peculiarity in his design, wisely gives the contractor the benefit of his experience and knowledge of the particular case in hand, which is often not only useful, but essential.

The plan of first punching and then drilling the holes recommended by the author is very costly on account of the many handlings of the plates, and is only adopted in special and rare instances.

The author objects to the customary plan of attaching the cross girders to the main girders by means of resting them on the bottom flange, and rivetting them also to the gussets, because, he says, "the whole load of, and borne by, the cross girders is sustained by one side of the main girders, thus tending to tilt over the latter out of plumb." This is another illustration of the theory which he so much objects to, for practically the tilting of the main girders is imperceptible, and certainly does not require the elaborate, and I may say impracticable, arrangements for setting the main girders proposed by the author. With plate girders, where headway is of importance, it is impossible to do away with the arrangement objected to, and although it would appear that the load is not transmitted fairly and equally to the main girder, it is practically, and the arrangement has the advantage of making a rigid connection between the main and cross girder, thus converting the cross girder into a beam fixed at the ends.

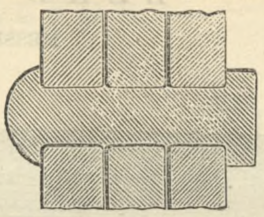
The author gives a sketch—Fig. 6—of a very ugly attachment of cross to main girder which he strongly recommends. I would ask him if the drawings of the angle irons are correct; if so, how are they rivetted to the booms?

The author "fails to perceive" the advantages of fish-bellied girders, and considers them again as a theoretical whim. The advantage of fish-bellied girders is not a theoretical one only, but also a practical one, for as the distance between rail or road level and the bottom of the girder has often to be reduced to a minimum, this is best done in open web girders, where the cross girders are often fixed on the top of the bottom boom by making the cross girders fish-bellied.

The author approves of drifting! He objects to the end of the angle iron stiffeners being cranked because of injuring the fibres of the iron; but would allow the iron to be submitted to the gentle treatment of a 7 lb. sledge on the top of a taper drift!

The author reminds us that if the girders are not placed in their proper position the holes for the cross girders will not come in. Why certainly! If the girders are placed upside down, the same difficulty will be experienced.

The author says, "During rivetting the resident engineer should see that the rivets are fully and equally heated all over, and concerning this point some better mode of heating them than the common portable hearth is greatly needed, it being almost impossible to get rivet boys to heat more than just the points of the rivets; consequently there is less probability of the shanks being upset in the holes, and the rivets have less contraction when cooling." This idea is certainly original; but the author may be very certain that engineers have had very good reasons for having up to now only heated the ends of the rivets. In the first place, the rivet holes are only made large enough to allow a hot rivet to enter, and if they were made large enough to take a white-hot rivet, they could not possibly fill the holes when cold, and the contraction endways would be so great as to seriously endanger the safety of the head. Next, in machine rivetting especially, where the plates were not tight together, the metal of the rivets would be forced between the plates, as in the following sketch, and the plates could then never be brought together.



"The plate round the head should not be cut with the snap." Is this theory again, or practice? It is almost an impossibility to avoid cutting the plate. The author objects to lugs on columns, but if they are properly designed, they are very efficient, and form a good attachment to bracing, and for large columns are preferable to the expensive plan proposed by the author. The novel plan proposed by the author of bolting flanges together, certainly has the merit of antiquity, for the flanges at the bolts in good work is always metal to metal.

The author recommends the use of a theodolite for setting out the camber of the girders. It would be rather an interesting sight to see a theodolite being manipulated by a plater. I must apologise for the length of my letter. John J. Webster.

Stephenson Chambers, 25, Lord-street,
Liverpool, October 8th.

SEISMIC DISTURBANCES.

Sir,—Following on the calamitous earthquakes of Ischia and Java, if predictions be correct, is to be another of equal if not greater magnitude. Whilst I do not profess to predict the coming earthquake, I am firmly of opinion that it is possible to tell when one is actually occurring, no matter in what part of the globe it may be.

Mr. G. Darwin, in his report to the British Association last year, said:—"Oscillations in the bulb of a level were observed at Pulkova Observatory, in Russia, an hour and fourteen minutes after a severe earthquake at Iquique, 7000 miles away. Similar observations were observed twice previously, and on each occasion it was learned afterwards that earthquakes had taken place some minutes before at places more or less remote." M. D'Abbadie, investigating earth tremors in the South of France by means of reflections from a pool of mercury, also found that there were periods of agitation and quiescence in the mercury without perceptible external cause. Again, Professor Milne notices indirect evidence of the occurrence of earth pulsations too slow in period to be felt. For example, the earthquake which laid Lisbon in ruins, he says, produced no perceptible motion in the soil of Northern Europe. That there was movement, however, is proved by the fact that throughout the northern hemisphere slow oscillations of water in lakes, ponds, and canals were observed. The waters of Loch Lomond rose and fell about 2½ft. every five minutes, and other lakes were similarly agitated. Electricians have not hitherto troubled themselves with seismic questions, but the study appears to me to be one peculiarly their own, and may be considered to class in interest with magnetic storms or earth currents.

I seldom care to rush into print, but my reasons for troubling you with this communication are as follows:—Mr. Wm. Fereday Bottomley, of the National Telephone Company—my *collaborateur*—and I have for many months been making experiments on voltaic batteries, which showed a marked change during the earthquakes of Ischia, and which at the time somewhat confused us. Careful notes were made in the diary of the observations, and when the awful results of the earthquake were made public, we discovered that the time coincided with the disturbances noted. We therefore determined to be on the *qui vive*, and very shortly afterwards a similar result was experienced in our tests, and we ejaculated, "Another earthquake." The following morning's papers announced one in the Piræus. We were unfortunate enough not to take notes when the Java earthquake occurred, and consequently missed the opportunity of confirming for a third time our experiences.

Now, as Dr. Fall and "J. H." prognosticate another disturbance, I would recommend all interested electricians who may have a simple cell of Leclanché, Fleming's or other battery, with galvanometer at their disposal, to examine them frequently, taking particular notes as to "quantity" and "intensity," also the hour, with the state of the thermometer and barometer. There will probably be found an increased power during the earthquake, and no doubt the effects will be felt simultaneously with the eruption.

It would appear from our experiments that inorganic batteries, although not connected or joined to "earth," evidently sympathise with abrupt inorganic changes, whilst, on the contrary, our organic batteries remain uninfluenced by them.

John J. Lundy.

56, Leadenhall-street, E.C., September 19th.

THE DEFINITION OF FORCE.

Sir,—Having read with much interest your article and correspondence on the definition of force, I wish to offer a few remarks. To a student of mechanics, it must be very perplexing to find so many definitions of one term; but force, the most important term in the science, seems to be highly favoured in that respect, it being clear and concise, and having just the same definition given it by all the greatest masters.

We have, however, been told it is insufficient, and simply gives the meaning, but not its explanation. But it must be remembered there are terms when, from their very nature, they cannot be explained, yet the terms are required to denote the causes that produce certain effects. The mere word is a useful thing, although a correct knowledge may not be forthcoming. Force is one of those terms; it has been defined by Newton as an action exercised on a body, tending to change its state either of rest or of uniform motion in one direction. This definition does not explain what it is that changes the motion of a body; no one seems to know. It is true that Newton and Le Sage, of Geneva, did speculate on the nature of the force, gravity; but until the nature of the cause or action is known, what could be better than the above, or Rankine's, or Moseley's—they explain clearly the meaning we are to attach to the term; they say we are to call force whatever produces or tends to produce motion.

There are those who say they know what this cause which tends to produce motion is—it is motion or rate of momentum. But how can it be, when we know it exists without motion, consequently without momentum, as in the case of a pressure. If I hold a body in my hand it tends to move towards the earth, and the cause of this attraction we call force. The effect of this force is balanced by an equal effect produced by the opposite force; the force is there but where is the motion? If I withdraw the reactive force, the gravitational force produces motion in the body, the rate of momentum changes; is it not due to the force still acting on the body? If the force cease, the momentum does not change. Momentum does not produce momentum, as it must do if it is a force. The body arrives on the earth and tends to move it with a force caused by its velocity; but velocity is rate of motion, therefore the force must be momentum or motion, but that is only the force of impact caused by the previous acting force. But there are other forces causing simple attraction and repulsion, as gravity, cohesion, chemical affinity, magnetism, and electricity; we know these to act without motion. Hence I cannot conceive momentum as being the cause of motion, only in impact.

We are all anxious, I am sure, to be put right on this subject, and know what is the cause of motion. All we know at present is that bodies tend to move, and do move, unless balanced. We believe there must be a cause, and agree for convenience sake to call it force.

Force is not the only term the nature of which is unknown. Take the terms mind, vitality, and if I may be allowed, electricity, and yet they are convenient to express the causes which produce certain effects. I must agree with your article, that the present definition of force, that is, the definition of either Newton, Rankine, Moseley, Whewell, or Goodwin, is simple and exact enough for a student who approaches it in the right direction. If, however, any one does know the real nature of force, and can improve upon the present definition, let him do so; but it must be confessed that the definitions so far presented are not improvements. Φ. Π. mentioned in his first letter that the true explanation of the cause of motion had been explained by Professor Oliver Lodge, and that he would state it again. I will therefore drop my pen and await anxiously to be enlightened on such an important subject.

Handsworth, September 25th. STEPHEN EDDY.

SIR,—Having been away from home I had not until now noticed "A Student's" letter in your issue of 7th inst., in which I am challenged to explain certain things. I have neither time nor inclination to enter into controversy with this "Student," my interest being at present absorbed in practical applications of mechanics. But I have formerly taken keen interest in the theoretic fundamentals of mechanical science, and for a full explanation of my views as to "force," I must refer "Students" outside my own classes to the letters in *Nature*, to which I before referred. They are to be found in the issues of January, 1876. These do not deal with the definition of mass. Of course, so long as one is concerned only about consistency and not about real physical meanings, one may put his cart before his horse if he likes, and derive "mass" from "force," but what modern mechanician would so fly in the face of settled and systematic modern practice? Has not the C.G.S. system of fundamental units been pretty well accepted? In order to learn some of the reasons that have led the scientific world to adopt universally "mass" as one of the fundamental units, "Student" may refer to such a book as Everett's "Units and Physical Constants."

The "Student's" amusing array of authorities for and against his own opinion, owes its whole merit to its grotesqueness—not at all to its accuracy. ROBERT H. SMITH.

The Mason Science College, Birmingham,
September 24th.

THE LATE MR. CROMWELL F. VARLEY.

SIR,—Allow me to state that the history of the artificial line dates back as far as 1854. It was constructed at that time of such materials as the knowledge of dielectrics and resistance then known rendered available. The smaller resistance coils were made of copper and the larger of iron wire, and the dielectric for the condensers of paper saturated in a mixture composed chiefly of Venice turpentine, with the addition of resin and a small quantity of beeswax. The condensers were built up of alternate layers of conductor and dielectric. The maker of the condensers was my late eldest brother, Cornelius John Varley, who made them under instructions from Cromwell Fleetwood Varley. The original sets of resistance coils were made by Cromwell F. Varley entirely, but copies of these were reproduced by Cornelius John Varley. S. Alfred Varley about this time was away from London, and shortly afterwards left for the Crimea, where he had charge during the war of the first military field telegraph. Owing to this absence from home he may have been unacquainted with what Cromwell F. Varley had previously accomplished, and to have reinvented what had already been done. With regard to the construction of condensers, it may be interesting to state that Cromwell F. Varley employed papers saturated with Venice turpentine in consequence of the costliness of gutta-percha tissue.

The condensers used by S. Alfred Varley, and described by him at the Society of Arts, were made of paper, coated with shellac varnish, and subsequently sufficiently heated to evaporate the alcohol; whilst the artificial lines of greater proportions with which Cromwell F. Varley was justly identified were a great improvement, both upon his former invention and the subsequent re-application of S. Alfred Varley's, insomuch that the condensers possessed greater dielectric resistance, and were capable of storing up charges from 1000 to 2000 volts tension. This he accomplished by employing for the first time paraffine wax to saturate the paper, and convert the same into a permanent dielectric, whilst more carefully constructed and adjusted resistance coils were used. He also added to the arrangement a contrivance for putting in and taking out the condensers at will; making the artificial line to illustrate the twofold effects of resistance pure and simple of the conductor, or by the insertion of condensers to give the requisite inductive capacity to illustrate the retardation of the current, as experienced in long submarine cables.

Full credit is doubtless due to S. Alfred Varley for having aroused the attention of the public to the fact that science more than foreshadowed a promise of the commercial success of Atlantic telegraphy. Still, I cannot allow that Cromwell F. Varley's memory should be assailed by the hint of a suspicion that in taking credit to himself for the production of the artificial line he even for one moment considered that he was depriving his brother, S. Alfred Varley, of any credit which might be due to him. It may, however, be asked why the artificial line, though comparatively in embryo, was thus early invented—1854—it was not brought prominently before the scientific world. In answer, it is only necessary to say, under the engagement with the Electric and International Telegraph Company, he was debarred from making his researches and discoveries public without first having obtained the sanction of the Board—a disability which in recent years he frequently complained of. FREDERICK W. VARLEY.

Mildmay-park Works,
Mildmay-avenue, Islington, N.,
September 24th.

THE NEW PATENT ACT.

SIR,—I have read with great attention the Patent Act as published in your columns, and I am greatly in doubt about some points. Perhaps your readers can help me. If I take out a provisional protection now I shall have nothing more to pay in the way of fees until after the 1st of January. What fees must I pay then? According to one interpretation I come under the new scale, according to another interpretation under the old.

I find in the *Times* a letter by Mr. J. J. Aston, a well-known authority on patent law—a letter which expresses my views better than I can. Says Mr. Aston:—

"At the present moment there are two interesting and by no means easy questions to answer—(1) Whether applications for patents made before the 1st of January next, and on which provisional protection can now be obtained at a cost of £5, will come within the reduced scale of fees payable on and after that date, so that, if they do, a complete patent will be obtainable at a total cost of £8, instead of £25 as now. And (2) it is difficult, if not impossible, to say for certain whether patents granted after the new Act comes into operation upon applications pending at that time will be subject to the conditions of the new Patent Act or to the old conditions. One section of the new Act would seem to say, subject to two exceptions, that they will, and another that they will not.

"Section 45, sub-sections 2 and 3, say, except as to binding the Crown and compulsory licences, that the Act shall extend to all patents granted before the commencement of the Act or on applications then pending in substitution for such enactments as would have applied thereto if this Act had not been passed.

"Section 113 repeals all such enactments, with a provision that the repeal shall not affect any patent granted on applications pending before or at the commencement of this Act."

I shall be very much obliged by an expression of opinion on this point. JULIUS.

London, September 26th.

COMPETITION.

SIR,—About twelve months ago we were induced, through seeing an advertisement in your valuable publication, to join a competition, and to apply to the urban sanitary authority of the borough of Bedford for the requisite particulars to enable us to prepare a design and estimate for a new bridge and approaches to the same for crossing the river Ouse in that town, when we were furnished by the representative of the said authority with certain data, such as the width of roadway required, the width of waterway to be provided, as well as height of road above, and especially the loads the bridge must be designed to carry in safety, &c. The moving load the bridge was required to carry in addition to anything else that might be passing over it at the same time being a road roller or traction engine of 20 tons weight—that being the weight of such engines now in use—and there was to be a clear waterway of 200ft. Having these particulars, with what could be obtained in addition by a careful examination of the site, we prepared a design, accompanied with estimates and tenders accordingly, and sent them to the urban authority at the time required. Shortly afterwards we received a letter informing us the designs and estimates of another competitor, named Webster, had been accepted. Our papers were returned with thanks, and we considered the matter ended so far as it concerned us.

In the early part of August last we were rather surprised to see the same urban authority again advertising for tenders for a bridge and approaches at the same place, "the drawings to be seen at the office of Mr. Webster," who, it thereby appears, had been recently appointed engineer of the work. It then occurred to us that probably Mr. Webster could not or had not, complied with all the conditions of the competition, and had entered into arrangements to superintend instead of carrying out his accepted tender.

We have taken the opportunity thus offered to us of seeing the drawings of Mr. Webster, when we noticed the bridge is to be of a very much cheaper and weaker construction than was asked for at the competition; inasmuch as it is to have only 185½ft. clear waterway, instead of 200ft.; and the strength is to be very far short of what was then required.

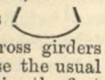
The strength of the iron floor, for example, is to be only about a twelfth of that contemplated; as it is to be composed of No. 3 size of Westwood and Baillie's flooring plates, of trough-shaped corrugations 5in. deep, ¼in. thick, supported on bearings 6ft. apart centre to centre, or about 5ft. between. These floor plates have a strength, according to the patentee's advertisements, when five-sixteenths of an inch thick, supported on bearings 8½ft. apart, of only a very little over 4 cwt. per square foot; that weight causes them to deflect as much as should be allowed. The same size plates are to be used, but they are to be 20 per cent. less in thickness, while the load on them is to be very much greater.

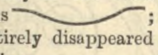
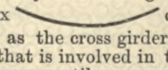
The greatest load and strain occurs on these plates, when a traction engine or steam road roller is passing over the bridge, when they have to support the wheels upon which the twenty tons is carried, and that puts seven tons on a single wheel; consequently the floor plates have to bear 140 cwt. at any of the points of contact with the wheels, on what is apparently little more than a square foot, which has been tested to carry only 4 cwt.; in other words, it would appear there is a deficiency of strength to the extent of 136 cwt. per square foot. This deficiency, however, has some favourable circumstances which, if taken into consideration, somewhat reduce it. (1) The depth of the trough of the corrugations is 5in. in either case, whilst the distance apart of the supports is 8½ft. in one case, or a proportion of 1 of depth to about 20 of length, whilst in the case of the bridge it is 5ft. between supports, or in the proportion of 1 of depth to 12 of length; therefore the comparative strength is found by the well-known formula for girders $\frac{W\,L}{8\,d}$ to stand in the proportion of 5 to 3, which in effect reduces the 136 cwt. to three-fifths of that weight, or 81 cwt. (2) Making liberal allowances for distribution of load, distance apart of corrugations, and the distributing effect of the concrete laid on the floor, by taking the remaining 81 cwt. to be supported on any point of, say, 1⅔ square feet, it gives the pressure of 48 cwt. per square foot. Without going further into the unfair nature of this competition, or dealing further with the question of strength of other parts of the work, we suggest that we think the competitors under these circumstances have a claim upon the authors of the advertisement for expenses in preparing plans, &c.

Those designers who carefully studied all the stipulations laid down by the urban authority are thus thrown out of court, their labour has all been wasted, and they gain nothing; not because they are less able or have less talent, but because of their honesty, and because those who have given them the trouble and expense they have been put to, have not excluded from the competition designs that did not comply with the conditions laid down.

Westminster, October 2nd. ALPHA AND OMEGA.

THE BRENT VIADUCT.

SIR,—In reply to "Inquirer" the strains on the cross girders of the Brent Viaduct must be complex, for when the bridge is fully loaded each cross girder can only act as a beam loosely supported at the ends, the main girders being incapable of carrying any considerable weight on cantilevers from their comparative instability. The deflection curve would therefore be a simple one, concave from end to end, the main girders tilting inwards thus 

But the case is very different with the individual cross girders when the bridge is only partially loaded. If we suppose the usual process of gradually loading the bridge by a moving train, the first cross girder when fully loaded being rigidly fixed at either end must act as a fixed girder, for in such case all the other unloaded cross girders give the main girders ample stability to resist the canting tendency produced by the one. This state of things, however, is only momentary, for as soon as the second cross girder is also loaded, the stability of the main girders is proportionately lessened, and the tendency to cant doubled, and this change continually goes on as more cross girders get their load, until the main girders have all their stability taken away, when, being incapable of supporting a cantilever, the case is as first supposed, and all the cross girders are practically only loosely supported beams. The curve of deflection of any of the cross girders would at first be convex at the ends, thus ; the convexity gradually diminishing until it entirely disappeared and a simple convex  curve remains.

So much so far as the cross girders themselves are concerned, but this is not all that is involved in the question, for if the main girders are to carry cantilevers—and they evidently are—the perpendiculars must be made stiff enough to support them; which means so much metal in addition to that necessary in the case of loosely attached cross girders. Perpendiculars with rigidly fixed cross girders at their lower ends have strains similar to those in the shank of an anchor. Seeing, then, that rigidly fixed cross girders necessitate additional metal in the perpendiculars of the main girders, it is difficult to see the advantage of such a system. Nothing is saved in the cross girders themselves certainly, and, as we have seen, the reverse of a saving occurs in the main girders. If the object is to provide against their being blown over it would seem that such provision could be more economically made at the ends in the usual way. In closing it may be well to remember that in the case of a bridge with substantial overhead cross stays the above argument would not hold good, for then the main girders would be prevented from canting inwards, and would have the necessary stability for carrying the cross girders as rigidly fixed beams. HERBERT GUTHRIE.

22, Lime-grove, Longsight, Manchester.
October 2nd.

THE REGULATION OF THE MISSISSIPPI.

SIR,—I was pleased to read in your issue of September 7th your comments on that much-abused Mississippi River, regarding attempts to improve it. As you correctly infer, that river as regards floods and inundations and difficulties of navigation is getting incomparably worse and worse each succeeding year, both apparently and actually in proportion to the number of millions of dollars the Government is spending each year to improve it. This cannot be otherwise, as the Government system of improvement is to dam and narrow it along its length and at its mouth so that its waters are impeded in their escape to the sea, and in consequence, instead of cutting out the sand and sediment of its bottom, it is actually filling in above all its artificial contractments; and because of its several mouths being dammed across and contracted, one-third of its waters now escape to the Gulf through the Atchafalaya River, which was a fordable bayou a few years since, instead of all passing as formerly down by New Orleans.

The scheme of Mr. Erkson, which you mention, of using movable dams and jetties first at one place and then at another, seems and is most absurd, when similar but permanent dams and jetties to throw a current so as to scour the bottom, has always failed in producing an improvement. This is simply because all obstructions to free flow of current cause many times greater fill along the river above such contractments than such contractments can scour out between them, therefore the more spent on such system of engineering the worse the river gets, both for floods and navigation. I am somewhat surprised to hear you say the United States Government engineers endorse the movable jetty scheme of Mr. Erkson's, as it is virtually their old method of engineering on that river, varied by an attempt at economy; but as the corps has lately been under the orders of a wildly political congress, you may be correct.

In conclusion, I wish to say I have been a "kicker" for many years against some of the usual modes of engineering on rivers and harbours, and in 1879 I wrote an exhaustive and purely scientific paper on the subject, in competition for a prize offered by the King of Belgium, which prize was to have been awarded within three months, but the committee for deciding have evidently struck a snag, for three years have passed and no award has yet been made. As I know, from long years of study and practice, that my paper is undoubtedly the most radical one offered, I am justified in believing my paper is the snag that causes the delay, as usually the award of a prize in such a case is all cut and dried beforehand. When the committee decides I trust you will be furnished a copy of my paper, and publish it, as it cannot fail to be greatly interesting to your readers. H. F. KNAPP, C.E.

135, Paul-street, New York,
September 28th.

LONG SPAN RAILWAY BRIDGES.

SIR,—In your impression of last week—September 28th—under the head of "Railway Matters," appears a list which has recently been compiled by a Mr. Pfarsk, of the length of the principal railway viaducts in the world. I notice in this that he makes no mention whatever of the longest railway viaduct at present existing in this country, namely, that over the river Severn near Lydney. The length of this viaduct, of which Mr. G. W. Keeling, M. Inst. C.E., and I were joint engineers, and which was opened for traffic on October 17th, 1879, is 1387 yards. Of this a small portion consists of masonry arches over the land, but the main portion over the river, constructed with bowstring girders and cast iron cylindrical piers, comprises the following spans, each measured from centre to centre of the piers:—One span of 150ft.; two of 327ft. each; one of 178ft.; four of 171ft.; thirteen of 134ft. 6in.; and a swing bridge of two openings 203ft. long, including the central pier. G. WELLS OWEN, M. Inst. C.E.

7, Westminster-chambers, Victoria-street,
London, S.W., Oct. 3rd.

HOLLOW CARBON LAMPS.

SIR,—I hope you will allow me to correct what appears to me to be an inaccuracy in your last week's report on the Electrical Exhibition in Vienna, viz., "Mr. Bernstein's object is to make the carbon hollow, while not increasing its cross section; an idea that has probably occurred to many, but no one has hitherto carried it out with practical success."

The invention of Mr. Cruto, an Italian, is much more perfect than that referred to above, and was fully exhibited at last year's Exhibition in Munich. It has, however, been improved again since then. Mr. Cruto prepares his carbons by precipitating chemically pure carbon upon a fine platinum wire, bent into any conceivable form, and succeeds in this way in preparing carbons of any size and resistance. After this operation, the platinum wire is evaporated by passing a strong current through it, and thus a very fine and homogeneous carbon tube is formed, giving a maximum of radiating surface with a minimum of bodily volume.

Elaborate experiments have proved that a considerably greater percentage of Cruto lamps can be lighted per horse-power than any other existing systems of incandescent lamps, and it is surprising to see that this principle of making carbons is not more universally followed.

I do not know whether Mr. Cruto's invention is represented at the Vienna Exhibition, but if it is, it deserves a good reward, as being a great improvement in incandescent lighting. DUX.

London, September 27th.

THE PHONOGRAPH.

SIR,—While reading a treatise on the phonograph, it occurred to me that the following arrangement for transmitting the voice by telegraph, which to my knowledge has not hitherto been suggested, may be made to act:—Fix the tinfoil containing the message on the barrel of a phonograph, and a pointer resting on it in such a manner that the rising and falling of the pointer in traversing the indentations in the tinfoil would make and break the circuit. At the other end of the cable or wire have a pointer so arranged that while the current passed it would be raised, and that when the current stopped it would fall by its gravity, and make a dent in the tinfoil on the receiving phonograph, the signal for starting the turning of the phonographs being given beforehand.

I shall feel much obliged if any one can inform me whether the above arrangement is feasible. W. F. FREMERSDORF.

Cardiff, September 19th.

THE TREVITHICK MEMORIAL.

SIR,—In the notice you were kind enough to give of the "Memorial Life of Richard Trevithick" in your last week's copy of THE ENGINEER, you state that you do not know to whom the credit of initiating the memorial is due. Mr. Hyde Clarke first brought it forward in the columns of *The Mining Journal*, and he has taken an active interest in it ever since. I trust you will publish this explanation in your next issue. JOHN DAVIS, Major,

2, Edinburgh-chambers, Victoria-street, S.W. Hon. Sec.
9th October, 1883.

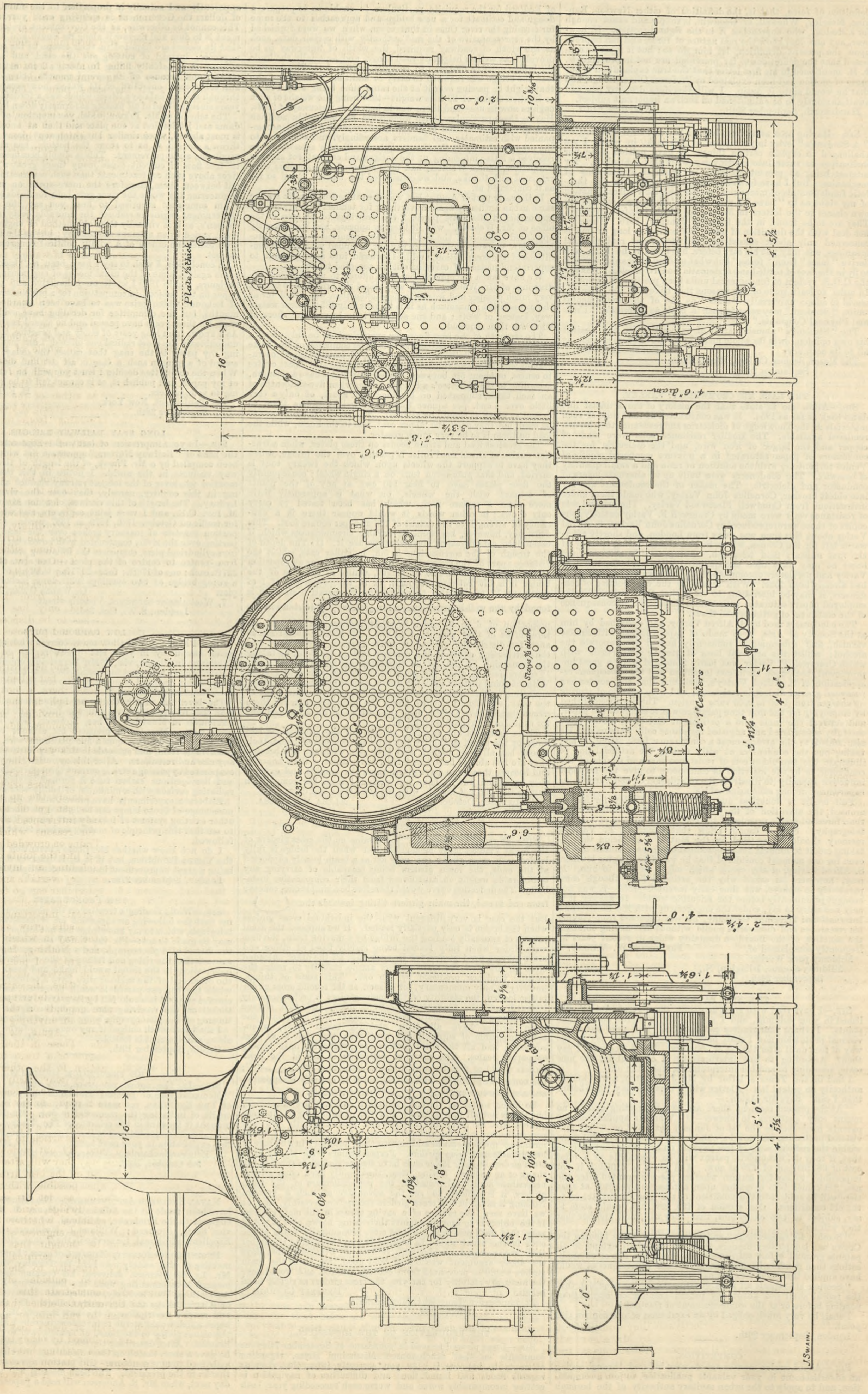
NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—Henry M. G. Pellew, chief engineer to the Pembroke, additional, for service in the Dolphin, vice Scott, deceased; William J. Mullinger, engineer, to the Excellent, additional, for service in the Comet, vice Jordan, retired.

ENGINEERING SOCIETY, KING'S COLLEGE, LONDON.—A general meeting of this society was held on Tuesday, October 9th, when Mr. Le B. Atkinson delivered his opening address. He commenced by commenting upon the Engineering Exhibition at the Agricultural Hall last July, with special reference to the exhibits of King's College and University College. He then gave a short and concise description of the new Patents Bill, and the advantages which would accrue to inventors thereby; also remarking on the clause giving to the Board of Trade power to grant compulsory licenses. After describing the scheme of the Jordan Valley Canal, he gave a short sketch on the objects and working of the society, addressed to new members. The proceedings closed with a vote of thanks to the president. The next meeting will be held on Tuesday next, when Mr. R. Anderson will read a paper on "Explosives."

FOUR-COUPLED EXPRESS PASSENGER ENGINE, LONDON AND BRIGHTON RAILWAY.

MR. W. STROUDLEY, M.I.C.E., ENGINEER.

(For description see page 287.)



FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

PARIS.—Madame Boyveau, *Rue de la Banque.*
BERLIN.—Asher and Co., 5, *Unter den Linden.*
VIENNA.—Messrs. Gerold and Co., *Booksellers.*
LEIPSIC.—A. Twietmeyer, *Bookseller.*
NEW YORK.—The Willmer and Rogers News Company, 31, *Beekman-street.*

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 1d. postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

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

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

A. S.—*We make no charge for letters of inquiry inserted in this column.*

Manchester.—*For runs of under* 100 *miles, the fastest train in the world is the Flying Dutchman on the Great Western.*

A Workman.—*Reid's is the best book you can study to prepare you for passing the Board of Trade examination for a certificate as a sea-going engineer.*

Junior Reader.—*Safety lamps fail for one reason, because a current of air will force flame through the gauze. You can test a lamp with ordinary coal gas, but unless you are cautious you may do yourself serious injury.*

G. L.—*No special article on raising water from a low to a high level has appeared in our columns. There will be no difficulty in pumping water from the brook to the pool* 200 *yards away. If you will state precisely what information you require we shall be happy to supply it.*

Viatus.—*It is quite impossible to give you a valuable opinion as to what you ought to charge on the information you supply. It seems strange that you are unable to say what time was spent in the survey. As far as we can judge, we should think* £50 *ought to pay you, which would, we estimate, amount to about* £2 *a day.*

G. S.—*The sketch you send us illustrates a very old invention, which you will find in a slightly different form in Dirk's* "Perpetuum Mobile." *The wheel will not revolve, because the weight on the bellows* A *in your sketch must fall in order to open the bellows, and it will not have arrived at the point right over the axle at the same time that the weight* B *is right under the axle, consequently the system will not balance. If the parts are properly proportioned, the wheel may be caused to revolve in a liquid without either gain or loss of force, the floating power of the bellows just balancing the loss due to the successive falling of the weights in opening the bellows. The device is worth notice because it supplies a very neat illustration of the law of the conservation of energy, and you will find a mathematical investigation of its properties repay you.*

JOHNSON'S LUBRICATOR.

(*To the Editor of The Engineer.*)

Sir,—Can any of your readers tell us who are the makers of Johnson's patent lubricator? A. and A.

October 8th.

COFFEE'S STILLS.

(*To the Editor of The Engineer.*)

Sir,—I shall be glad to be put in communication with any one making Coffee's stills for producing alcohol from grain. Can any reader give me the address of Mr. Coffee's representative? J. R.

Barcelona, October 5th.

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THE ENGINEER.

OCTOBER 12, 1883.

THE AUSTRAL.

In another page will be found the judgment pronounced on Saturday by Mr. Rothery in the case of the Austral. The importance of the investigation can hardly be exaggerated; and we have reported the evidence at such length that our readers can form their own opinions concerning the propriety of this judgment. To us it appears to be in all respects just and consistent with the facts. No one in particular is to blame, because all of a good many people were in fault. The condemnation of the Court is mild and equally distributed. No one is much, if at all, the worse in reputation; and the Austral herself comes out best of all. The last word, however, has not been said concerning an event which will leave its mark in the mercantile marine. Much of the usually hidden life of a great ship and her crew has been made public; and the revelation is curious and suggestive. In commenting on the overturning of the Daphne we pointed out that while high sided tender ships were, with care, perfectly safe, they required very cautious handling. The evidence given by Mr. Elgar and others concerning the Austral confirms in the strongest possible way what we published on the 31st August. The Austral is a very large vessel; not by any means the largest vessel afloat, but taking rank nevertheless with the finest ocean-going steamers. Yet a comparatively small quantity of coal in the wrong place sufficed to sink her. 120 tons of coal put 7ft. from the side of a ship with a displacement of over 8000 tons, sufficed to send her to the bottom. No one would dream of being anxious concerning the safety of a steamer of the old type, such as the Persia, because 200 or 300 tons more coal was stowed on one side than the other. But the new type screw steamer is a very different kind of craft, more scientifically constructed we are assured, but requiring much more dainty handling. It is very easy to say that the Austral is an eminently safe and stable ship; we have said as much. But she is not a safe and stable ship always. She was a thoroughly unsafe ship at the time she was coaling in Sydney harbour. Whether she kept afloat or not depended on the vigilance of two or three men. This vigilance was not exerted, and she filled and went down, just as the Royal George did at Spithead, when Admiral Kempenfelt and 800 men were drowned. But the Royal George sunk because she had been purposely careened. She went on taking in stores while she was in this condition, till her lower deck ports, which were open, were submerged, and then all was over. The Austral went to the bottom because she had a little more coal in one bunker than another. Some ships are perfectly safe under all circumstances while in port. The captain may go ashore, and all the officers go to sleep; but nothing can happen in the way of oversetting. The Austral, the Thames, the Daphne, and certain other ships, are not safe in this sense at all. At sea they are all right; in port and empty they must be watched, or they will go over. We have explained the nature of the advantages claimed for the deep ship with small initial stability. Some shipowners will think that they may be too dearly purchased. It is a nervous thing for an underwriter to know that a costly ship may go to the bottom if the captain and chief engineer both go to bed while the ship is lying quietly in harbour. It occurs to us that picked captains and engineers will be needed for this class of vessel. The arrival of a collier will be regarded as the approach of a possible enemy. A new terror is added to the life of a sailor. No doubt it may be quite possible to get captains, first officers, and chief engineers who will keep watch with the necessary care; but taking all things into consideration, we venture to say that ships less tender than the Austral will be found, in the long run, more satisfactory than vessels of her type ever can be.

We have said that some curious things came out in evidence. The captain is responsible for certain statements, the accuracy of which has not been disputed. The Austral is a new ship, she has three cylinder engines, as we gather from the evidence. According to Captain Murdoch they were in a dreadful state when the ship reached Sydney. Here are his words: "The engines had all gone to pieces on the voyage out as everyone knew, and there were heavy repairs to be done in Sydney, and so they were in no hurry to leave Sydney. The forward length of shafting had a heavy flaw in it. This was discovered before arriving at Simon's Bay. The high-pressure and the two low-pressure pistons were cracked. The fault in the two latter pistons was discovered at Sydney. The high-pressure valve gear was completely useless. They were trying a little patent with regard to rings inside the valves, and the low-pressure valve gear was in very bad order. When the high-pressure valve gear gave out before arriving at Simon's Bay it broke the crosshead." This is a heavy indictment. We are told by Mr. Rothery and others that the chief engineer was a highly-competent man, a first-rate man, indeed. We can well believe it, but we cannot help asking how it is that new engines went to rack and ruin as these did? We suppose that all the mischief took place during the last voyage of the ship, for, of course, her owners would not send her to sea with a flaw in her crank shaft, to say nothing of the cracked pistons and the damaged valve gear. Even if they had been lax enough to do this the Board of Trade inspector would have interfered. It is not easy to understand how so much mischief could have happened in the time. Messrs. Elder and Co., the builders of the engines, are always extremely reticent about their work. They never permit the outer world of engineers to know much about the proportions they adopt, and criticism is, of course, easily baffled in this way. We do not for a moment venture to suggest that Messrs. Elder are not right, or that their policy is not prudent; but the statements made by Captain Murdoch come as a surprise, and we only utter the sentiments of a great many engineers when we say that we would like some information as to the cause of the breakdown all round of the Austral's machinery. If such a thing had happened in a man-of-war, we would not have been surprised, because it is well known that men-of-war are engined at enormous cost on very peculiar principles, and the engines never have fair play; but the breaking of anything but a crank or propeller shaft is so rare in the merchant service that this failure of the Austral's engines cannot be passed over in silence. When pistons are broken it is usually the result of priming. Was this the case with the Austral? This is only one of many questions that may be and will be asked. Whether they will obtain answers or not remains to be seen. It is well known that a certain amount of reticence is observed concerning the performance of the machinery of most of our great ocean steamers, but we are willing to believe that the cracking of three pistons, the flawing of a crank shaft, and the ruin of the valve gear, do not often all occur on the same voyage. We believe the Austral has got piston valves. There have always been grave doubts among engineers as to their excellence. The experience had with them on board the Austral is not re-assuring. It is a fortunate circumstance that after the failure of her machinery the Austral did not meet with exceptionally heavy weather.

RAILWAY UNPUNCTUALITY.

The columns of the daily press have recently been filled with letters complaining of the unpunctuality of railway trains. The South-Eastern Company appears to have done more than any other to excite metropolitan wrath; and it must be admitted that the statements concerning its proceedings are sufficiently damaging. There are, however, certain points on which the travelling public, from lack of knowledge concerning what we may term the inner life of railways, are mistaken; or concerning which they have got erroneous impressions, and it is worth while to remove these. Physicians formerly treated symptoms instead of the causes of the symptoms, and the travelling public pursues much the same plan. They complain because trains are late, and do not keep time; but railway unpunctuality is only a symptom of deep-seated evil, and it is to the removal of this attention should be directed. Unfortunately the subject with which we have to deal is so complex and extensive that much more space than we can spare might with advantage be devoted to it. We can, indeed, do little more than glance at some of the more prominent features of the system, or want of system, that makes trains late.

We have often heard it urged that it would be just as easy to run trains with punctuality as without it, if the time tables were properly drawn up. This, however, is not the case. The time tables have little or nothing to do with the matter. The primary cause of want of punctuality in such trains as those run by the South-Eastern, is the overcrowded state of the road. The secondary cause lies in the relative incompetence of the traffic manager or his staff. Just as a good coachman will manage to proceed at a fair pace through crowded streets, while a bad driver can scarcely make any progress, so will one railway man deal successfully with an amount of traffic which will drive another half crazy. But the whole of the responsibility must not be thrown on the traffic manager. A great deal rests with the engineer and with the locomotive superintendent, and we fear we must add that the former is usually as great a sinner as either of the others. A theoretically perfect railroad would consist of two lines, one up and the other down, extending from terminus to terminus, without break or interruption of continuity. On such a road the maximum amount of traffic could be conducted, the trains following one another up and down in regular succession. It will be seen, however, that even this, the simplest form of railway, cannot be worked without introducing certain complications at the termini. One train which we shall call A arrives, let us say, from the country. Another train B is timed to start about the same time for the country, and it departs accordingly. As soon as it has left, A has to be moved from the arrival to the starting platform, and this may be done either by the engine which has just brought it in or by the engine which is just going to take it out. While the train is being shunted both roads are blocked as regards regular traffic, nothing can come in from the country and nothing can go out. Not only has the train to be shunted, but the engine has to be disposed of; its movements constitute to all intents and purposes a separate shunting, and by this means the time during which the line is blocked is practically doubled. When a considerable interval elapses between the arrival and departure of trains there is plenty of time for shunting; but when the trains follow close on each other's heels there is not, and the result is that accommodation enough in the shape of "docks," as they are called, must be provided; so that if a train on its arrival outside the terminus finds one dock occupied, or access to it interrupted, it can be sent into another. This entails the fantail arrangement, with which most railway travellers are familiar. If they take the trouble to think the matter out with a little care, they will find that no matter how many blades there are to the fan, it can have but one handle—namely, the up and down main lines—and unless the trains can get off these on to the blades, traffic must be seriously interrupted, even to long distances down the country, for reasons which will no doubt be sufficiently obvious. Trains on crowded roads near the metropolis follow one another like the joints of a caterpillar, the block system establishing an invisible link between them; and no one joint can overtake another, any more than one segment of a caterpillar can go faster than another segment. If our readers have followed us thus far, they will see that very great importance attaches to the way in which the fan blades grow out of the handle, or in other words, to the way in which the main line is connected to the docks. Nothing, for example, can be worse than to make one group of points in close proximity to each other serve for several docks; because as only one pair can be used at a time, the entrance to or exit from other docks may be repeatedly interrupted. It is not too much to say that more depends on the attention paid to such a matter as this than on anything else in the conduct of heavy terminal traffic. Again, we have what are known as cross-over roads. These in their simplest form are used to enable an engine or a train to proceed from one side of a wide station to the other without interminable shunting; but they may easily do more harm than good. Where possible, dock roads should always each grow out of the main road, and not out of each other. In the latter case, one train going out or going in may block two or three others. We strongly advise young engineers who may read this article to take paper, pencil, and drawing-board, and lay out a few termini on different systems. In this way they will, after a certain number of trials and failures, hit on the best arrangement. Let them then compare this, when possible, with the actual arrangements in such a station as, let us say, Lime-street, Waterloo, or London Bridge, and they will thus be able to say for themselves whether the most has or has not been made by the engineer of the space available. Lest it should be thought that we exaggerate the importance of proper terminal arrangement, we call our readers' attention to the fact that trains are constantly delayed outside of termini. Their own experience will demonstrate this. Delays of this kind are due to the circumstance either that there is no dock empty for the train to run into, or, as is more often the case, although a dock or docks may be empty, the lines leading to it are all fouled by other trains going in or going out. On some roads nothing but the utmost care on the part of pointsmen and station superintendents prevents traffic coming to a dead-lock. A light engine, for example, getting on to a bit of road between two trains, may tie an almost inextricable knot, leading to an enormous amount of shunting to get the unlucky intruder out of the way.

Now, it requires not much experience in the management of railway traffic to perceive that in not a few of our termini the roads have been laid out just as they ought not to be. We can hardly say that this was due directly to want of—shall we say proper thought?—on the part of the engineer. The growth of the systems accounts for it. Stations are enlarged, and new docks, and sidings, and cross-over roads have to be put down; and these have to be put in, not where they ought to be, but where they can. The result is disastrous. The effect of crossings, again, is extremely detrimental. A very few crossings, indeed, may reduce the accommodation presented by a road to a surprising extent. Many examples of these are to be found near London. For example, at Herne Hill the London, Chatham, and Dover Railway splits into two, one leg of the Y running to Victoria and the other to Ludgate Hill. But the up line to the latter place, of course, crosses the down line from Victoria; consequently, if a train to Ludgate Hill arrives at the junction when a down train from Victoria is nearly due, the up train has to await the arrival of the down train. We have in this case an excellent example of how unpunctuality all over a line may be brought about by bad terminal accommodation. Let us suppose that a South-Western train arrives at Herne Hill for Ludgate. This train, being a species of interloper, has to give precedence to the main line trains. The down main line train, let us suppose to Ramsgate, is due just before the Ludgate Hill train comes in; but the Ramsgate train has been shut in at Victoria by other trains shunting on the only road out. Consequently it arrives at Herne Hill, we shall say, three minutes late. The South-Western crosses as soon as the main line train has cleared the road; but on arriving at Loughborough Junction it finds that it is now behind a Crystal Palace up train, instead of before it. The Palace train stops at all stations, the South-Western is express; but it now perforce moves at the same pace as the Palace train; and when it does arrive at Ludgate it finds no platform ready to receive it, or if one is ready, it has to wait for a crossing to be cleared. In this way half an hour may be lost entirely because there is a cross-over road at Herne Hill, and main line trains cannot always get out of Victoria when they ought. The line we have mentioned, however, is well laid out compared to some others. The South-Eastern, including all that portion between Charing-cross and Spa-road, Bermondsey, is as bad as it is possible for a road to be.

Recapitulating what we have said, we repeat that for all that species of unpunctuality of which city men justly complain want of terminal accommodation is mainly to blame. It is often urged that more cannot be done for want of room. With this we do not agree; a general remodelling of points and crossings and the superseding of some and the putting in of others, might often effect great changes for the better. We could cite cases in which the use of a starting platform as one of arrival nearly doubled station accommodation. In another case, when a train arrived late, it had to be sent out again at once. It was the practice to draw the train out of the station and back it in on another road at the opposite side of an island platform. At least five minutes were lost in this way; then it occurred to the station-master that when the train went out it might just as well go on instead of coming back. So the engine was run round the island platform while the passengers were taking their seats, and great expedition was the result. But sometimes the road was blocked, so that the engine could not get round the train, and delay was incurred. To overcome this a second engine was kept on a siding where it was not in the way, and it was coupled on to the train and ready to go away with it almost before the passengers were out. Here we have an example of what may be done by skilful management to obviate the defects of a road. One shunt was dispensed with by despatching the train from the platform at which it had just arrived. Unfortunately far too little attention has been paid to the laying out of stations. For moderate or main line traffic almost anything will do, but the case is very different when we come to deal with the enormous tide of traffic which ebbs and flows through London termini and terminal stations. Not less than 1800 trains and light engines, for example, pass through Farringdon-street Metropolitan station in the twenty-three hours of a railway day. These trains belong to six companies, namely, the Metropolitan, the Metropolitan District, the Metropolitan Extension, the Midland, the Great Northern, and the South-Eastern, and they have four lines of rails to run over. This gives 450 trains in twenty-three hours for each line, or, in round numbers, a train every three minutes. This traffic could not possibly have been conducted but for the precautions adopted to avoid the use of a cross-over road, the trains going to King's Cross and St. Pancras dipping under the Metropolitan line, itself already in a tunnel. Finally we may point out that no amount of complaining on the part of the public will do any good, when fantails are already properly laid out, cross-over roads judiciously put in, and the management able and willing to make the most of the accommodation available. Unfortunately, however, there are very few lines in which there is not room for improvement in both respects, if there is not room for anything else. Mr. Nupkin's servant, on being asked by Sam Weller if he did not answer the drawing-room bell, replied, "Not unless they persewere." The managers of metropolitan railways are prone to follow this example, and refuse to do anything for the public unless they persevere. The public is sometimes not only very unjust but injudicious in its complaints. In the present instance, however, it appears to be neither one nor the other. The South-Eastern Railway terminal accommodation is very nearly as bad as possible. So is the management of the passenger traffic.

IS WOOD PAVEMENT UNHEALTHY?

THE re-laying of wood pavements in London has been going on for some time, and those whose business or pleasure takes them through Fleet-street or Queen Victoria-street will find ample opportunities for learning how it is done. The use of wood pavement in the metropolis is extending. Thus, Victoria-street, Westminster, which was for many years macadamised, and always in a dreadful condition, was paved with wood last year. Asphalte holds its place, but its use is not extending. In all cases in which stone pavements have been recently discarded, wood has been laid down instead, and it is worth considering whether those in authority have acted wisely in giving the preference to wood. In saying this we have no intention of raising any question regarding cost or durability. The doubt which we suggest concerns the hygienic conditions under which the inhabitants of great cities live. It may be new to many of our readers to learn that eminent authorities have strongly disapproved of wood pavement; and the municipal authorities of New York have gone so far as to abandon the use of wood altogether as a material for street roadways. Some time since an inquiry was addressed to the *Journal of Commerce*, a very high-class New York paper, which inquiry ran as follows:—"Will you kindly inform us if the use of wood as a street pavement has been discontinued in New York from fear of its liability to harbour infectious diseases?" Our contemporary replied, "The reason assigned was one objection to the use of wood pavements, but the chief reason for their discontinuance was on account of their total failure to answer the purpose of their construction. They very soon became rotten, unhealthy, and dangerous to life and limb." New York is almost entirely paved with stone, and the streets are therefore extremely noisy. As Americans study comfort a great deal, it seems to be proved that wood pavement has failed in New York.

Experience in this country is on the whole favourable to its use, and it is quite possible that the peculiar conditions which obtain in New York, and do not obtain here, have much to do with the rejection of wood as a paving material in that city. New York is founded on rock, covered with a few feet of soil. Thus cellars have to be blasted out. This rock is apparently impervious to moisture, and all the rain that falls is trapped in the soil. The conditions are those of the earth in a badly drained flowerpot. The sewer system of New York is also defective. Fevers of the malarial type are common enough there, though little known here. The conditions of temperature, too, are favourable to the development of infectious and contagious diseases. The temperature in summer constantly exceeds 80 deg., and sometimes passes even 100 deg. For these reasons wood pavements may be unhealthy there and not in London. As regards wear and tear and durability, we have nothing like so much reason to complain as our transatlantic friends. Wood pavement here answers on the whole very fairly, and in one respect it is infinitely superior to asphalte. It always gives foothold for horses, very nearly if not quite as good as stone. A shower of rain on a summer day will render the streets laid with asphalte in the City absolutely impassable in five minutes. Horses fall down as though they tried to stand on ice. When quite wet and clean, asphalte is not slippery; but when just moistened, and ever so little dirty, no horse can stand on it. The interruption of traffic from this cause is a matter of almost daily occurrence in spring and summer, and those who go to the City day by day could narrate many cases illustrating the effects produced by a little rain in Cheapside, the Poultry, Bishopsgate-street, &c. But however good wood pavement may be in other respects if it can really "harbour infectious disease," then we should think twice before using it. General Gilmore, an American engineer officer, and an excellent authority on most of the subjects on which he has written, has handled this question at some length. In his treatise on roads, published in New York in 1876, he describes wood pavements of various types much the same as we use now, and quotes several authorities concerning their unhealthiness. He points out that the joints of a pavement, whether of wood or stone, constitute, after enlargement by wear, fully one-third of its area, and under average care the surface of filth exposed to evaporation covers fully three-fourths of the entire street. "This foul organic matter, composed largely of the urine and excrement of different animals, is retained in the joints, ruts, and gutters, where it undergoes putrefactive fermentation in warm, damp weather, and becomes a fruitful source of noxious effluvium. In dry weather this street soil, of which horse dung is a large ingredient, floats in the atmosphere and penetrates the dwellings in the form of unwholesome dust, irritating the eyes and poisonous to the organs of respiration," and so on. The late Mr. P. Le Neve Foster reported to the Society of Arts in 1873 against wood:—"Impregnation of the wood with mineral matters to preserve it from decay may diminish these evils, but nothing as yet tried prevents the fibres being separated and the absorption of dung and putrescent matter by the wood being continued. Wood is wet or damp, more or less, except during continued dry weather. Its structure is admirably adapted to receive and hold, and then give off by evaporation very foul matters, which taint the atmosphere, and so far injure health." Professor Fonnsagrèves, of France, says:—"The hygienist cannot, moreover, look friendly upon a street covering consisting of a porous substance capable of absorbing organic matter, and by its own decomposition giving rise to noxious miasma, which, proceeding from so large a surface, cannot be regarded as insignificant. I am convinced that a city with a damp climate paved entirely with wood would become a city of marsh fevers." We do not think we need proceed further with this indictment. We have quoted enough to show that very strong opinions are held on the subject.

Now, we certainly cannot go so far as General Gilmore; and the establishment of what is known as "the street orderly binn system," by which dung is removed at once from the streets, has considerably modified the conditions of relative cleanliness and dirt. It must not be forgotten that the question is complicated by the fact that there is no non-absorbent pavement or roadway in existence save asphalte, and to that there are, as we have pointed out, grievous objections. The points for discussion are, is wood pavement worse than stone or macadam from a sanitary point of view? Our own opinion is that it is not; but on the other hand, there are wood pavements and wood pavements. Thus, on one system, creosoted wood blocks are laid direct on a bed of cement concrete, and rendered watertight by a filling of asphalte and gravel put between the blocks. According to another system the blocks are laid on a flooring of boards interposed between them and the cement; and in a third plan the blocks are of yellow pine not creosoted; these are laid on concrete, a carpet of tarred felt being interposed between the two, and strips of felt are placed on edge between the blocks. The whole road is then covered with hot asphalte run into every crevice, and fine gravel being spread over all, the road is complete. The gravel is crushed into the wood and makes a hard surface, promoting the longevity of the road. It is not easy to see how such a track as this can absorb much putrescible matter, and we may ask whether there is really any tangible basis of fact to go on, proving that wood pavements are more unhealthy than any of the others available by the engineer. These are very few; his choice must be made within a very narrow range, but the range is at least wide enough to permit us to reject wood if it could be shown, for example, that it propagated fevers. Theorising on this matter is of little avail. We suppose that in New York it was really found that wood pavements were prejudicial to health. We do not think that this has been found to be the case in this country. It is, however, worth while to ask the question, has it? and the appearance of the query in our pages may perhaps elicit some useful information on a subject concerning which, in truth, very little seems to be available.

THE REALISED PRICE OF IRON.

THE return of the accountants appointed under the sliding scale in the Cleveland iron trade of the North of England shows that there has been a fall in the realised price of pig iron, and to an extent that brings that price down below £2 per ton. It is shown by this that the price has now nearly reached that in the market, and that the rate that now prevails is about as low as allows of a profit. Of course the producer of the iron may obtain a higher price, because the price ascertained and reported on by the accountants is that of Cleveland No. 3 quality; and there is a considerable production of better qualities, and a production also of hematite and other iron that brings a higher price. For a considerable period the make of pig iron in the Cleveland and Durham district has been increasing in the total, though the increase has been mainly in the production of hematite iron. But now that prices are so low for all classes of iron, it may be looked upon as probable that that enlargement of the manufacture will be checked, unless the decrease in the stocks that has been so marked during the last month has a beneficial effect upon prices. The realised price is not likely to move upwards during the present year, because there have been contracts entered into that will not allow of much movement, low though the present price may be. But at the end of the year the sliding scale that is set in motion by the realised price comes to a termination, and it is possible that the reduction in the stocks of Cleveland iron, and the effect that the low prices must have on the production, must materially affect the situation, and may cause the range of prices in the next year to be very different from what they have been this. The damping down of the furnaces at Middleton, near Darlington, is one the effects of the period of low prices that is likely to be followed by others, and if that example is largely followed the decrease in the stocks of pig iron in the hands of the makers that has been known during the summer may continue throughout the winter. Inland, in other centres, the production of crude iron is being reduced, and the effect of that reduction must speedily tell upon the stocks in Cleveland and Scotland—the two chief reservoirs of iron—and ultimately on the price of iron in those districts.

A VACUUM BRAKE COLLISION.

A SERIOUS collision has occurred on the Long Island Railroad, the circumstances connected with which are somewhat remarkable. The American papers write:—"A fresh disaster, accompanied by loss of life, has been added to the tragic record with which the Long Island Railroad closes the summer season. Either through the carelessness of an engineer or the use of defective air brakes, the train which left Manhattan Beach at six o'clock in the evening of September 11th dashed into a North Shore locomotive at Hunter's Point. The engine of the train, as well as that with which it collided, was reduced to a shapeless heap of shattered metal. The forward cars of the train were also crushed into fragments. In the sudden and terrible collision many suffered injuries. Few of the passengers, indeed, escaped a bruise or a scar. Two men lost their lives in the disaster and three others had to be removed from the scene of the accident in an ambulance. The hospital surgeons found the injuries of all these very serious, and it is thought not improbable that the list of fatalities may be further extended." It appears that the train which did the mischief was fitted with a vacuum brake, and that when an attempt was made to stop at East New York station, it was found that the brakes were out of order and would not act. No harm, however, was done; the train ran through the station and had to be backed up to the platform, in a way well understood by all who have had much experience with vacuum brakes. The train proceeded deprived of brake power. We should have supposed that it would have been run afterwards with great caution. Whether it was or not, however, instead of stopping at a junction known as "The Switch," to let another train pass, it kept on its way and ran into the other train, with the result already stated. Taking all the circumstances into consideration, the vacuum brake does not come out of this affair with any accession of credit.

LITERATURE.

The Theoretical and Practical Boiler-maker, containing a Variety of Useful Information for Foremen and Working Boiler-makers, &c. &c. By SAMUEL NICHOLLS. Second edition. Published by the Author, South Beach, Blackpool. 322 pp.

THE first edition of this book was published in 1876, and its appearance in a second edition is some evidence that it contains what is required. It deals with boiler-making chiefly from the foreman boiler-maker's standpoint. It gives fully the practical geometry necessary to enable a plate-worker to set out plates for any form of boiler work. It gives a number of tables of circumferences and areas, weights, bursting pressures, and strength of materials. But it gives a good deal more, and this new edition contains some judicious remarks on the use of steel in boiler-making, and its manipulation in the boiler shop. On the strength of flat plates and stayed surfaces the author supplies about all the rules that can be found, and on heating surfaces he gives the results of a large number of experiments, which have led to the construction of numerous empirical rules on the subject, from the early days of boiler-making to recent times. From these a fairly accurate idea of the necessary amount of heating and grate surface in any case may be obtained by any reader; but the author might somewhat increase the value of this important part of the book by entering more fully on the theory which should guide an engineer in determining the amount of heating surface in accordance with the position of the several surfaces making up the total, and in proportioning it in accordance with the form and size of the boiler and its requirements. For those for whom the book is intended, however, it is to be recommended, as it contains something on almost every question in boiler-making in general; and the rules are backed by references to experimental proofs, and examples of their applications are given. There is, moreover, nothing in the book which any one wishing to learn cannot understand.

American Foundry Practice. Treating of Loam, Dry Sand, and Green Sand Moulding, and containing a Practical Treatise on the Management of Cupolas and Melting of Iron. By T. D. West. New York: J. Wiley and Son. 391 pp.

In the opening chapter of this book the author, who it soon becomes evident is what he describes himself to be, a practical moulder and foundry foreman, takes up the cudgels in praise of moulders in a style which is American in freshness. Although he tells the moulder it is his fault when he loses a casting, he tells others that the draughtsman, pattern-maker, and fitter are not more necessary to men entering foundries, and it is not at all of the sort written by the lettered but unpractised compiler of books.

ON THE CHANGES BROUGHT ABOUT BY ARTIFICIAL ILLUMINATION IN THE COMPOSITION OF THE AIR OF CLOSED ROOMS.

On the contamination of the air of rooms by artificial illumination, results have already been published by B. Zoch and F. Erismann. These, however, applied to rooms with a strong natural change of air, and in the case of the work of the last-mentioned showed the percentage of carbonic acid only was from 1·3 to 3·4. Such experiments can only have a value for the room in which they are carried out. We here purpose to draw attention to the investigations of Ferdinand Fischer; he takes for the material of his experiments the gas of Hanover, which according to the published analyses requires, when it is burnt, for 1 cubic metre of it, 1·12 cubic metre of oxygen, and gives 0·57 cubic metre or 1·13 kilogs. of carbonic acid, and 1·07 kilogs. watery vapour. In a similar way the oxygen required by other illuminating materials may be represented, so that the changes in the air by this loss of oxygen cannot be compared with the contamination of the same by the quantity of carbonic acid and watery vapour produced, as can be seen from the following composition:—

Illuminating materials.	Percentage composition.			1 kilog. requires for combustion.	1 kilog. produces	
	Carbon.	Hydro'n	Oxygen	Oxgen. Kilogs.	Cabonic acid: kiogs	Water kilogs.
Stearine ..	76·1	12·5	11·4	2·92	2·79	1·13
Rape oil ..	77·2	13·4	9·4	3·04	2·83	1·21
Tallow ..	78·1	11·7	9·3	2·91	2·86	1·05
Spermaceti	81·6	12·8	5·6	3·14	2·99	1·15
Bees-wax ..	81·8	12·7	5·5	3·14	3·00	1·14
Petroleum	85·2	14·8	—	3·45	3·12	1·33
Paraffin ..	85·7	14·3	—	3·43	3·14	1·29

According to the experiments of the Paris Commission, the electric light, on the arc system with an equal current, gives from 71 to 113 Carcel*; in the electric candle it gives what is equivalent to from 25 to 52 Carcels; and in the incandescent light, from 12 to 22 Carcels. To produce a light power of 100 German candles, there are consequently required for the arc light 0·09 to 0·25 of *e*—by which is meant a unit of an electric lighting power—for an incandescent light, 0·46 deg. to 0·85 *e* are required, which correspond to an amount of heat per hour of 57 deg. to 158 deg. Cent., or 290 deg. to 536 deg. Cent. respectively. The costs given in the following table of them are founded on the experiments which have been made at Strasburg. According to the experiments which have been made by Schilling, the Paris Carcel lamp burns hourly 42 grammes of purified rape oil; the Munich normal candle, 10·4 grammes of stearine; the German candle, 7·7 grammes of paraffine; and the English normal candle, 7·82 grammes of spermaceti. The quantities in the following table reckoned from this, as well as the quantities of gas calculated from the results of Fr. Siemens and Rüdorff, correspond to the most favourable conditions. The remaining numbers are the result of personal investigations:—

For the hourly production of 100 candles there are required			There will be produced		
Nature of illuminant.	Quantity.	Price in pfennigs.	Water, kilo.	Carbonic acid, cb. m. at 0°.	Heat, Centigrade.
Electric arc light ..	0 09 to 0·25 e.	5·4 to 12·3	0	0	57 to 158
Electric incandescent light	0·46 to 0·85 e.	14·8 to 14·9	0	0	290 to 536
Gas in Siemens' regenerative lamp .	0·35 to 0·56 c. m.	6·3 to 10·1	—	—	about 1500
Gas in Argand burner	0·8 cb. m. to 2	14·4	0·86	0·46	4,860
Gas in fish-tail ..	2 cb. m. to 8	36·0	2·14	1·14	12,150
Petroleum in large round burner ..	0·28 kilo.	5·0	0·37	0·44	3,360
Petroleum in small flat burner	0·60	10·8	0·80	0·95	7,200
Solar oil lamp ..	0·28	5·3	0·37	0·44	3,360
Solar oil small flat burner	0·60	11·4	0·80	0·95	7,200
Rape oil in Carcel lamp	0·43	41 3	0·52	0·61	4,200
Rape oil in study lamp	0·70	67 2	0·85	1·06	6,800
Paraffin	0·77	139	0·99	1·22	9,200
Spermaceti	0·77	270	0·89	1·17	7,960
Beeswax	0·77	308	0·88	1·18	7,960
Stearine	0·92	166	1·04	1·30	8,940
Tallow	1·00	160	1·05	1·45	9,700

If we calculate one cubic metre of coal-gas to be worth 18 pfennigs, including interest, 1 kilo. petroleum to be worth 18 pfennigs, 1 kilo. solar oil at 19 pfennigs, stearine and paraffin at 180, tallow at 160, purified rape oil at 96, spermaceti at 350, and beeswax at 400 pfennigs, we obtain the values per hour given in the second column for 100 candles lighting power; they depend naturally, especially where the electric lighting is concerned, on local circumstances. With regard to the contamination of the air, carbonic acid and watery vapour claim our first attention. From the numbers given in the above table, it follows that carbonic acid and water have to be considered first. Solar oil and petroleum give the least carbonic acid and water, and coal-gas and tallow the most. With a view of testing whether the composition of the air is likewise changed during artificial illumination by products of incomplete combustion, such as carbonic oxide, hydrocarbons, &c., an apparatus was prepared by which the gas coming from the cylinder of a lamp was conducted through a series of tubes, which could collect whatever might be formed. Only traces of carbonic oxide and of hydrocarbons could be recognised in 12 litres of burned gases. When the flame is made very large or very small, however, the admixture becomes more apparent, and they all yield a large excess of free oxygen. Flat wicks of solar oil or petroleum give from 4 to 5 per cent. of carbonic acid and about 15 per cent. of excess of oxygen; small round burners from 5 to 6 per cent., and larger ones 5 to 8·5 per cent. of carbonic acid, and from 9·3 to 14·0 per cent. of oxygen. Argand burners yield from 8 to 16 per cent. of excess of oxygen. The larger the excess of air, the lower is the temperature of the flame, and the smaller the amount of light emitted, till, by continued diminution of the flame, the temperature at last falls so low that a part of the gas finally escapes unburnt.

Immediately above the points of spermaceti and stearine flames, the developed gases give no combustible gases, provided the flames are quite steady; but as soon as the flame begins to flicker, the combustion commences to be incomplete. In the case of coal gas, if the flame is badly placed, or by awkward treatment of the burning gas, the coal gas itself escapes direct into the room, the impurities which are constantly present in this illuminant must not be forgotten. The gas illumination, too, developes much more heat than an oil illuminant. Of the solid materials, tallow burns with the least inconvenience in this respect. Among the cheapest are solar oil and petroleum. Ordinary gas illumination is decidedly dearer, and renders the air more impure by its great heat. Where all other conditions are the same, the illumination with the so-called regenerative burners, and removal of the products of combustion, or electric illumination—especially the incandescent lamps with accumulators, which give a quiet and pleasant light—are to be preferred to others, because they do not render the air impure, and give the least heat of all kinds.

* 1 Carcel is equal to 9·6 English spermaceti candles, equal to 8·7 Munich stearine candles, and equal to 9·8 German paraffine candles. Compare with Schilling on "The Luminous Powers of Gas," page 214.

FIG. 1

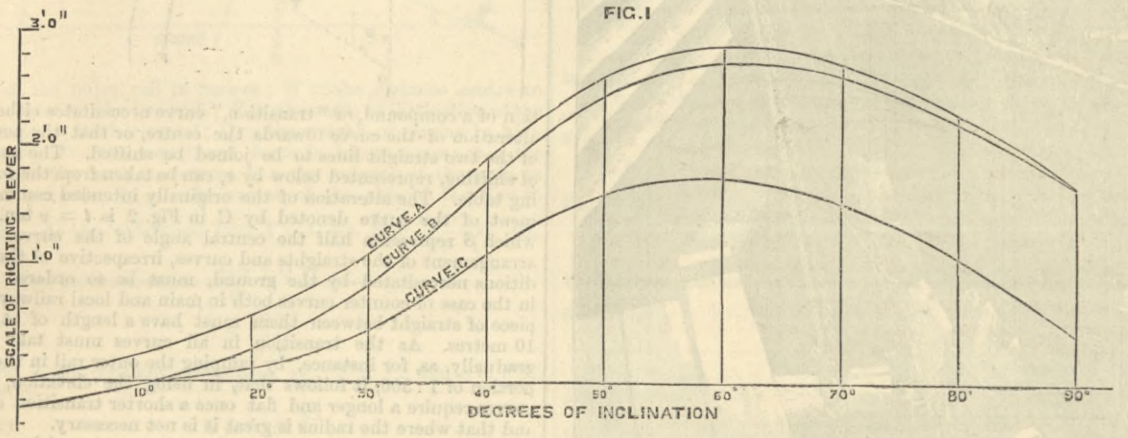
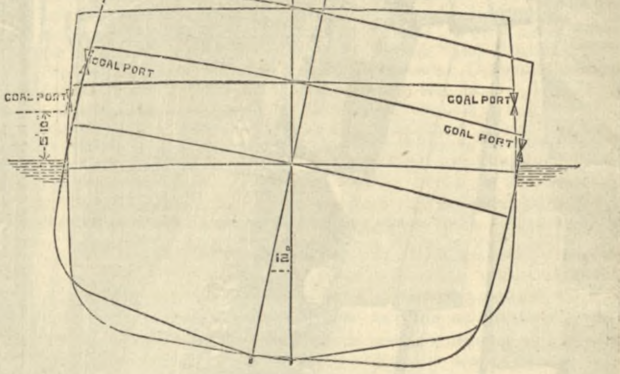


FIG. 2



CURVES OF STABILITY OF S.S. AUSTRAL.

production of that sublime structure a steam engine than is the moulder, and he complains that the importance of the real skill and ability displayed in making good castings is only sufficiently appreciated when the moulder is wanted to explain his reason for ornamenting his work with scabs and sand holes. The author is amusing on moulders' excuses, and does the moulder no more than justice when he says that there is no trade that keeps the mind so unsettled, expectant of reverses, and likely to produce nervousness as that of the moulder.

Books on foundry work are not very numerous or too good. There is yet room for a really well-written book on foundry work. The book before us is quite a valuable addition to those on the subject. It is written by one who writes of his own experience and knowledge, and not merely of what he has read. The fault of the book is that where illustrated descriptions are necessary, the author, knowing of the thing or things himself, cannot always put himself in the position of one who does not know. Hence some of those parts of the volume which are illustrated are not as clear as they need be. On the other hand, the author has given more information of how to proceed with a job, from the point of view of one who really has to do it, than has been published in any previous work. He does not tell a student, for example, that a box is rammed up, but he tells him a great deal of how different boxes with different forms of moulds and sizes of castings must be rammed, for successful ramming is far from the simplest of arts. Of coring, venting, supporting cores and projections, he gives information which tells a man how to go to work, and not merely that such and such things have to be done carefully and properly.

Some parts of the book contain American expressions not easily at first understood, and the following, from the chapter on iron mixtures, for sash-weight mixture, may be a joke; but the author is not explicit in this matter, and does not follow the commendable plan of Mark Twain, and say when a joke is meant: "Two-thirds scrap tin, one-third stone plate scrap. This mixture when melted made white iron." On some points the author necessarily deals with American practice in matters which are of equal importance with us; but his information has a local value only. For instance, in the chapters on iron mixtures, melting iron, and fuel, and charging iron, the different irons may have the same numbers as some of the best known British pigs; but the character of the irons is very different, and hence much that is said on these subjects is more illustrative than specific. On fuel, and charging into the cupola, the author speaks at considerable length on the relative efficiencies of coke and coal in cupolas, and on their effects on the iron and on the cupola. On chilled castings the author is less specific as to mixtures than on other castings; but on the means of obtaining clean chilled castings he gives some useful hints, evidently from personal experience. The book is a useful one, especially for young

STABILITY CURVES OF THE S.S. AUSTRAL.

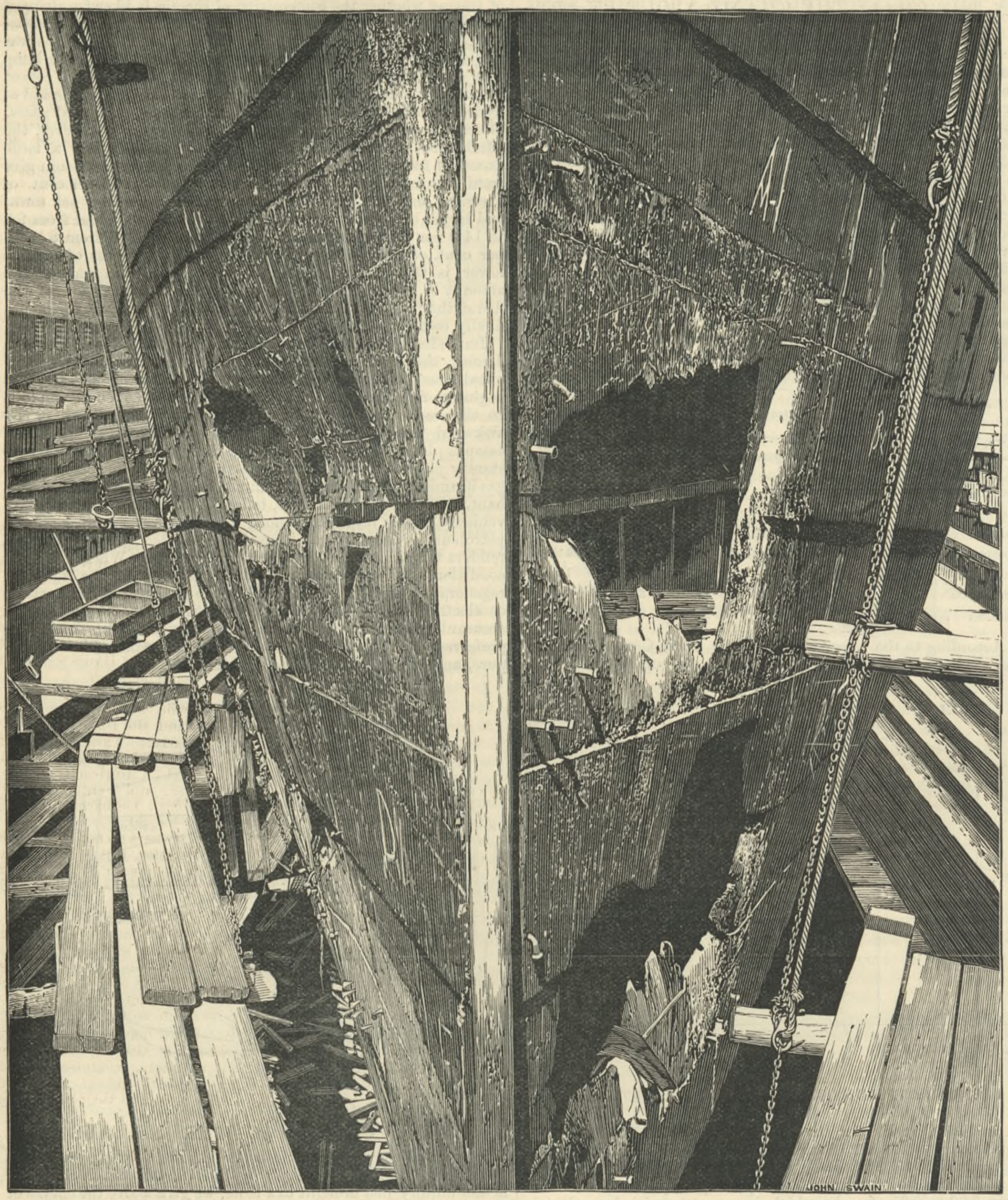
In view of the very great interest that has been shown by the public generally, and especially by those interested in shipping, in the inquiry just brought to a close, we give above the curves of stability of the Austral as deduced from calculations by Mr. Elgar. The curve marked A is the curve of stability the vessel would have had on the night of the disaster had the centre of gravity of the 120 tons of coal taken on board that night been at the middle line. The mean draught at that time was 22ft. 3⅝in., and the displacement at that draught 8070 tons. The metacentric height was 1·276ft.; the maximum righting moment is reached at an inclination of 61 deg., where the length of the righting lever is 2·88ft., and the righting moment 23,242 foot-tons; while at an inclination of 90 deg., when the vessel is on her beam ends, the length of the righting lever is 1·71ft., and the righting moment 13,800 foot-tons. With the 120 tons of coal placed, however, with its centre of gravity at a distance of 7ft. 2in. from the side of the vessel, the centre of gravity of the vessel itself is moved towards that side a distance of about 3in., and the stability becomes reduced, as shown by curve B, which gives the stability under those circumstances. It will be seen that curve B crosses the base line at an inclination of 12 deg., and the vessel would, therefore, incline through that angle before attaining a position of equilibrium. When this position is reached, however, the lower edge of the aftermost coaling port is at the water level, and the water commences to enter the vessel. It will be seen that at large angles of inclination the difference between curves A and B is but small. Curve C represents the stability the Austral would have if the centre of gravity were raised 1·276ft., so as to make the metacentric height *nil*. In this case the curve rises very slowly, starting from the upright position, but it has a considerable maximum righting moment, and a large range. Fig. 2 shows the position of the aftermost coaling port relative to the water level with the vessel upright, and also its position when the vessel is inclined through an angle of 12 deg.

EXPRESS PASSENGER ENGINE, LONDON AND BRIGHTON RAILWAY.

In our impression for September 7th we illustrated a new express locomotive designed and constructed by Mr. W. Stroudley, locomotive superintendent of the London, Brighton, and South Coast Railway, for working fast trains. On page 284 will be found end views and cross sections of this engine, which we shall further illustrate and fully describe in an early impression. The engravings we now publish are dimensioned, and explain themselves. We may add that the slide valves are placed under the cylinders instead of on top or at the side.

South Kensington Museum.—Visitors during the week ending Oct. 6th, 1883:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 11,491; mercantile marine, Indian section, and other collections, 5247. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 5 p.m., Museum, 1768; mercantile marine, Indian section, and other collections, 1789. Total, 20,295. Average of corresponding week in former years, 17,511. Total from the opening of the Museum, 22,451,709.

THE BOWS OF THE S.S. ST. GERMAINS AFTER COLLISION.



In tl e month of August the steamship St. Germains, of the French Transatlantic Company, ran into the Woodburn, a disabled steamer in tow of a tug. The Woodburn sank in three minutes, and eighteen lives were lost. The St. Germains was on her way from Havre to New York with 600 passengers on board. She is over 400ft. long, and 4000 tons burthen. The passengers were rescued by the tug, and the St. Germains at slow speed ran for Devonport. She was then taken into dock at Plymouth, and her bows were patched up with wood, and she was then sent round to Southampton to be repaired. Our engraving is from a photograph, by Messrs. Adams and Stilliard, Southampton, showing the condition of her bows when the wood patching was removed. She reached Southampton on September 4th, and was docked on the 8th, and repairs commenced by Messrs. Oswald, Mordaunt, and Co.

An examination of the ship when docked showed that the plating was broken above the water line for a distance of 40ft., and on the starboard the side is crushed in below the water line for a length of 55ft. The damage on the port side, though not so great, was sufficiently alarming. The forward bulkhead was also greatly damaged. The next one, however, stood very well, and it was owing to this and to the calm weather prevailing that the ship remained afloat. The extreme shortness of the fracture, and apparent brittleness of the plates, has excited some amount of remark. The iron has, however, every appearance of being good quality, and experimental fractures give good results. On removal of the plates the frames of the ship were found greatly damaged, being forced from 2ft. to 3ft. into the ship.

GRADIENTS AND CURVES ON AUSTRIAN RAILWAYS.

The following paper is a translation of directions for determining the steepness of gradients, and for interpolating transition curves, between curves and straights, adopted by the Austrian State Railway Department:—

(1) *Principles on which the instructions are based.*—For the purpose of increasing the capacity of railways without adding to the cost of construction, or altering the average gradients, or lengthening the line, it is necessary, on lengths in which the maximum gradient allowed by the conditions of concession is adopted, to decrease the same in proportion to the sharpness of the curves, but at the same time to make up for the lost height by exceeding the average maximum on the straight portions. This applies specially to the working of long and anticipatedly wet tunnels. The idea is taken from a train travelling on a gradient from A to B, in whose several lengths the maximum gradient has been adopted that attains one and the same speed with the same expenditure of power.

(2) *Formula for calculation.*—The formula adopted, on the one hand, is d per mille $= \frac{650}{R - 55}$, in which R is expressed in metres, d represents, in per mille, the decrease of the gradients as calculated for a straight line to suit the curves, by which the resistance on the same is reduced. This formula gives in round numbers for curves of—

M.	M. per 1000.	M.	M. per 1000.
Radius 150 – 170	d = 6	Radius 351 – 600	d = 2
Radius 171 – 2 0	d = 5	Radius 601 – 1300	d = 1
Radius 201 – 250	d = 4	Radius 1301 – ∞	d = 0 pro mille.
Radius 251 – 350	d = 3		

On the other hand, in wet tunnels, to deal with the decreased capacity, the gradients calculated to suit the curves, when the tunnels are more than 40 metres long, must be further decreased 2 per mille. The following formula is to be used for further calculation:—

$$s_0 = S + \frac{l_1 + 2l_2 + 3l_3 + 4l_4 + 5l_5 + 6l_6 + 2t}{L}$$

L represents the entire length of adjoining or separate sections, on which the maximum gradient S per mille occurs; l_1, l_2, l_3, l_4, l_5, l_6 denote the total length of the several curves of radii between 601-1300, 351-600, 251-300, 201-250, 171-200, and 150-170 in the length L; whereby the transition curves are to be taken as belonging one-half to the main curves and one half to the straights.

(3) *An example.*—Suppose on any length of a railway A B the maximum gradient S = 20 per mille occurs without a break, say—

From kilos. 10·5 to kilos. 16·5, length 6·0 kilos.
From kilos. 17·0 to kilos. 20·0, length 3·0 kilos. } 16·5 = L.
From kilos. 32·5 to kilos. 40·0, length 7·5 kilos.

Further, the total of the curves in the same length are—

Of a radius between 171 and 200 l_5 = 2·0 kilos.
Of a radius between 201 and 250 l_4 = 2·5 kilos.
Of a radius between 251 and 350 l_3 = 3·5 kilos.
Of a radius between 351 and 600 l_2 = 1·5 kilos. } 16·5 = kilos.
Of a radius between 601 and 1300 l_1 = 3·0 kilos.
Of a radius between 1301 and ∞ l_0 = 4·0 kilos.

and the total length of the anticipated wet tunnels t = 1·5 kilos. of which 1 kilo. is on the straight, and 0·5 kilo. in curves between 601 and 1300 metres; therefore—

$$S_0 = 20 + \frac{3 \cdot 0 + 3 \cdot 0 + 10 \cdot 5 + 10 \cdot 0 + 10 \cdot 0 + 3 \cdot 00}{16 \cdot 5} = 22 \cdot 394,$$

or, say, 22·4, and the section in this case must be so arranged that the gradients shall be as follows:—

	M.		M.		Per 1000 per cent.
In curves of between	171	and	200 rad.		17·4
In curves of between	201	and	250 rad.		18·4
In curves of between	251	and	350 rad.		19·4
In curves of between	351	and	600 rad.		20·4
In curves of between	601	and	1300 rad.	open line	21·4
In curves of between	601	and	1300 rad.	tunnel	19·4
In curves of between	1301	and	∞ rad.	open line	22·4
In curves of between	1301	and	∞ rad.	tunnel	20·4

(4) *Closing remarks.*—It is naturally to be understood that, on lengths of railway where the maximum gradient does not occur, gradients steeper than those obtained by the formulæ contained in (2) must not be used.

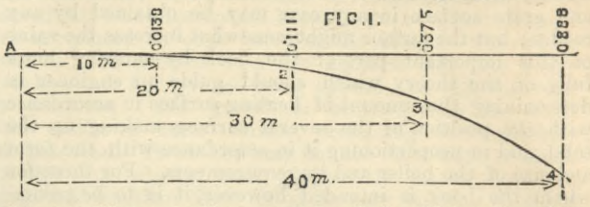
Directions as to the Use of Transition Curves between Straights and Curves.

I.—Main Lines.

(1) *Principle on which the instructions are based.*—The introduction of transition curves between straights and curves is principally necessary for calculating the amount of the necessary elevation of the outer rail.

(2) *Form of the transition curve.*—The form of the transition curve for main railways is shown in the following Fig. 1:—

FIG. 1.

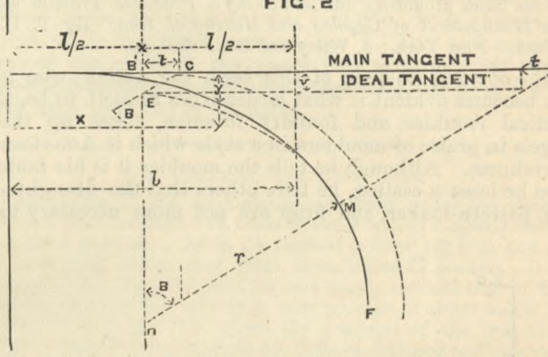


This transition curve is a parabola of the third order, which forms a tangent with the straight in the point A, and consists in the points

1 of a radius of 1200 metres.
2 of a radius of 600 metres.
3 of a radius of 400 metres.
4 of a radius of 300 metres.

(3) *Determining the point of commencement.*—The interpolation of a compound, or "transition," curve necessitates either the alteration of the curve towards the centre, or that the position of the two straight lines to be joined be shifted. The amount of shifting, represented below by v, can be taken from the following table. The alteration of the originally intended commencement of the curve denoted by C in Fig. 2 is $t = v$ tan. β, in which β represents half the central angle of the curve. The arrangement of the straights and curves, irrespective of the conditions necessitated by the ground, must be so ordered that, in the case of counter curves both in main and local railways, the piece of straight between them must have a length of at least 10 metres. As the transition in all curves must take place gradually, as, for instance, by ramping the outer rail in the proportion of 1 : 300, it follows that, in using the elevation, sharp curves require a longer and flat ones a shorter transition curve, and that where the radius is great it is not necessary.

FIG. 2



(4) *Setting out.*—The method of setting out transition curves is shown in the above Fig. 2. The values of $l/_2$ and v calculated for different radii from 200 metres up to 1000 metres, are shown in the following table:—

Radius of curve.	$l/_2$	v	e
	Metres.		
250	24·80	0·384	1·536
275	21·82	0·288	1·152
300	20 00	0·222	0·888
350	17·14	0·140	0·560
400	15·00	0·094	0·376
500	12 00	0·048	0 192
600	10·00	0 028	0·112
700	8 57	0·017	0·068
800	7 50	0·012	0 048
900	6 67	0·008	0 032
1000	6·00	0·006	0·024

The values of x and y, the intermediate points, are to be calculated according to the formula IV. and Fig 1. The circular or main curve can be set out either with the theodolite from B, or by ordinates from B_1. In the lattter case v must be added to each ordinate.

In this case I. $t = v$ tan. β

$$\text{II. } v = \frac{6{,}000{,}000}{r^3} = \frac{e}{4}$$

$$\text{III. } l = \frac{12{,}000}{r}$$

$$\text{IV. } y = \frac{x^3}{72{,}000} \text{ from } x = o \text{ to } x =$$

$$\text{V. } e = \frac{24{,}000{,}000}{r^3} = 4\,v$$

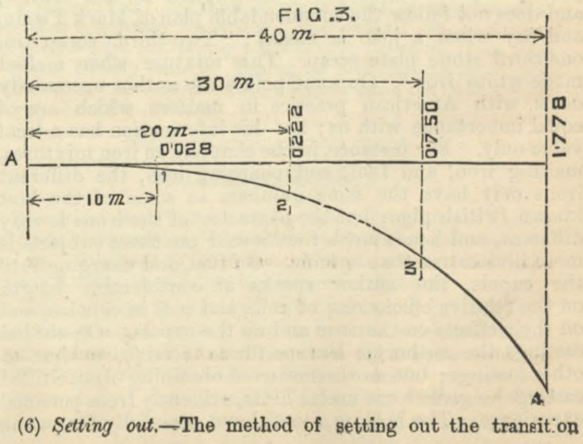
The ramp of the outer rail is constant 1 : 300.

II.—Local Railways.

(5) *Form of the transition curve.*—The form of transition curves on local railways is shown in Fig. 3. This curve is also a parabola of the third order, which forms a tangent in the point A, and consists in the points—

1 of a radius of 600 metres.
2 of a radius of 300 metres.
3 of a radius of 200 metres.
4 of a radius of 100 metres.

FIG. 3.



(6) *Setting out.*—The method of setting out the transition

curve is the same as in Fig. 2. The values of $l/_2$ and v are calculated for different radii from 150-600 metres, and shown in the following table:—

Radius of curve.	$l/_2$	v	e
	Metres.		
150	20·00	0·444	1·776
160	18·75	0·366	1·464
170	17·65	0·305	1·220
180	16·67	0·257	1·028
190	15 79	0·219	0·876
200	15 00	0·188	0·752
220	13 64	0·141	0·564
240	12·50	0·109	0·436
260	11 54	0 (85	0·340
280	10 72	0 068	0 272
300	10·00	0 056	0·224
350	8·57	0 035	0·140
400	7 50	0·023	0 092
450	6 67	0 016	0·064
500	6 00	0 012	0·048
600	5 00	0 007	0 028

In which case—

I. $t = v \tan. \beta$

II. $v = \frac{1{,}500{,}000}{r^3} = \frac{e}{4}$

III. $l = \frac{6000}{r}$

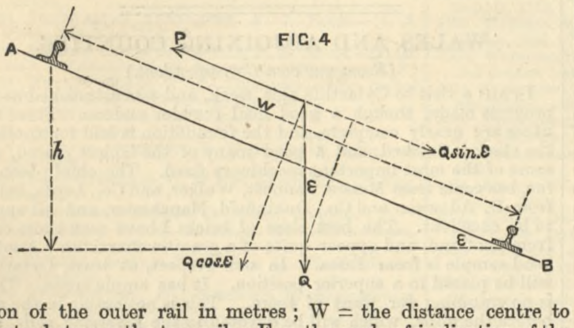
IV. $y = \frac{x^3}{36{,}000}$ from $x = o$ to $x = l$

V. $e = \frac{6.000{,}000}{r^3} = 4\,v$

The ramp of the outer rail is constant, 1 : 600.

Theoretical development of the transition curve.—h = the elevation of the outer rail in metres; W = the distance centre to centre between the two rails; E = the angle of inclination of the line A B to the horizontal; Q = the weight of engine in kilogrammes; P = the centrifugal force in kilogrammes; g = the motion of the earth in metres; V = the velocity of the train in metres per second; ρ = the radius of the axis of the line in metres. As the centrifugal force P = Q sin. E = $\frac{Q\,V^2}{g\,\rho}$ and sin. E = $\frac{h}{W}$, we get the equation : $\frac{Q\,h}{W} = \frac{Q\,V^2}{g\,.\,\rho}$ or—

FIG. 4

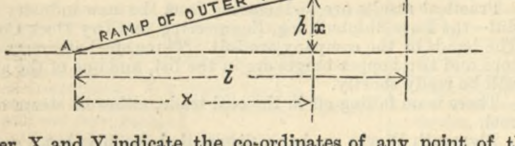


I. $$h = \frac{W\,V^2}{g\,.\,\rho};$$

W and g are constant quantities, *i.e.*, W = 1·5 and g = 9·81, therefore—

II. $$h = 0{\cdot}153\,\frac{V^2}{\rho};$$

FIG. 5.



further, X and Y indicate the co-ordinates of any point of the transition curve in proportion to the point of commencement of the same. h_x the amount of elevation for the said point; ρ = radius for the same; $\frac{1}{i}$ the proportion of ramp in the outer rail of the transition curve, which is taken as constant. Hence the proportion—

III. $$h_x = \frac{x}{i};$$

by amalgamation of the equations I. and III. we obtain $\frac{x}{i}\,\frac{W\,.\,V^2}{g\,.\,\rho}$ or $\rho = \frac{W.\,V^2\,i}{g.\,x}$; if we substitute

IV. $$\frac{W.\,V^2.\,i}{g} = C;$$ we get

V. $$\rho = \frac{C}{x}.$$

If s be the length of the curve and x the abscissa, so is in general $\rho = \frac{d\,s^3}{dx\,.\,d^2\,y}$; as in the present case $d\,x$ can be substituted for $d\,s$, with sufficient exactness so $\rho = \frac{d\,x^2}{d^2\,y}$, and according to formula V. $\frac{C}{x} = \frac{d\,x^2}{d^2\,y}$ or $d^2\,y = \frac{x.\,dx^2}{C}$, whence through double integration,

VI. $$y = \frac{x^3}{6\,c},$$ as equation for the transition curve.

The tangent of the angle $\phi\,x$—Fig. 6—of a tangent to the transition curve is taken from the above equation, and is :

VII. $$\tan.\,\phi\,x = \frac{d\,y}{d\,x} = \frac{x^2}{2C}.$$

The length Z of the subtangent for any point $(x\,.\,y)$ of the transition curve is found by amalgamating the equations VI. and VII. into

VIII. $$z = \frac{\frac{x^3}{6\,C}}{\frac{x}{2\,C}} = \frac{x}{3};$$

when $x = l$ and $\rho = r$ it follows from V. that $r = \frac{C}{l}$ or

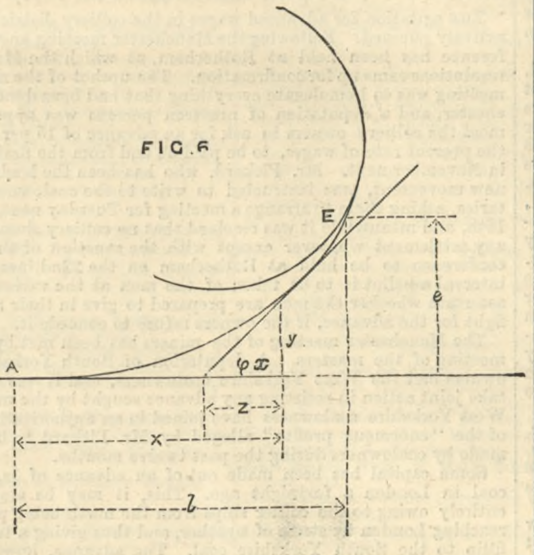
IX. $$l = \frac{C}{r},$$

and when $y = e$ it follows from VI. that $e = \frac{l^3}{6\,C}$, and having regard to IX. that

X. $$e = \frac{C^2}{6\,r^3}.$$

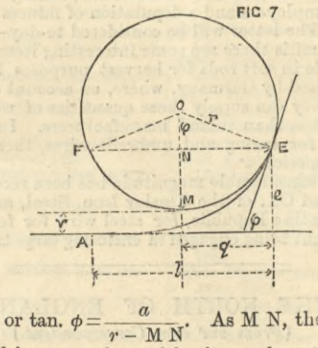
In determining the position of the transition curve with regard to the circular curve, care must be taken that both have a

FIG. 6



common tangent in the point E—Fig. 7. Referring to Fig. 7, N E = N O tan. ϕ, therefore

FIG. 7



$\tan.\,\phi = \frac{N\,E}{N\,O}$ or $\tan.\,\phi = \frac{a}{r - M\,N}$. As M N, the ordinate of the curve, is small in comparison with r it may be neglected; we then get :

XI. $$\tan.\,\phi = \frac{a}{r}.$$

Further, we get from the equation VIII. for $\phi\,x = \phi$ and $x = l$.

XII. $$\tan.\,\phi = \frac{l^2}{2C}.$$

From the equations IX., XI., and XII., $\frac{a}{r} = \frac{l^2}{2C} = \frac{l^2}{2\,.\,l.\,r}$; therefore,

XIII. $$a = \frac{l}{2}.$$

Lastly, $v = e - f = e - \frac{l^2}{8\,r}$, and because also according to equations IX. and X.

$$e = \frac{l^2\,r^2}{6\,r^3} = \frac{l^2}{6\,r};\ \text{therefore, } v = \frac{l^2}{6\,r} - \frac{l^2}{8\,r} = \frac{l^2}{24\,r};$$

and by substituting l out of equation IX.

XIV. $$v = \frac{C^2}{24\,r^3},$$ and in regard to x, $v = \frac{E}{4}$.

In the above formulæ, according to form IV., $C = \frac{W\,.\,V^2\,.\,i}{g}$ in the case of main railways,

with W = 1·5 m.
v = 16·2 m.
g = 9·81 m., and with $\frac{1}{i} = \frac{1}{300}$ C = 12,000,

and in the case of local railways,

with W = 1·5 m.
v = 8·1 m.
g = 9·81 m., and with $\frac{1}{i} = \frac{1}{600}$ C = 6000.

The amount of elevation obtained for main railways, as well as for local railways, differs somewhat from the results of the formula §7, when the several speeds of 16·2 m. per second —58·3 kilos. per hour—and 8·1 m. per second—29·1 kilos. per hour—are adopted, but the influence of the difference on the development is so trifling that it has no perceptible effect.

Vienna, October, 1883. T.

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

(From our own Correspondent.)

THE quarterly meetings have been held this week, and, happily, they were held under much more favourable circumstances than were the July gatherings. At that earlier date the ironworkers' strike was at its height; to-day there are no labour troubles to disturb the ordinary course of the market.

Marked bars have been re-declared for the new quarter at £8 2s. 6d. for the Earl of Dudley's make, and £7 10s. for those of the other list houses. The number of new orders which were booked this—Thursday—afternoon in Birmingham by makers of such bars was not large. More was done by firms who make a capital bar, and who are prepared to accept £7, and £6 15s. Good Australian inquiries, amongst other foreign orders, are just now reaching these firms.

Bars rolled by N. Hingley and Sons were quoted this afternoon at—Netherton Crown, best, £7 10s.; best horseshoe, £7 10s.; best rivet, £8; best best plating, £9; double best Crown, £8 10s.; and treble best ditto, £9 10s.; angles were 10s. per ton additional to the above prices, and tees 20s. per ton additional. Millington and Co.'s flats, rounds, and squares of ordinary quality were £7 10s.; small rounds and squares, £8; Nos. 1 and 2, £8 10s.; Nos. 3 and 4, £9; No. 5, £9 10s.; No. 6, £10; No. 7, £11; No. 8, £12; No. 9, £13 10s.; No. 10, £15 10s.; and No. 11, £17 10s. per ton at works. Bagnall and Son's flat bars varied from £7 10s. to £8; their rounds and squares from £7 10s. up to £9 and £10, and their rounds only from £10 10s. and on to £15 per ton.

Common bars were in good inquiry at £6 10s. to £6 2s. 6d. as the minimum for working up purposes. Common hoops were lower upon the quarter by 2s. 6d. per ton, the present price for export purposes being £6 10s. Superior hoops were £6 17s. 6d. to £7 per ton. Nail strip and gas strip is also easier by 2s. 6d. compared with the July prices. At date £6 5s. is quoted. This week some capital Canadian orders have been booked for rail strip.

Shropshire wire rod makers complained this afternoon of the continued severe competition of the Westphalian makers who are taking the bulk of the trade. Our prices for the sizes that are in most request vary from £6 10s. to £7 10s. per ton delivered Liverpool or equal.

Plate-makers were eagerly on the look-out for orders alike for tank and boiler sorts, since their mills have for a long time past been only partially occupied, and there is at present no improvement. For girder and bridge plates the demand is here and there fair and increasing. Boiler-plates of ordinary quality were £8 10s. to £9, up to 5 cwt. each; superior sorts, up to 4 cwt. each, were variously quoted at £10, £11, and £12; and plates for flanging, &c., up to 3 cwt. each, were £15 10s.; while charcoal plates were £17 10s. and £19 5s., according to quality. Common tank plates for use without angles might have been had to-day at as low as £7 12s. 6d., but the more general figure was £8.

Makers of best thin sheets, and also of best tin-plates, reported a big business doing at remunerative prices. Not only are home orders good, but merchant orders for Australia, Canada, the European Continent, and other export markets are highly gratifying.

"Severn" singles were quoted to merchants, £11; Baldwin-Wilden B, £12; ditto B.B., £13; B.B.B., £14; charcoal quality, £16 10s.; best charcoal, £19 10s.; and E. Bt. charcoal, £21 10s. per ton at the works.

A steadily growing business is doing in mild steel sheets for stamping and other best purposes. They are mostly rolled in this district by the thin sheet iron makers from blooms bought in the steel producing centres. Certain of these steel sheets are selling at date at £13 per ton hereabouts.

The class of iron that has been in largest demand at this week's gatherings are ordinary merchant and galvanising sheets. Numerous and heavy home and export inquiries have been and still are on the market for these, and makers are booked well forward. For early deliveries the demand cannot be satisfied with the needed promptitude, but the makers are so many that it is impossible to get up prices, and on the quarter they are easier by 2s. 6d. per ton. Doubles are still priced at £8 5s. to £8 10s., and lattens £9 5s. to £9 10s.

All-mine pig makers have redeclared the former quotations of 65s. to 62s. 6d. for hot blast, and 85s. to 82s. 6d. for cold blast sorts. The first-named quotation as to each quality it is impossible to obtain, and one or two makers were prepared to-day to take 60s. for hot blast. The demand was very slack, and makers' stocks are heavy. Indeed the Staffordshire pig trade as a whole has not yet got over the accumulation of stocks that occurred during the late ironworkers' strike. Some all-mine firms have 5000 or 6000 tons stocked. Spring Vale pigs were nominal at: Hydrates, 60s.; mine, 52s. 6d.; and common, 42s. 6d. Common cinder pigs were to be had at 40s. down to even 37s. 6d. in a few cases.

Hematites were quiet. The Barrow brand was quoted 61s. to 62s. for forge; the Tredegar brand, 60s.; and the Blaina, 58s. 6d. Tredegar pigs were "down" 5s. on the quarter. There were some fair sales of foreign medium quality. Cumberland pigs were 61s. net cash delivery; Thorneycliffe pigs, 57s. 6d., a drop on the quarter of 2s. 6d.; Lincolnshire, common Wigan, and Fenton—North Staffordshire—mine pigs were all quoted 50s.; Derbyshires varied from 47s. 6d. to 50s.; Northamptons were 46s. 3d.

Manufacturing coal is very abundant. Owners do not favour the idea that there will be any conspicuous advance this winter, and they are prepared to enter into forward contracts for half a year at present low prices, which are for forge coal 5s. 9d. to 6s. 6d., and furnace, 8s. to 9s.

The colliers continue their agitation for 10 per cent. rise in wages, but it has not yet assumed any very definite form. At a meeting of delegates at Tipton, on Tuesday, at which it was claimed that some 12,000 miners were represented, it was resolved that, "Wages being too low and the time having arrived for an advance, the secretary should be empowered to ask for a full meeting of the Conciliation Board of masters and men, to claim an advance."

Heavy machinery for ironworks is just now leaving this district for France and Belgium, and some demand is also expressed from Germany and Russia. The home call is quiet. Engineers report that heavy cast iron wheels and pinions with helical teeth are steadily getting into increased favour, by reason of their endurance and the smoothness with which they work.

An increased number of orders are arriving for roofing, bridges, and gasometers. One local firm is just completing the erection of massive bridge over the Avon at Bristol, which carries the roadway, and connects Bristol and Bedminster. The bridge is a very substantial one, and the two outer girders are excellent specimens of decorative cast iron work.

The new wire gauge is still calling forth many suggestions as to modifications. Among several deserving of consideration is one which is intended to meet the desire of iron manufacturers—that the smaller fractions of an inch should not be dropped. Sheetmakers and hoopmakers may readily, it is urged, have gauges cut to the standard, and may, in addition, have $\frac{1}{4}$, $\frac{3}{16}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$, and $\frac{1}{40}$ cut in these gauges to meet the requirements of the trade. It certainly does not seem at all needful to destroy the object aimed at in the new gauge in order to get in a few sizes that do not require any number to express them. The meeting of the sheetmakers that was convened for Thursday, in Birmingham, to consider this question, has been postponed for a week.

The various industries of Birmingham will have full representation at the coming Calcutta Exhibition, as leading firms in nearly all departments are sending out. Few more handsome collections will go from any part of England than that got together by Messrs. Ralph Heaton and Sons, the well-known Government coiners and ammunition contractors, of the Mint, Birmingham. The case may be described as a spacious and lofty quadrangular stall of solid walnut, and of classic design, with fluted Corinthian pillars at the four corners, and heraldic shields on the cornices, the name of the firm being set forth in ebony letters in full relief upon a panelling of light wood. The centre of the stall is occupied by an upright cluster of solid brass and copper tubes, plain, twisted, and ornamented with spiral coils of rolled metal arranged round the base. On the four sides of the stall, which slope inwards towards the tube trophy, are grouped in tasteful devices the various other articles for the manufacture of which the firm is famed. These include coins, medals, and checks and name plates; gas, water, and bedstead fittings; stamped brass panels in imitation of *repoussé* work, ceiling plates for Russia, brass stirrups for Mexico, brass bangles, armlets, and leglets for India and parts of Africa, together with wire and rolled metal for all parts of the world.

The importance to local industries of technical instruction is becoming more and more recognised in this district. A short time back I recorded the institution of engineering lectures at our Mason's College and the teaching of modelling in Wolverhampton. Now arrangements are being made for the Birmingham Trades' Council to send practical demonstrators to enforce the theoretical teaching given at the Birmingham and Midland Institute, whilst in the town of Wednesbury a fund has been opened for the building of a laboratory in connection with the Science and Art Institute classes.

NOTES FROM LANCASHIRE.

(From our own Correspondents.)

Manchester.—A general quieting down is noticeable throughout the iron trade of this district, and there is a very prevalent conviction that we are approaching a period of dulness in most branches of industry. There is still a fair amount of present work in hand, but there is very little indication in the market of any large forward requirements. Users of iron are evidently buying very cautiously, and limit their purchases as much as possible to ascertained necessities. Makers, on the other hand, in view of the unsettled state of the men with regard to wages both in the iron and the coal trades, are also cautious about committing themselves to forward engagements. The present condition of trade may be described generally as of a hand-to-mouth character, but fairly steady. The tendency of prices is in a downward direction, but there is no great pressure to sell, and concessions, which are only made slowly, are confined chiefly to pig iron, where makers' order books are getting bare and there is a disposition to entertain offers.

The business doing in the Manchester market continues small, and although there was a fair average attendance on 'Change last Tuesday, a very quiet tone prevailed generally. Pig iron buyers who had anything like large orders to place were holding back for lower prices, and in some cases makers were prepared to take less money rather than let business pass them. Lancashire makers were open to entertain offers for foundry qualities at about 3d. to 6d. per ton under the list rates which have recently been quoted, but for forge qualities they are still very firm at full prices. Quotations for both forge and foundry iron are, in fact, now practically on the same basis, and average 45s. 3d. per ton, less 2½ per cent. delivered equal to Manchester. In district brands, some of the Lincolnshire makers have been quoting 6d. under list rates for forge qualities, and exceptional sales have been made at 1s. per ton under the full prices recently quoted. Delivered equal to Manchester, Lincolnshire forge now averages 44s. 4d., with foundry qualities up to 45s. 10d., less 2½. Good brands of Middlesbrough foundry have been sold at 47s. 6d. net cash for delivery equal to Manchester over the first three months of next year.

Finished iron makers continue busily engaged on present orders, and are firm in their prices at £6 2s. 6d. to £6 5s. for bars, £6 12s. 6d. to £6 15s. for hoops, and £8 to £8 5s. for sheets delivered into the Manchester district, but some of the merchants are underselling.

Ironfounders generally report trade as very quiet. Even at low prices they are only indifferently employed, and the limited weight of work giving out is keenly competed for. Cast iron columns delivered into the Manchester district can be bought at £5 per ton, and ordinary pipe castings can be got at as low as £4 11s. per ton delivered.

A gradual quieting down is reported in nearly all branches of engineering, locomotive building being about the only department in which activity is being maintained.

The Lancashire sheet and hoop iron makers do not, I understand, regard very favourably the operation of the new standard wire gauge under existing conditions. Indirectly sheet and hoop iron makers are materially affected by the new standard, and they consider that they ought to have been consulted in the matter before any definite arrangement was come to. At present any action with regard to the question as affecting their interests is being held in abeyance.

Recently several specialities in engineering have been brought under my notice, to which a brief reference will be of interest. Last week I was at the works of Messrs. Rose, Downs, and Thompson, of Hull, and was there shown an Anglo-American oil mill just completed for a firm abroad. In this mill a number of special improvements have been introduced, and the work of extracting the oil and pressing the crushed seed into cakes is made as automatic as possible. The machine is complete in an independent frame and foundation, with engine attached, so that it can be readily exerted without the necessity of employing skilled labour. The seed is conveyed into the heating kettle by elevators, and discharged from the bottom in regular quantities sufficient for a single cake, an ingenious arrangement automatically opening and closing the door as each charge is taken. The seed is then moulded under automatic mechanical pressure to the size of the press, which is constructed to take in a number of moulds simultaneously; and here the oil is extracted and the seed finally pressed into cakes. The old-fashioned, cumbersome methods are entirely dispensed with, the only actual handling of the seed being in transferring from the mould to the press, and when once started the work progresses without interruption, requiring only one attendant for the whole of the requisite operations.

The same firm have also in hand a novel arrangement of a suction pump, which is to be employed for dredging up the beds of rivers supposed to contain gold. The pump is capable of drawing up almost any ordinary material, including fairly large stones, which would compose the bed of a river, and discharging it into a receptacle provided. The pump, engines, and boilers are carried in light pontoons, and the whole apparatus is constructed in small sections, capable of being readily transported across country whenever required.

Another speciality I may mention is a new machine just completed by Messrs. Kendal and Gent, of Manchester, for rolling screw threads on bolt blanks, and for other similar work such as twist drills, spindle ends, &c. The machine, which has been patented by Mr. Fairbairn, is the result of experiments and improvements carried out by the inventor over a number of years, and consists of three revolving steel rollers having threads cut on their edges, and which are brought together under pressure upon the rod or bolt. By pressing down a foot lever the bolt blank is drawn inward with its adjustable sliding support; on arriving at a fixed point the holder pushes against a lever which reverses the machine; the screw is then rolled in the opposite direction and delivered finished.

An exceptionally powerful steam hammer has been constructed by Messrs. B. and S. Massey, of Openshaw, near Manchester, for the Mersey Forge, Liverpool. The hammer is of the bow form, with a distance of 18ft. between the standards, and is made specially for dealing with heavy marine work. Nominally it is a 10-ton hammer, but it has a falling weight of nearly 11 tons; the cylinder is 34in. diameter, and the piston has a stroke of 7ft.; the total weight of the hammer, exclusive of base-plate and anvil block, is about 50 tons. One or two special improvements have been introduced into the hammer, which all through is an excellent piece of work. The entablature, instead of being a simple casting, as is often the case, has been carefully bored to ensure an accurate bearing support for the piston, and the flat sides are guided by steel slides let into the entablature, thus securing precision and free working to the hammer. In order that the floor space round the anvil may be left perfectly clear, the hammer is controlled from a raised staging, about 4ft. above the ground level.

Business in the coal trade of this district is quiet. Pits are still kept going about full time, but the output generally is amply sufficient to meet requirements, and prices are scarcely being maintained at the full rates. Slack, if anything, is moving rather better, but is still abundant in the market. At the pit mouth prices average 9s. 6d. to 10s. for best coal, 7s. 6d. to 8s. for seconds, 5s. 9d. to 6s. 6d. for common, 4s. 6d. to 5s. for burgy, 3s. 6d. to 4s. for good slack, and about 3s. per ton for common sorts.

Shipping is fairly active, with good Lancashire steam coal fetching about 8s. per ton at the high-level, Liverpool, or the Garston Docks.

Barrow.—I notice that no perceptible improvement has taken place in the tone of the hematite pig iron trade of this district. There is a quiet demand for all qualities, but the business done on both home and foreign account is so inextensive that there is no hope of any decided improvement during the coming winter. Although the business done is small, the yield of metal is well maintained, and thus there is a tendency to increase the already large stocks. Prices, I think, are somewhat easier, and a lower value can be quoted all round. No. 1 Bessemer is selling at 49s. per ton net at works for ordinary heavy sections and prompt delivery, No. 2, 48s.; and No. 3, 47s.; while No. 3 forge is in limited request at 47s. per ton and upwards, and inferior samples at 45s. per ton. I should think there would hardly be any further reduction in prices, as the above quotations are certainly as low as the metal can be produced at a profit. Steel makers are fairly well employed, but orders are not plentiful. Steel rails are in limited request, and the orders coming to hand for merchant qualities are few. Prices are a little easier. Shipbuilders are still badly off for orders. Marine engineers, boiler-makers, and the other minor departments of the iron and steel trades are in receipt of few orders. Iron ore remains in quiet demand at from 9s. to 10s. per ton at mines.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

The agitation for advanced wages in the colliery district is being actively pursued. Following the Manchester meeting another conference has been held at Rotherham, at which the Manchester resolutions came up for confirmation. The upshot of the adjourned meeting was to homologate everything that had been done at Manchester, and a deputation of nineteen persons was appointed to meet the colliery owners to ask for an advance of 15 per cent. on the present rate of wages, to be paid on and from the first pay day in November next. Mr. Pickard, who has been the leader in this new movement, was instructed to write to the coalowners' secretaries, asking them to arrange a meeting for Tuesday next, October 16th, and meanwhile it was resolved that no colliery should accept any settlement whatever except with the sanction of the further conference to be held at Rotherham on the 22nd inst. In the interval a ballot is to be taken of the men at the various pits to ascertain whether the men are prepared to give in their notices to fight for the advance, if the owners refuse to concede it.

The Manchester meeting of the miners has been met by a Leeds meeting of the masters. A deputation of South Yorkshire coalowners met the West Yorkshire coalowners, and it was agreed to take joint action in resisting any advance sought by the men. The West Yorkshire coalowners have joined in an authoritative denial of the "enormous profits" alleged by Mr. Pickard to have been made by coalowners during the past twelve months.

Some capital has been made out of an advance of 1s. a ton in coal in London a fortnight ago. This, it may be stated, was entirely owing to the collier ships from the north being prevented reaching London by stress of weather, and thus giving a temporary fillip to the South Yorkshire coal. The advance, however, was only temporary.

Mr. B. Pickard has forwarded a letter to Mr. E. C. Rhodes, the secretary of the Coalowners' Association, asking for an interview between the employers and a deputation of miners in regard to the 15 per cent. The letter will be considered to-day—Friday.

In the wire mills there are some interesting items to notice. The American trade in soft rods for harvest purposes has, it appears, been monopolised by Germany, where, on account of their superior water-ways, they can supply those quantities of wire at from 30s. to £2 per ton less than inland manufacturers. In hard qualities, such as rods for spring and umbrella wires, there is still a fair demand for America.

An order of considerable magnitude has been received by Messrs. Wm. Cooke and Co., of the Tinsley Iron, Steel, and Wire Works, from the Argentine Republic, for steel wire for fencing purposes, that Government being engaged in enclosing large tracts of country.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

The quarterly meeting of the Cleveland iron trade was held at Middlesbrough on Tuesday last, and was well attended. The tone was firm and steady, but prices did not advance. There are still some makers willing to accept 39s. per ton for No. 3 g.m.b. for early delivery, which is also the price merchants are quoting. The principal makers, however, ask 39s. 3d. to 39s. 6d. for that grade. For forward delivery of No. 3, the price is nominally 38s. 6d. per ton. The general quotation for grey forge iron is 37s. 6d. per ton, but sales have been made as low as 37s.

There were several exhibits at the market on Tuesday, the most important being a model of the Jameson coke oven, and including samples of coke produced by that oven from various kinds of coal.

Very little business is reported in warrants, though they are freely offered at 38s. 9d. to 38s. 10½d. per ton.

The stock of Cleveland pig iron in Messrs. Connal's store at Middlesbrough has decreased 150 tons during the past week.

Owing to the stormy weather which prevailed during the early days of the present month, shipments are far behind those for last month. Up to Monday night only 18,748 tons of pig iron had been exported, as against 26,737 tons during the corresponding period of September.

The manufactured iron trade continues steady, and numbers of small orders for prompt execution have been given out at the rates which have ruled for some time past, viz., ship plates, £6 5s. per ton; shipbuilding angles, £5 12s. 6d.; and common bars, £5 17s. 6d., free on trucks at producers' works, less 2½ per cent. Puddled bars are £3 12s. 6d. to £3 17s. 6d. per ton net on trucks at works. For forward delivery prices are lower, but little business is done.

The bulk of the workmen recently paid off by the Darlington Steel and Iron Company are still idle. A notice was posted at the works on Saturday last saying that the two small rail mills which were at work last week would be started again on Monday. No intimation was made as to when the remainder of the men would be required. The majority of the men are, it is said, willing to commence work at the reduced rate of wages offered by the firm. The reductions vary from 7½ to 15 per cent.

The accountant's certificate issued in connection with the Cleveland miners' and blast furnacemen's sliding scales shows that the net average invoiced price of No. 3 Cleveland pig iron during the three months ending September 30th was 39s. 2·24d. per ton. This gives a reduction of 2½ per cent. in blast furnacemen's wages, one-eighth of a penny in miners' tonnage rates, and about 1¼ per cent. in datal wages from the present time to the end of the year. The men have given notice to terminate their sliding scale on the 31st December, and will submit a new one to take its place.

The man Rawdon, who was severely burned at the North-Eastern Steel Company's works during the visit of the Iron and Steel Institute, died on Thursday last.

The pier jutting out into the sea at Saltburn has been for years without a head or properly finished area and buildings at the end. This is due to the destructive action of former storms. The property having passed into the hands of the Pease family, their engineer, Mr. Whipham, recently set about supplying the deficiency. Scaffolding was erected and several iron piles were driven. But the gale of Saturday week raised an angry sea, which swept away everything new, and exactly restored the pier end to its previous unfinished condition.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

The pig iron market, which was strong last week, had begun to get quieter at the opening of the present week, but a feeling of firmness was imparted by an unexpected strike of miners in the Hamilton district. It was not believed that this dispute could be of long duration; but yet it had an effect upon the current quotations. Since last report five furnaces have been put out of blast, reducing the output of pig iron by about 1000 tons per week, and as the shipments have been good, the addition to stocks in the warrant stores is smaller than for a number of weeks past.

Business was done in the warrant market on Friday forenoon at 47s. to 47s. 1½d. cash, and 47s. 2d. to 47s. 4d. one month, the afternoon quotations being 46s. 11½d. to 46s. 9d. cash, and 47s. 1½d. to 46s. 11d. one month. The market was easier on Friday forenoon at 46s. 9d. to 46s. 7½d. cash, and 46s. 8½d. to 46s. 9½d. one month. In the afternoon the prices were 46s. 6½d. to 46s. 8d. cash, and 46s. 8½d. to 46s. 10½d. one month. On Tuesday forenoon transactions occurred at 46s. 8d. to 46s. 11d. cash, and 46s. 10½d. to 47s. 1d. one month, the tone being somewhat easier in the afternoon with quotations at 46s. 10½d. to 46s. 9½d. cash. Transactions took place on Wednesday forenoon at 46s. 8½d. to 46s. 9d. cash, and in the afternoon at 46s. 10d. to 46s. 9½d. To-day—Thursday—the market was quiet at 46s. 9d. cash.

In consequence of the greater animation in the warrant market, the values of makers' iron are firmer all round, there being a slight advance in certain cases. The quotations are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 55s. 6d.; No. 3, 52s.; Coltness, 58s. and 52s.; Langloan, 58s. and 52s. 6d.; Summerlee, 56s. 6d. and 50s. 6d.; Chapelhall, 55s. 6d. and 52s.; Calder, 59s. and 49s.; Carnbroe, 54s. 6d. and 48s. 6d.; Clyde, 49s. 9d. and 47s. 9d.; Monkland, 48s. and 46s.; Quarter, 47s. 3d. and 45s.; Govan, at Broomielaw, 48s. and 46s.; Shotts, at Leith, 58s. and 53s. 6d.; Carron, at Grangemouth, 49s. (specially selected, 56s. 6d.) and 47s. 6d.; Kinneil, at Bo'ness, 48s. 6d. and 47s. 6d.; Glengarnock, at Ardrossan, 54s. 6d. and 47s. 6d.; Eglinton, 48s. 6d. and 45s. 3d,; Dalmellington, 48s. 3d. and 47s. 3d.

Up till date the total shipment of Scotch pig iron has been 505,637 tons as compared with 497,644 in the corresponding period of 1882, while the stock in the Glasgow warrant stores is 589,054 tons against 623,773 tons at the same date last year.

The manufactured iron and steel works are both well employed, and the values of most articles of manufacture appear to be without appreciable change. In the course of the week there were shipped from Glasgow £17,270 worth of machinery, £5660 sewing machines, £39,900 iron manufactures, and £17,000 worth of steel goods.

In the coal trade there is considerable activity, although the quantities shipped have not been so large at some of the ports as of late. It would be no unusual occurrence were the trade to experience a slight check at the present season. Happily business has been excellent all through the summer, although prices have not been full enough to enable masters to meet the wishes of the miners as to wages. It is highly improbable that at this advanced period of the season any further increase will be obtained. Still the coalmasters of Hamilton have offered to give an advance of 6d. a day to their men on 1st November.

There have been sectional strikes of miners here and there in addition to the large turn-out in Hamilton district; but the disputes have arisen from local causes, and ought not to be difficult of settlement.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

I paid a visit to Cyfarthfa this week, and was astonished at the progress made, though a good deal remains undone. Three furnaces are nearly complete, and the foundation is laid for another; the stack is finished, and a good many of the boilers placed, and some of the most important machinery fixed. The chief plant, so far, has come from Messrs. Tannett, Walker, and Co., Leeds, boilers from D. Adamson and Co., Dukinfield, Manchester, and all appear to be excellent. The best class of bricks I have seen there come from Scotland, and appear quite of a granitic character. Another good sample is from Risca. In one respect, at least, Cyfarthfa will be placed in a superior position. It has ample space. There is no cramping for want of room. This is noticeable in the area before the mills, which will be devoted to the reversing rolls, and here the longest lengths may be worked without interfering with any other branch of labour.

There is no change to report of any account in the iron trade. Orders are rather tardy in coming to hand, as buyers wait to see if the reduction will be followed by lower quotations. When these are stationary an improvement in business may be expected. A tolerably large quantity of manufactured iron, amounting to close upon 10,000 tons, left the Welsh ports this week.

That there is some degree of vitality in the trade is evidenced by the re-starting of the Milford Steel Works, and general alterations and improvements carried on in most of the large establishments.

The reduction is now accepted in nearly all the works, the prominent exception being Llynvi Works, Maesteg, where a strike prevails.

In the tin trade there is a gratifying movement, and the meeting this week is expected to improve it. In the Monmouthshire district, such as Machen and Rudry, good work is being done. Morriston continues to turn out excellent plates, under the special direction of Mr. Davies, and good results are obtained in neighbouring establishments. I see that Llangennech is likely to be sold and re-started.

Practical results are forthcoming from the new industry at Cardiff—the Bute Shipbuilding, Engineering, and Dry Dock Company. The hands of the company are full. Three steel steamers of 2000 tons and two hopper barges are in the list, and one of the steamers will be ready shortly.

There is no falling off in the coal trade, either in steam or house coal.

Plymouth Works are being dismantled steadily, but a good coalfield remains, and something near eleven years of lease yet to run.

The last report of the Miners' Provident Society is hopeful. There are now nearly 20,000 members, and the balance in hand amounts to £10,000.

A mass meeting was held by the colliers at Merthyr on Monday to further unionism and reduction of prices on food.

The Corinth Canal.—In a report to the Foreign Office on the trade of the Piræus, Consul Meslin describes the ship canal through the Isthmus of Corinth, which was commenced in May last year, the first mine being fired by Queen Olga, in the presence of King George, the diplomatic corps, and the principal Greek Government officials. The actual length of the canal when finished will be 6342 metres; the entrances to the channel will be 100 metres in breadth, diminishing to 22, and the depth 8 metres. According to studies made by M. Gerster, the total quantity of material to be extracted will be about 9,835,000 cubic metres. The nature of the ground through which this channel has to be cut is composed, according to the report of the engineers of the company, of three distinct kinds:—Firstly, from the Gulf of Corinth, through s plain, consisting of sand and alluvial soil, for a distance of 1¼ kilometres; secondly, through a mountain range, varying in height from 40 to 80 metres, of the length of 4½ kilometres; thirdly, beyond the mountain range to the sea, in the Bay of Calamaki. the proposed canal will traverse a little plain of the length of 600 metres, composed of alluvial soil and rocks. The excavation of those parts of the canal situated in the plains presents no difficulties; but this is not the case as regards the mountainous parts, where on enormous mass of 8,000,000 metres of solid rock will have to be excavated and transported to a distance, which labour, according to the contract, has to be done within three years. The following plan of executing the work has been decided on by the engineers of the company, M. Gerster and M. Kauser:—That part of the canal situated in the plains will be excavated by ordinary means, namely, hand labour, dredging machines, a railway, and sand pumps. This portion of the labour, it is calculated, will be finished at the end of the present year, 1883. At the same time as the above-mentioned work is in progress, the upper portion of the rocky crest will be excavated by mines, and the refuse carried away by railway, for which purpose four locomotives and 200 trucks will be employed. Towards the end of the year 1883 several large dredging machines, constructed on the most approved modern principles, will be delivered to the company. These machines will be capable of removing 5500 cubic metres of soil in ten hours. They will be each of 300-horse power. As regards the system of excavating the rock, M. Gerster's plan is to sink vertical shafts in the mountain by means of perforating machines constructed expressly for the purpose, which shafts will be sunk to the level of the proposed canal, for which cartridges of dynamite will be employed at distances of 2 to 3 metres from each other, which will be exploded simultaneously. The execution of this enterprise has been confided to the Société des Ponts et Travaux en Fer (ancienne maison Joret et Cie.), in conjunction with L'Association des Constructeurs. These two companies engage to undertake the cutting of the canal for the sum of 24,600,000f., under forfeit if not completed within the prescribed time.

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.

2nd October, 1883.

4668. Velocipedes, H. Thresher, Brixton.

4669. Telephonic Apparatus, E. George, F. A. Pocock, J. S. and J. S. Muir, jun., London.

4670. Vaporisation of Antiseptic Substances, A. H. Hassall, London.

4671. Alarm Bells for Bicycles, H. Serrell, U.S.

4672. Governing Apparatus, D. Dunlop, Port Glasgow.

4673. Stands for Bottles, J. Mallol, Birmingham.

4674. Gas Cooking Ovens, S. Leoni, London.

4675. Latches and Locks, F. J. Biggs, London.

4676. Iron and Steel, G. Hatton, Hagley.

4677. Caustic Soda, S. Pitt.—(*F. P. Harned, U.S.*)

4678. Attaching Buttons to Textile Fabrics, J. F. Atwood, Boston, U.S.

4679. Protecting Submerged Structures from Corrosion, F. M. Lyte, Putney.

4680 Ring Spinning Frames, J. M. Hetherington, Manchester.

4681. Gas Producers, J. E. Bott, Manchester.

4682. Levels, &c., H. Darwin, Cambridge.

4683. Electro-motors, S. J. Coxeter and H. Nehmer, London.

4684. Ventilating Apparatus, A. J. Boult.—(*L. J. Wing, New York, U.S.*)

4685. Making Cartridge Shells, A. J. Boult.—(*J. H. Ring, C. Callahan, J. H. Pindar, & J. Morrison, U.S.*)

4686. Wooden Boxes, W. P. Thompson.—(*The United States Box Machine Company, New York.*)

4687. Packing Cases, M. Stuart, Liverpool.

4688. Postal Boxes, T. P. Bethell, Liverpool.

4689. Locking Apparatus, H. W. R. Smith, Kingston-upon-Hull.

4690. Ironing Boards, G. W. von Nawrocki.—(*J. Hess, Germany.*)

4691. Pianoforte Actions, C. Collard, London.

4692. Carrying School Books, G. W. von Nawrocki.—(*J. Wolff, Germany.*)

4693. Breech-loading Fire-arms, G. H. Needham, Wandsworth.

4694. Transmitting, &c., Messages by Electricity, A. F. St. George, London.

4695. Steam Boilers J. Tordoff, Leeds.

4696. Steam Pumps, M. W. and A. E. Hall, U.S.

4697. Water-closets, W. Lake.—(*J. P. Putnam, U.S.*)

4698. Preserving Food, J. Y. Johnson.—(*La Société Anonyme de Conservation Alimentaire, Paris.*)

3rd October, 1883.

4699. Drying Sugar, C. A. Day.—(*G. M. Newhall, U.S.*)

4700. Sewing Machines, J. McDevitt, Belfast.

4701. Making Bread, A. McDonald, Glasgow.

4702. Raising Trouser Ends, H. F. Richardson.—(*R. Siecke, Berlin.*)

4703. Buttons, G. von Nawrocki.—(*F. Seidel, Germany.*)

4704. Washing Machines, J. Child, Headingley.

4705. Typographic Blocks, R. Brown, R. W. Barnes, and J. Bell, Liverpool.

4706. Chaff Cutters, S. Edwards, Salford.

4707. Inner Bands of Hats, J. Thompson, Prestwich.

4708. Cuffs, M. Wilson, Peckham.

4709. Railway Switch, E. Bivort, Belgium.

4710. Telephonic, &c., Apparatus, A. Shaw, London.

4th October, 1883.

4711. Sewing Machines, H. Gamwell, Liverpool.

4712. Sewing Machines, C. Pieper. — (*R. Gritzner, Durlach.*)

4713. Vanning Apparatus, P. M. Justice.—(*The Frue Vanning Machine Company, Detroit, U.S.*)

4714. Joints of Pipes, J. Robbins, London.

4715. Coloured Glass Windows, H. J. Allison.—(*J. La Farge, New York, U.S.*)

4716. Air Compressors, F. W. Scott, London.

4717. Belts for Machinery, B. A. Barczinsky.—(*Messrs. Korngold and Joffe, Poland.*)

4718. Weaving Fabrics, J. Lee, Rochdale.

4719. Branding Machines, F. W. Blood, Liverpool.

4720. Producing, &c., Gas, E. Davies, London.

4721. Toilet Paper Holder, S. Wheeler, London.

4722. Fishing Tackle, W. J. McMullen, East Dulwich.

4723. Axes and Adzes, T. Myers and G. Neill, York.

4724. Castings, J. Stanley and L. Bailey, Sheffield.

4725. Aerial Transit Apparatus, F. Byrnes, Liverpool.

4726. Electric Cables, F. C. Guilleaume, Cologne.

4727. Umbrellas, H. Haddan.—(*W. Jaedicke, Berlin.*)

4728. Voltaic Batteries, A. C. Henderson.—(*N. Basset, Paris.*)

4729. Lubricating Apparatus, W. R. Lake.—(*E. L. Bucaille, jun., Paris.*)

4730. Wheels for Bicycles, &c., E. Hutchison, London.

4731. Producing Spray, H. Brooks and R. Mestern, London.

4732. Transporting Sensitised Photographic Plates, J. E. Atkinson, Greenwich.

4733. Improved Safety Toy, F. J. Thomas and R. H. C. Cotton, Birmingham.

4734. Harness, G. Bray, Deptford.

5th October, 1883.

4735. Printing Blocks, W. Woodbury, South Norwood.

4736. Carriages, D. Phillips, Battersea.

4737. Couplings, F. Wirth.—(*C. R. Ruyven, Holland.*)

4738. Bleaching Cotton, G. B. Sharples, Walmersley.

4739. Type Writers, H. J. Allison.—(*W. Perce, U.S.*)

4740. Dampening Apparatus, L. Schmiers, Leipzig.

4741. Trace Hooks, O. Lampe, Hamburg.

4742. Steam Generator, J. Imray.—(*Comte de Dion, G. T. Bouton, and C. Trépardoux, Paris.*)

4743. Saucepan Covers, L. B. Bertram, London.

4744. Pressing, &c., Garments, W. & J. Beecroft, Leeds.

4745. Pneumatic Machines for Drying Corn, E. G. Brewer.—(*E. Dolbecchi, Italy.*)

4746. Raising Water from Wells, A. J. Boult.—(*J. B. Yeagley, Indianapolis, U.S.*)

4747. Gas Burners, J. W. Sutton, London.

4748. Organ Pedals, J. Rushton, London.

4749. Extracting Essential Oils from Hops, &c., W. R. Lake.—(*T. A. Breithaupt, Strasbourg.*)

4750. Propelling Ships, C. Crosier. — (*A. Keating, Valparaiso.*)

4751. Pyrometers, W. Wise.—(*A. & E. Boulier, Paris.*)

6th October, 1883.

4752. Chains, &c., C. H. Reed, Sunderland.

4753. Washing Machines, J. Donald, Glasgow.

4754. Driving Gear, F. Jenkin, Edinburgh.

4755. Raising Water, C. Burnett, Hartlepool.

4756. Casting Metals, F. Gill and W. Rockliffe, Sunderland.

4757. Refrigerator Tubes, S. Briggs, Burton-on-Trent.

4758. Ores, J. Beveridge, Runcorn.

4759. Saw-sharpening Machines, H. Sands, Notts.

4760. Producing Warmth, F. Wirth.—(*M. Honigmann, Aachen.*)

4761. Grinding Apparatus, J. S. Dronsfield and C. Butterworth, Oldham.

4762. Separating Impurities from Machinery Oils, J. Davids.—(*A. Koellner, Newmuehlen.*)

4763. Steam Engines, L. Chapman, Erith.

4764. Packing of Pistons, W. R. Lake.—(*J. Bell, U.S.*)

4765. Goffering, &c., Textile Fabrics, W. R. Lake.—(*C. Garnier, Lyons, and P. Depoully, Paris.*)

8th October, 1883.

4766. Coke Ovens, J. Jameson, Newcastle-on-Tyne.

4767. Cap for Protecting the Teeth of Horse-clippers, G. Twigg, Birmingham.

4768. Storing up Power Apparatus, R. Heyworth, Manchester.

4769. Telegraph Cables, T. C. Loe, New Charlton.

4770. Slide Valves, C. de Lucia, Naples.

4771. Artificial Fuel, E. Marriott, Highgate.

4772. Stoppers for Bottles, J. Davidson, Sunderland.

4773. Cements, &c., E. Robbins, Battersea.

4774. Regulating Gas, &c., W. P. Thompson.—(*Messrs. F. L. Muratori and E. Cros, Paris.*)

4775. Producing Ornamental Stitching in Sewing Machines, F. C. Glaser.—(*G. A. Greiner, Germany.*)

4776. Heating, &c., Gas, W. A. Bartlett.—(*G. E. Haight, W. H. Wood, and W. E. Winsor, U.S.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

4669. Telephonic Apparatus, E George, F. A Pocock, J. S. and J. S. Muir, jun., London.—*2nd October*, 1883.

4678. Attaching Buttons to Textile Fabrics, J. F. Atwood, Boston, U.S.—*2nd October*, 1883.

4685. Cartridge Shells, A. J. Boult, London.—A communication from J. H. Ring, C. Callahan, J. H. Pindar, and J. H. Morrison, Lowell, U.S.—*2nd October*, 1883.

4686. Making Wooden Boxes, W. P. Thompson, Liverpool.—A communication from The United States Box Machine Company, New York.—*2nd October*, 1883.

4740 Dampening Apparatus, L. Schmiers, Leipzig.—*5th October*, 1883.

4746. Raising Water from Wells, A. J. Boult, London.—A communication from J. B. Yeagley, Indianapolis, U.S.—*5th October*, 1883.

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

3979. Stoves, W. Smith, jun., Barnard Castle.—*1st October*, 1880.

3984. Horseshoe Nails, W. R. Lake, London.—*1st October*, 1880.

4008. Warming Houses, &c., G. Jennings, Stangate.—*2nd October*, 1880.

4011. Filtering Medium, P. A. Maignen, London.—*2nd October*, 1880.

4033. Discharging Ashes from Steamboats, J. J. and T. L. Galloway, Glasgow.—*5th October*, 1880.

4012. Velocipedes, W. R. Lake, London.—*2nd October*, 1880.

4036. Sewing Machines, H. J. Haddan, London.—*5th October*, 1880.

4050. Motive Power, J. Robson, Falmouth Road.—*5th October*, 1880.

4255. Billiard, &c., Tables, W. Buttery, London.—*19th October*, 1880.

4040. Preventing the Escape of Birds from Pens, M. Arnold, London.—*5th October*, 1880.

4206. Velvet Pile Carpets, T. B. Worth, Stourport.—*15th October*, 1880.

4065. Refrigerating Apparatus, T. B. Lightfoot, Dartford—*6th October*, 1880.

4088. Tricycles, R. H. Charsley, Oxford.—*8th October*, 1880.

4097. Producing Coloured Designs, H. C. Webb, Worcester.—*8th October*, 1880.

4070. Tie and Core Metal, G. M. Edwards, London.—*7th October*, 1880.

4400. Obtaining Various Colours on Cotton, T. Holliday, Huddersfield.—*28th October*, 1880.

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

3812. Self-cleaning Furnaces, T. Henderson, Birkenhead.—*2nd October*, 1876.

3924. Synchronising Clocks, J. A. Lund, London.—*11th October*, 1876.

3880. Coal Gas Scrubbers, H. Green, Preston.—*7th October*, 1876.

4022. Metal Heel Tips, T. Shutt, Birmingham.—*18th October*, 1876.

3857. Portable Ovens, J. H. Johnson, London.—*5th October*, 1876.

3940. Anchors, G. Tyzack, Stourbridge.—*12th October*, 1876.

3949. Making Gas, E. Brook and A. Wilson, Middlesbrough-on-Tees.—*12th October*, 1876.

3873. Cutting Rags, &c., J. R. Readett, Dover.—*6th October*, 1876.

4160. Hydraulic Engines, H. Davey, Leeds.—*26th October*, 1876.

Notices of Intention to Proceed with Applications.

(*Last day for filing opposition*, 26*th October*, 1883.)

2652. Stretching Woven Fabrics, J. Strang, Ramsbottom.—*29th May*, 1883.

2563. Ploughs, E. Edwards, London.—A communication from S. Boreau.—*29th May*, 1883.

2658. Ring Spinning Frames, W. T. Emmott, Blackfriars.—A communication from C. Verenet and E. Appenzeller.—*29th May*, 1883.

2664. Purifying Musty Hay, C. Perkin, Northenden.—*29th May*, 1883.

2665. Covers for Conveying Articles, J. Hertz, London.—*30th May*, 1883.

2730. Shot, &c., G. Lampen, Gateshead-on-Tyne.—*1st June*, 1883.

2740. Boots and Shoes, W. P. Thompson, London.—A communication from W. Rogers.—*1st June*, 1883.

2743. Regulating Electric Arc Lamps, F. L. Willard, London.—*2nd June*, 1883.

2751. Cutting Slate Rolls, O. Thomas, Bangor, and R. G. Thomas, Menai Bridge.—*2nd June*, 1883.

2769. Electric Lamps, W. R. Lake, London.—A communication from C. L. R. Menges.—*4th June*, 1883.

2792. Rock-drilling Apparatus, W. P. Thompson, London.—Com. from G. M. Derby.—*5th June*, 1883.

2793. Stoppering Bottles, W. E. Gedge, London.—A communication from Messieurs Berthe, Wulvéryck, and Servas.—*5th June*, 1883.

2808. Pens, W. Brierley, Halifax.—A communication from A. F. I. L. Scholz.—*6th June*, 1883.

2809. Extracting Oils from Seeds, C. Eskrett and W. H. Searle, Hull.—*6th June*, 1883.

2813. Breech-loading Small-arms, J. Woodward and F. Beesley, London.—*6th June*, 1883.

2823. Spinning Spindles, A. M. Clark, London.—A communication from G. Jaquith.—*6th June*, 1883.

2852. Ships' Sleeping Berths, W. R. Lake, London.—A communication from C. A. Milligan and M. J. Killion.—*7th June*, 1883.

2866. Roadways for Tram-cars, T. E. Knightley, London.—*8th June*, 1883.

2874. Tin and Terne Plates, D. Grey, Maesteg.—*8th June*, 1883.

2949. Electrical Conductors, J. H. Johnson, London.—A communication from La Société A. Chertemps et Cie.—*13th June*, 1883.

2966. Marking the Score of Games, J. H. Wilkenson and G. S. Rogers.—*14th June*, 1883.

3062. Producing Intense White Light, C. D. Abel, London.—Com. from C. Clamond.—*20th June*, 1883.

3070. Gas-motor Engines, J. Fielding, Gloucester.—*20th June*, 1883.

3145. Saddle Cloths, H. H. Lake, London.—A communication from G. Hüttemann and C. Wackerow.—*25th June*, 1883.

3441. Match-boxes, P. Jensen, London.—A communication from F. Lundgreen.—*12th July*, 1883.

3820. Treatment of Liquors, L. Mond, Northwich.—*4th August*, 1883.

3821. Gas Generating Furnaces, L. Mond, Northwich.—*4th August*, 1883.

3871. Noble's Combing Machines, H. Priestman, F. K. Adcock, J. Brown, and J. Copley, Bradford.—*9th August*, 1883.

3350. Cigar Holders, J. H. Johnson.—A communication from W. B. Espeut.—*15th August*, 1883.

3965. Boxes for Conveying Articles, H. J. Herbert, Richmond.—*15th August*, 1883.

4020. Self-feeding Flat Forme Printing Machines, W. Brooks, London.—A communication from D. F. Simpson.—*20th August*, 1883.

4127. Metal Laths, G. M. Edwards, London.—*27th August*, 1883.

4275. Light-feed Lubricators, W. A. G. Schönheyder, London.—*5th September*, 1883.

4276. Electrical Switches, H. H. Lake, London.—A com. from C. W. Holden.—*5th September*, 1883.

4297. Supports for Telephonic Instruments, H. H. Lake, London.—A communication from C. W. Holden.—*6th September*, 1883.

4303. Pneumatic Hammers, C. Sholl, London.—*7th September*, 1883.

4632. Rabbit Traps, W. Burgess, Malvern Wells.—*28th September*, 1883.

4633. Animal Traps, W. Burgess, Malvern Wells.—*28th September*, 1883.

4669. Telephonic Apparatus, E. George, F. A. Pocock, J. S. Muir, and J. S. Muir, jun., London.—*2nd October*, 1883.

(*Last day for filing opposition*, 30*th October*, 1883.)

2757. Moulding in Sand, S. E. Seanor and J. Hill, Leeds, and J. Butler, Bradford.—*4th June*, 1883.

2771. Ligneous Compounds, C. D. Abel, London.—A communication from B. Harrass.—*4th June*, 1883.

2782. Electrical Wire Protectors, J. O. Cottrell, Fanwood, U.S.—*5th June*, 1883.

2784. Horse Hoes, F. Mote, Burnham Market.—*5th June*, 1883.

2788. Primary Voltaic Batteries, G. G. André, Dorking.—*5th June*, 1883.

2791. Bending Angle Iron, C. Wicksteed, Kettering.—*5th June*, 1883.

2796. Treating Rags, J. Illingworth, Whitelee.—*5th June*, 1883.

2803. Safety Apparatus for Gas Burners, &c., J. W. Plunkett, Dunstall Priory, and J. C. Hart, Stratford.—*6th June*, 1883.

2804. Generating, &c., Electric Currents, A. and T. Gray, Glasgow.—*6th June*, 1883.

2806. Weighing Apparatus, &c., I. and A. Wallwork, Hurst.—*6th June*, 1883.

2825. Paring Leather, W. Douglas, Kingswood.—*7th June*, 1883.

2828. Ornamenting Tiles, G., C., and L. Wedgwood, Stafford, and A. Marsden, Stafford.—*7th June*, 1883.

2831. Pneumatic Breech-loading Guns, T. N. Palmer, Dalston.—A communication from D. M. Mefford.—*7th June*, 1883.

2842. Regenerative Furnaces, W. Spence, London.—Com. from G. Stumpf.—*7th June*, 1883.

2851. Flour Mills, K. J. Dance, Clifton.—*7th June*, 1883.

2855. Electrodes, D. G. Fitz-Gerald, Brixton.—*7th June*, 1883.

2859. Glass, &c., J. Reynolds, Mount Greenwich.—*8th June*, 1883.

2869. Treatment of Milk, G. Lawrence, London.—*8th June*, 1883.

2872. Electric Arc Lamps, H. J. Allison, London.—Com. from W. Baxter, jun.—*8th June*, 1883.

2873. Spittoons, W. Vale, Birmingham.—*8th June*, 1883.

2886. Stoves, S. C. Davidson, Belfast.—*9th June*, 1883.

2889. Indicators for Steam Engines, J., G., and J. T. S. Pimbley, Springside.—*9th June*, 1883.

2902. Safes, H. W. Chubb, London.—*11th June*, 1883.

2906. Dyeing Textile Fabrics, H. H. Lake, London.—A communication from La Société Anonyme des Teintures et Apprêts de Tarare.—*11th June*, 1883.

2907. Moulding Bricks, J. H. Johnson, London.—Com. from G. J. P. Couffinhal.—*12th June*, 1883.

2918. Buoys, H. J. Haddan, London.—A communication from V. Vidal.—*12th June*, 1883.

2933. Indicating the Depth of Water, R. I. Barnes and H. S. Heath.—*13th June*, 1883.

2940. Gas Stoves, H. J. Haddan, London.—A communication from R. Kutscher.—*13th June*, 1883.

2943. Fastening Apparatus for Scaffolding, W. P. Thompson, London.—A communication from C. Mansion.—*13th June*, 1883.

2944. Driving Centrifugal Machines, A. Watt, Liverpool.—*13th June*, 1883.

2982. Lifts, H. J. Haddan, London.—A communication from R. Liebig.—*15th June*, 1883.

2990. Treating Phosphates of Lime, J. H. Johnson, London.—A communication from Messieurs Crespel and Martin.—*15th June*, 1883.

2993. Galvanic Elements, F. Wirth, Frankfort-on-the-Main.—Com. from C. Pabst.—*15th June*, 1883.

2994. Electric Incandescent Lamps, A. M. Clark, London.—A communication from J. M. A. Gérard-Lescuyer.—*15th June*, 1883.

3080. Telephones, A. W. Rose, London.—*21st June*, 1883.

3337. Horseshoes, T. H. Heard, Sheffield.—*5th July*, 1883.

3568. Gas Motor Engines, C. T. Wordsworth, Leeds, and H. Lindley, Manchester.—*20th July*, 1883.

3836. Holding Cables, F. C. Guillaume, Cologne.—*7th August*, 1883.

4072. Securing Fur to Hardened Wool, C. Vero and J. Everitt, Atherstone.—*22nd August*, 1883.

4081. Felt Carpets, W. Mitchell, Waterfoot.—*23rd August*, 1883.

4102. Measuring Cloth, &c., J. Farmer, Salford.—*24th August*, 1883.

4158. Checking Workmen's Time, N. C. Firth, Chester.—*28th August*, 1883.

4191. Pumping Apparatus, J. A. Wade and J. Cherry, Hornsea.—*30th August*, 1883.

4225. Intermittent Cocks, B. H. Chameroy, Vesinet.—*1st September*, 1883.

4266. Rollers for Spinning Frames, J. T. Chadwick, Salford, and J. Crossley, Bury.—*5th September*, 1883.

4292. Securing the Lids of Baskets, T. Humphreys, Salford.—*6th September*, 1883.

4346. Self-levelling Berths, B. F. Merrill, Boston, U.S.—*11th September*, 1883.

4629. Buckles, H. J. Haddan, London.—A communication from H. Kimball.—*28th September*, 1883.

4685. Cartridge Shells, A. J. Boult, London.—A communication from J. H. Ring, C. Callahan, J. H. Pindar, and J. H. Morrison.—*2nd October*, 1883.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 5th October*, 1883.)

1745. Electric Lamps, &c., F. H. Varley, London.—*6th April*, 1883.

1755. Vehicles for Carrying Furniture, J. W. and H. J. Davey, Bristol.—*7th April*, 1883.

1760. Feeding the Carbons of Electric Arc Lamps, J. Henry and H. B. Bourne, London.

1761. Evaporating by Compression, J. Weibel and P. Piccard, Switzerland.—*7th April*, 1883.

1762. Chimneys, &c., R. H. and S. Reeves, London.—*7th April*, 1883.

1768. Treatment of Plants, W. A. Barlow, London.—*7th April*, 1883.

1771. Studs, &c., J. Buchanan, jun., and J. Brown, Liverpool.—*9th April*, 1883.

1776. Incandescent Electric Lamps, E. Müller, London.—*9th April*, 1883.

1782. Window Blind Rollers, H. A. Walker, London.—*9th April*, 1883.

1785. Secondary Batteries, E. G. Brewer, London.—*9th April*, 1883.

1793. Boat Disengaging Gear, N. Hamblin, jun., Poplar.—*9th April*, 1883.

1794. Secondary Batteries, R. Tatham, Rochdale, and A. Hollings, Salford.—*10th April*, 1883.

1799. Extracting Internal Stoppers from Bottles, J. Hamer, Stalybridge.—*10th April*, 1883.

1800. Tipping Vans, &c., C. Hill, London.—*10th April*, 1883.

1804. Cutting Sheet Metal, A. N. Hopkins, Birmingham.—*10th April*, 1883.

1823. Steam Pump, J. G. Joicey, Newcastle-upon-Tyne.—*10th April*, 1883.

1824. Ships, &c., N. de Teiescheff, Paris.—*10th April*, 1883.

1833. Breech-loading Hammerless Guns, W. Anson and J. Deeley, Birmingham.—*11th April*, 1883.

1835. Gas-motor Engines, J. J. Butcher, Newcastle-upon-Tyne.—*11th April*, 1883.

1841. Pencil Holders, E. Lane, London.—*11th April*, 1883.

1854. Breech-loading Fire-arms, W. Gardner, London.—*12th April*, 1883.

1907. Protecting Firemen at Fires, &c., W. R. Lake, London.—*14th April*, 1883.

1948. Lawn-tennis Poles, J. Mellor, Corwen.—*17th April*, 1883.

1982. Conveying Oil to the Surface of the Sea, &c., J. Bowman, Huntly.—*19th April*, 1883.

2009. Ulmin Brown, H. J. Haddan, London.—*20th April*, 1883.

2020. Telephone Apparatus, H. A. C. Saunders and A. C. Brown, London.—*20th April*, 1883.

2032. Refrigerating Apparatus, A. S. Haslam, Derby.—*21st April*, 1883.

2036. Shuttle Sewing Machines, H. J. Haddan, London.—*21st April*, 1883.

2054. Cleaning Boots, &c., J. Hargrave, Leeds.—*23rd April*, 1883.

2071. Railway Ties, A. J. Boult, London.—*24th April*, 1883.

2089. Self-acting Feed-water Regulator, &c., A. M. Clark, London.—*24th April*, 1883.

2091. Treating Waste Materials, J. Walker, Leeds.—*25th April*, 1883.

2181. Treating Textile Fabrics, H. J. Haddan, London.—*30th April*, 1883.

2185. Incandescent Lamps, W. Crookes, London.—*30th April*, 1883.

2206. Clasps for Garments, H. J. Haddan, London.—*1st May*, 1883.

2237. Red Dye Stuffs, &c., S. Pitt, Sutton.—*2nd May*, 1883.

2429. Rock Drills, A. M. Clark, London.—*12th May*, 1883.

2435. Treating Phosphatic Slags, C. Pieper, Berlin.—*15th May*, 1883.

2958. Bleaching Kiers, C. L. Jackson and J. Westley, Bolton.—*14th June*, 1883.

2989. Effervescent Liquids, W. R. Lake, London.—*15th June*, 1883.

3028. Sewing Machinery, A. G. Brookes, London.—*19th June*, 1883.

3029. Supporting Shafting, A. G. Brookes, London.—*19th June*, 1883.

3114. Mariner's Compasses, W. R. Lake, London.—*22nd June*, 1883.

3549. Washing Machines, J. Heselwood, Leeds.—*19th July*, 1883.

3643. Pickers for Looms, J. K. Tullis, Glasgow.—*25th July*, 1883.

3685. Fastenings for Book-cases, W. A. Bonella, London.—*27th July*, 1883.

3736. Hats, &c., W. R. Lake, London.—*31st July*, 1883.

3837. Adjustable Chairs, W. R. Lake, London.—*7th August*, 1883.

3989. Producing Wrought Iron, E. P. Alexander, London.—*17th August*, 1883.

(*List of Letters Patent which passed the Great Seal on the 9th October*, 1883.)

1808. Gas Regulators, S. Slack, Sheffield.—*10th April*, 1883.

1827. Thrashing Machines, J. Coulson, Stamford.—*11th April*, 1883.

1829. Electric Signalling Apparatus, B. J. B. Mills, London.—*11th April*, 1883.

1843. Roof Ventilators, R. Oakley, London.—*12th April*, 1883.

1844. Preventing Water going down Ventilating Shafts, R. Oakley, London.—*12th April*, 1883.

1845. Ventilating Stoves, R. Oakley, London.—*12th April*, 1883.

1846. Ventilating Churches, R. Oakley, London.—*12th April*, 1883.

1849. Projectiles for Fire-arms, L. A. Groth, London.—*12th April*, 1883.

1858. Wick Trimmers, A. J. Boult, London.—*12th April*, 1883.

1862. Road Vehicles, W. J. Brewer, London.—*12th April*, 1883.

1873. Hand-power Lifts, A. Attwood and T. W. Barber, Ulverston.—*13th April*, 1883.

1893. Stud Fastener, A. Combault, London.—*14th April*, 1883.

1894. Pavement, W. Berry and P. Stuart, Edinburgh.—*14th April*, 1883.

1906. Stoves, J. A. Hanna and T. F. Shillington, Belfast.—*14th April*, 1883.

1909. Fire-arms, H. H. Lake, London.—*14th April*, 1883.

1923. Screw Propellers, &c., S. W. Snowden, West Hartlepool.—*16th April*, 1883.

1928. Hanging Ships' Rudders, S. W. Snowden, West Hartlepool.—*16th April*, 1883.

1933. Gum Tragacanth, A. C. Duncan, Manchester.—*17th April*, 1883.

1981. Mercurial Air Pumps, J. Barrett, London.—*19th April*, 1883.

1999. Preparing Flax, J. Reynolds, Belfast.—*19th April*, 1883.

2003. Preventing the Corrosion of Iron Ships, J. B. Hannay, Glasgow.—*20th April*, 1883.

2023. Supplying Electrical Force, &c., R. P. Sellon, Surbiton.—*20th April*, 1883.

2044. Dynamo-electric Machines, A. M. Clark, London.—*21st April*, 1883.

2045. Gun Carriages, W. R. Lake, London.—*23rd April*, 1883.

2047. Separating Sugar from Molasses, C. Pieper, Berlin.—*23rd April*, 1883.

2076. Assisting Persons Learning to Sing, &c., G. N. Carozzi, London.—*24th April*, 1883.

2095. Pipe Keys, J. S. Beeman, London.—*25th April*, 1883.

2101. Break-down Snap Guns, S. A. Grant and W. Adams, London.—*25th April*, 1883.

2134. Centrifugal Dressing Machines, R. Lund and T. F. Hind, Preston.—*27th April*, 1883.

2160. Surgical Injections, O. Imray, London.—*28th April*, 1883.

2162. Hoisting Machinery, T. Thomas, Cardiff.—*28th April*, 1883.

2280. Dynamo-electric Machines, C. T. Bright, London.—*4th May*, 1883.

2336. Locks for Railway Carriages, H. Parkin and C. J. Reynolds, London.—*8th May*, 1883.

2473. Insulating Electrical Conductors, A. J. Boult, London.—*17th May*, 1883.

2636. Lifeboats, &c., A. M. Clark, London.—*26th May*, 1883.

2674. Railway Buffers, H. H. Lake, London.—*29th May*, 1883.

2737. Adapting Railway Vehicles to Different Gauges, W. R. Lake, London.—*1st June*, 1883.

2847. Tumblers, J. T. H. Richardson, Hatton.—*7th June*, 1883.

2991. Protecting Iron Surfaces, A. S. Bower, St. Neots.—*15th June*, 1883.

3390. Counting Newspapers Delivered from the Folding Machine, J. E. Taylor, P. Allen, and C. P. Scott, Manchester.—*9th July*, 1883.

3428. Steam Boilers, J. Burlinson, Sunderland.—*12th July*, 1883.

3484. Noiseless Tires, W. H. Carmont, Manchester.—*16th July*, 1883.

3616. Repeating Fire-arms, H. H. Lake, London.—*23rd July*, 1883.

3705. Racks for Storing Spirits, E. Smith, Liverpool.—*28th July*, 1883.

3729. Drilling Machines, A. Shedlock, New York.—*31st July*, 1883.

List of Specifications published during the week ending October 6th, 1883.

122, 2d.; 138, 2d.; 278, 2d.; 306, 2d.; 521, 4d.; 656, 2d.; 678, 2d.; 681, 2d.; 682, 2d.; 687, 2d.; 694, 2d.; 696, 2d.; 702, 2d.; 707, 2d.; 709, 2d.; 710, 2d.; 714, 6d.; 715, 6d.; 716, 6d.; 717, 2d.; 738, 2d.; 741, 2d.; 743, 2d.; 749, 2d.; 753, 10d.; 757, 2d.; 759, 2d.; 760, 2d.; 765, 2d.; 767, 2d.; 769, 2d.; 770, 2d.; 772, 2d.; 779, 2d.; 788, 2d.; 789, 2d.; 793, 2d.; 794, 6d.; 802, 6d.; 807, 2d.; 808, 2d.; 809, 2d.; 810, 2d.; 815, 6d.; 816, 10d.; 817, 4d.; 819, 2d.; 820, 6d.; 822, 6d.; 823, 6d.; 824, 6d.; 826, 2d.; 829, 2d.; 830, 2d.; 831, 2d.; 833, 2d.; 834, 6d.; 835, 2d.; 839, 2d.; 840, 8d.; 842, 8d.; 843, 6d.; 844, 2d.; 845, 6d.; 846, 6d.; 847, 6d.; 848, 2d.; 849, 2d.; 850, 1s.; 851, 2d.; 852, 6d.; 854, 6d.; 855, 2d.; 859, 2d.; 860, 6d.; 861, 2d.; 863, 4d.; 864, 6d.; 870, 6d.; 871, 8d.; 872, 4d.; 873, 6d.; 875, 6d.; 876, 6d.; 877, 4d.; 879, 8d.; 880, 8d.; 884, 2d.; 885, 2d.; 889, 6d.; 890, 6d.; 892, 6d.; 894, 2d.; 895, 6d.; 897, 4d.; 899, 6d.; 900, 6d.; 906, 6d.; 907, 2d.; 910, 6d.; 911, 8d.; 914, 6d.; 915, 2d.; 917, 6d.; 918, 4d.; 920, 10d.; 923, 2d.; 928, 4d.; 933, 4d.; 937, 6d.; 938, 6d.; 940, 6d.; 942, 8d.; 944, 4d.; 945, 2d.; 948, 6d.; 949, 4d.; 950, 1s. 4d.; 959, 6d.; 961, 6d.; 963, 4d.; 984, 6d.; 1062, 6d.; 1079, 6d.; 1181, 6d.; 1218, 1s.; 1229, 4d.; 2270, 6d.; 3000, 6d.; 3001, 8d.; 3141, 6d.; 3160, 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.*

122. Joints of Sanitary Pipes, &c., *A. B. Wren, near Bideford.—9th January*, 1883.—(*Provisional protection not allowed.*) 2*d*.

One end of the pipe has a part of its substance removed from the exterior and the other end has a part of its substance removed from the interior, so that a joint may be made between two lengths of pipe. A covering is placed round the joint.

138. Slaying, Killing, Paralysing, or Stunning Fish, Crustacea, &c., *C. A. Barber, London.—10th January*, 1883.—(*Provisional protection not allowed.*) 2*d*.

This relates to the employment of an electric current.

156. Apparatus for Controlling, Indicating, and Arresting the Flow of Electric Current, *W. M. Mordey, London.—10th January*, 1883. 6*d*.

This consists of an automatic switch by which the connection between a dynamo-electric generator and an accumulator or system of mains is broken when the electro-motive force of either of the latter acquires an excess over that of the former. The reversal of the current causes a pair of solenoids to rock a lever fitted with contact making devices, by which the circuit is broken. A shutter of insulating material is interposed between the contact points at the moment of breaking circuit. An electric bell circuit is completed on the reversal of current.

278. Calculating Apparatus, *A. J. Boult, London.—17th January*, 1883.—(*A communication from A. Seignon, Marseilles.*)—(*Provisional protection not allowed.*) 2*d*.

This relates to the arrangement of squares bearing numerals for the multiplication table.

306. Electric Signs or Apparatus for Illuminating and Signalling Purposes, *H. V. Weyde, London.—18th January*, 1883. 2*d*.

The filament of an incandescent lamp is made in the form of the word or design required, and enclosed in a suitably formed glass casing.

309. Reaping and Mowing Machines, *H. and F. Armour, Linlithgow.—14th February*, 1883.—(*Not proceeded with.*) 2*d*.

This refers to means or fittings connected with the guiding and turning of reaping and mowing machines.

349. Telephonic Apparatus, *A. Teske, London.—22nd January*, 1883. 6*d*.

The instrument comprises a combined transmitter, receiver, signalling device, and means for breaking its signalling circuit, and completing that of the distant instrument; also means for placing the transmitter or receiver in circuit as required.

400. Electric Generators and Motors, *W. M. Mordey, London.—24th January*, 1883. 6*d*.

This invention relates to dynamo-electric generators having the coils of their armatures continuously wound. To simplify the collection of the current, the equipotential points of the armature are connected together. Various methods of winding and connecting the junctions of the coils are illustrated and described. The connections to the commutator pass between a hollow sleeve and the shaft to diametrically opposite segments in the shape of bars parallel to the axis, which are respectively connected interiorly by means of bars arranged radially along the shaft. The currents are collected by a pair of brushes in the ordinary manner.

460. Telephones, *T. J. Handford, London.—27th January*, 1883.—(*Not proceeded with.*) 2*d*.

The receiver is a solenoid, the core of which is attached to a diaphragm at about its centre, the other end of the core being acted upon by a spring tending to force the diaphragm outwards in opposition to the action of the current.

521. Training the Human Voice to Produce Musical Sounds, &c., *J. W. Lea, London.—31st January*, 1883.—(*Provisional protection not allowed.*) 2*d*.

This relates to an instrument consisting of keys which are played on by the fingers, and cause hammers to strike wires, so that the sounds produced are within the compass of the human voice.

594. Telephones, *G. H. Bassano, A. E. Slater, and F. T. Hollins, Derby.—3rd February*, 1883.—(*Not proceeded with.*) 2*d*.

The vibrating diaphragm forms a pole piece of an electro-magnet; or the electro-magnet is so arranged that a portion of it is capable of receiving sonorous vibrations. The diaphragm may be of non-inductive material, a piece of steel being fixed on it, or it may be extended in the form of an armature.

623. Apparatus for Measuring and Regulating Currents of Electricity, *P. Cordew, Chatham.—5th February*, 1883. 6*d*.

The expansion and contraction of a fine vertical wire placed in the circuit actuates a pivotted pointer, the outer end of which sweeps over a graduated arc. To regulate the potential the pointer has attached to it a piece of carbon which will dip more or less into mercury, and thus effects the current passing through a shunt on the magnetising coils.

624. Electro Motors, *W. R. Lake, London.—5th February*, 1883.—(*A communication from A. Skene, Vienna, and F. Kühmaier, Presburg.*) 6*d*.

This relates to means for regulating the speed of the motor, a system of winding the coils of the electro-magnets, and an adjustable commutator plate for reversing the direction of rotation of the motor.

628. Dynamo-electric or Electro-dynamic Machine, *R. W. Munro, London.—5th February*, 1883.—(*A communication from A. B. Swonnikoff, Paris.*)—(*Not proceeded with.*) 2*d*.

The pole pieces of a generator having a disc armature are divided in a line obliquely to the radius or in an undulating line. The cores of the armature coils are parallel to the axis, and are each connected by iron bars to their diametrically opposite cores.

629. Voltaic Batteries, *R. Larchim, London.—5th February*, 1883.—(*A communication from L. Hartmann, St. Petersburg.*)—(*Not proceeded with.*) 2*d*.

The positive element is of zinc and the negative of silver, preferably formed of pieces of carbon coated with silver, a solution of caustic potash or soda being employed as the exciting fluid.

631. Electric Lighting Apparatus for Railway and other Carriages, *A. M. Clark, London.—5th February*, 1883.—(*A communication from N. De Kabuth, Paris.*)—(*Not proceeded with.*) 6*d*.

The oil reservoirs of the existing lamps are replaced by accumulators, which supply current to an incandescent lamp.

632. Storage Batteries or Electrical Accumulators, *J. H. Johnson, London.—6th February*, 1883.—(*A communication from J. A. Mahoney, Washington, U.S.*)—(*Not proceeded with.*) 2*d*.

One electrode is formed of black oxide of manganese and the other of carbon, these are immersed in a solution of dilute sulphuric acid containing an ammoniacal salt.

633. Manufacture of Finely Divided Lead, Lead Alloys, and Compounds of the same, for Use in Secondary Batteries, &c., *W. Cross, London.—6th February*, 1883.—(*Not proceeded with.*) 4*d*.

The lead on its passage from one vessel to another in a semi-molten state, is acted on by a blast of any suitable gaseous fluid.

634. Apparatus for Regulating Electric Lamps, Electric Currents, Electric Potentials, &c., *A. and T. Gray, Glasgow.—6th February*, 1883.—(*Not proceeded with.*) 2*d*.

The feed of the carbons is regulated by a continuous endless motor controlled by a flier. To measure current, a cone, movable in the direction of its axis, gears with a friction wheel actuating a counting mechanism. The potential is regulated by introducing resistance into the circuit.

656. Construction of Tesselated Encaustic and other Tiles, &c., *W. M. Hobson, Birmingham.—6th February*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to a metallic frame divided into squares to receive the tiles.

659. Voltaic Batteries, *W. R. Lake, London.—6th February*, 1883.—(*A communication from J. M. Stebbins, New York, U.S.*)—(*Not proceeded with.*) 2*d*.

Each cell is provided with the necessary replenishing materials, so that the battery is one which shall be practically constant for an indefinite length of time.

661. Dynamo-electric Machines, *J. Munro, London.—6th February*, 1883. 6*d*.

The armature is constructed of grids of copper placed radially on the sides of a rotating disc; or the grids may be in the form of longitudinal bars arranged upon the circumference of a rotating drum-like frame.

676. Telephonic Apparatus, *H. H. Eldred, London.—7th February*, 1883. 6*d*.

The diaphragm is of non-inductive material, and has a small steel disc attached to its centre.

678. Propulsion Appliances for Bicycles, &c., *E. Nunan, London.—7th February*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to certain appliances to be fitted to the fork or frame of a bicycle, tricycle, or other like vehicle, to enable the wheel or wheels to be moved round by the hands of the rider alone, or in conjunction to that of the feet; also to means or appliances to facilitate the guiding of the vehicle.

681. Electric Meters, *C. V. Boys, Wing, Rutlandshire, and H. H. Cunynghame, London.—7th February*, 1883. 2*d*.

This relates to modifications of patents No. 4472, of 1881, and No. 3434, of 1882, and consists in causing part of the current to work a small motor, which, by means of a recoil escapement, divides a heavy balance.

682. Preparing Cotton Seed, *F. S. Fish, London.—7th February*, 1883.—(*A communication from T. Taylor, Washington.*—(*Not proceeded with.*) 2*d*.

The process consists in treating the cotton seeds with sulphuric acid in a special manner, whereby the seeds are left with a hard woody shell, capable of protecting them from dampness or other injury in handling or storage, but are fitted especially for crushing or sprouting.

687. Breech-loading Small-arms, *T. Woodward, Birmingham.—7th February*, 1883.—(*Not proceeded with.*) 2*d*.

This consists in improvements in the lock mechanism of self-cocking breech-loading small-arms.

694. Construction of Portable Rivetting Machines, *R. A. Binns, Halifax.—8th February*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to the construction of a machine worked by a screw.

696. Taps or Cocks for Drawing-off Fluids, *J. B. Tenby, Sutton-Coldfield.—8th February*, 1883.—(*Not proceeded with.*) 2*d*.

The object is to prevent continuous waste of fluid when cocks are left fully or partly open by design or negligence.

698. Apparatus or Switch for Electric Lamps, &c., *J. T. Todman, London.—8th February*, 1883. 6*d*.

An ebonite plug, through which a brass pin passes, turns in a casing of non-conducting material provided with contact points. The turning of the plug completes or breaks the circuit. The plug is secured in the casing in the ordinary way.

699. Moulds for Moulding or Shaping Bulbs for Incandescent Electric Lamps, &c., *A. Swan, Gateshead.—8th February*, 1883. 6*d*.

The mould is constructed with a bottom part formed in one piece and having an inclined upper surface, and with separate top parts correspondingly inclined on their lower surfaces, and capable of being closed over the bottom part to complete the mould.

702. Ink-supplying Penholders, *L. B. Bertram, London.—8th February*, 1883.—(*Not proceeded with.*) 2*d*.

The object is to construct an ink reservoir within a holder or casing, that it can be pushed forward to permit of a nozzle opening and ink to flow to feed a nib or other writing point, and then to return under the action of a spring, the return closing the nozzle to confine the remaining ink in the reservoir.

707. Cutter Box for Spiculating Spills for Watch Cleaning, &c., *R. D. Bennett, Manchester.—9th February*, 1883.—(*Not proceeded with.*) 2*d*.

This relates principally to the arrangement of the knife within the box.

709. Labels for Use in Gardens, &c., *G. B. Pierce, Richmond.—9th February*, 1883.—(*Provisional protection not allowed.*) 2*d*.

This relates to moulding the label in clay or similar material, on which the inscription is stamped or formed.

710. Railway Sleepers, *F. G. M. Stoney and R. C. Rapier, Westminster.—9th February*, 1883.—(*Not proceeded with.*) 2*d*.

The sleepers are formed by stamping or shaping a steel or wrought iron plate of suitable thickness by means of dies.

714. Apparatus for Warming Houses, *S. Deards, Harlow.—9th February*, 1883. 6*d*.

This consists essentially in constructing behind the grate a supplementary flue or fire-box, and forming in the back of the grate a number of openings leading into the said supplementary flue, and combining therewith means whereby the products of combustion may be caused to pass as required, either direct into the ordinary flue or into the supplementary flue or fire-box.

715. Apparatus for Extracting Ammonia from such Solutions as are Produced in the Manufacture of Soda by the Ammonia Process, *L. Mond, Northwich.—9th February*, 1883. 6*d*.

The invention is designed for the purpose of extracting ammonia from solutions containing both volatile salts of ammonia and those not easily volatile, such as the chloride.

716. Manufacture of Soda, &c., *L. Mond, Northwich.—9th February*, 1883. 6*d*.

This relates chiefly to the drying, furnacing, and cooling of the salts.

717. Lamps for Ships' Binnacles, *J. Bowman, Huntly.—9th February*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to the construction of lamps and their fittings for ships' binnacles, for the purpose of burning heavy mineral oils in them.

719. Electric Safety Plugs, and Appliances in Connection therewith, *K. W. Hedges, London.—7th February*, 1883. 6*d*.

The "plugs" consist of several fine wires or strips of foil kept separate and enclosed in mica, their collected ends being clamped to the main conductors. The fusing of the plug completes a by-pass circuit and also causes a bell to ring. A T-frame placed between the main conductors carries a plug on its upper part in cases where a local connection has to be made to an underground cable.

738. Fitting and Holding the Mouthpiece to the Stem of a Pipe Used for Smoking, *A. Strauss, London.—9th February*, 1883.—(*Not proceeded with.*) 2*d*.

The object is the employment of magnetic power discs or ends of mounts.

741 Apparatus for Taking Measurements or Patterns for Cutting out Wearing Apparel, *J. Baier and J. Werner, London.—10th February*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to patterns that are capable of expanding or contracting for the purpose of taking measures.

743. Apparatus for Polishing the Surface of Satin Fabrics, *E. Edwards, London.—10th February*, 1883.—(*A communication from F. Rousselon, Lyon.*)—(*Not proceeded with.*) 2*d*.

The apparatus consists of a series of polishing devices set in motion by a single driving shaft actuated by steam or other suitable power, accidental tearing or fraying being prevented by making the polishing devices flexible and operating against a support arranged so as to ensure the necessary polishing action either upon heavy or light fabrics.

749. Apparatus used in Roasting Meat, &c., *R. Walker, London.—10th February*, 1883.—(*Not proceeded with.*) 2*d*.

The object is to provide means (either combined with a roasting jack or independent therefrom) by which the basting of the meat, &c., is effected automatically.

753. Machinery for Sawing, Shaping, Surfacing, and Polishing Stone, Marble, Gypsum, &c., *J. H. Johnson, London.—10th February*, 1883.—(*A communication from J. Westinghouse, jun., Pittsburg, U.S.*) 10*d*.

This relates, First, to a sawing machine for cutting blocks of stone, &c., into pieces of various thicknesses according to the number of saws used and the distances they are set apart; Secondly, to a machine for grinding stone, &c., to the exact finished sizes by means of a rotating wheel of high speed composed of emery or other suitable grinding material, against which the stone or material to be ground is held and passed; Thirdly, to a machine for grinding the face of stone or other like articles, such, for example, as tiles perfectly true.

755. Preparing Cotton-seed, *F. L. Fish, New Jersey, U.S.—10th February*, 1883.—(*A communication from T. Taylor, Washington, U.S.*) 6*d*.

This consists in removing the cotton fibre which surrounds cotton seeds by treating such seeds with sulphuric acid, whereby they are left with a hard woody shell, capable of protecting them from dampness or other injury; but are better fitted for crushing or sprouting. Special apparatus is described in which the seeds are subjected to the action of the acid for about fifteen minutes, and then to friction by means of brushes or revolving cylinders, after which they are placed in a limewater bath and then washed.

756. Gun Carriages, *A. Noble, Newcastle-upon-Tyne.—10th February*, 1883. 8*d*.

The carriage is arranged as a three-pivot carriage; that is, it may be pivotted centrally, or at a forward point within the carriage, or at an external point by use of pivot bars, whose length may be arranged to suit the circumstances of the case. The rollers on which the carriage trains can be set to any required angle to suit the position of the several pivots. These rollers are cylindrical, but are divided into discs, so as to suit more nearly the various radii on which they may be worked. The recoil is taken up by a pair of recoil presses, the pistons of which are fitted with spring loaded valves, which allow water to pass from one side to the other. A hand pump is attached to the recoil presses for the purpose of pumping the gun in and out.

757. Machines for Breaking or Reducing Grain, *C. Pieper, Berlin.—12th February*, 1883.—(*A communication from A. C. Nagel, R. H. Kaemp, and A. Linnenbrugge, Hamburg.*)—(*Void.*) 2*d*.

The subject matter of this invention consists in improvements in machines or mills on which grain is broken or reduced between two discs having annular milling surfaces.

758. Pressing Glass, *J. G. Sowerby, Gateshead-on-Tyne.—12th February*, 1883. 4*d*.

The object is to prevent what is known in press glass making as "sucking," and it consists in an improved process of working the mould, and an improved arrangement of plungers, whereby the taper on the plunger usually found necessary to press any deep article is dispensed with and a cell is produced, the sides of which will not fall in or the bottom suck up. An outer and an inner plunger are used, and supposing both to be down directly the outer plunger begins to move slowly upwards the inner plunger is lifted quickly, and a current of air forced between the plungers into the bottom of the cell.

759. Washing Machines, *J. Kennedy, Strabane, Ireland.—12th February*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to the arrangement of a tub provided with friction rollers.

760. Apparatus for Exercising with Velocipedes for Indoor or like Practice, *J. M. Smith, West Bromwich.—12th February*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to an apparatus for exercising with velocipedes in such manner that exercise may be taken with the machine indoors or otherwise without progressive movement.

761. Manufacture of Lace in Twist Lace Machinery, &c., *G. Bentley and E. Elsey, Nottingham.—12th February*, 1883. 8*d*.

This relates to the manufacture of imitation Swiss lace, also to the manufacture of such lace with different coloured effects thereon, also to the manufacture of combination net or lace, also to the manufacture of combination Swiss net or lace by a new method of drafting the same in five different colours; also to the manufacture of combination throw thread lace; also to a new method of producing all three gait combination net, and also all two or three gait net in hands at the same time with combination or ordinary work as required, and to working colours in the same.

762. Appliances for Flushing Urinals, &c., *A. Codd, Battersea.—12th February*, 1883. 2*d*.

In the bottom of an outer cistern the flushing pipe is fitted, and is always open, and within this cistern a smaller one is pivotted and supplied with water by a ball valve, and connected to the pull of the urinal, so as to empty itself into the outer cistern.

763. Treatment of Textile Vegetable Fibres, *J. Imray, London.—12th February*, 1883.—(*A communication from E. Frémy and V. Urbain, Paris.*) 4*d*.

This consists in removing the pectose, cutose, and vasculose of vegetable fibres, such as those of Rhea or China grass, by subjecting the fibres to the double action of caustic alkali and pressure, or first subjecting them to the action of oxidants, such as nitric or chromic acids, permanganate of potassa, hypochlorites, chlorine, bromine, oxygenated water, or unstable oxides generally, and when the cement and pellicule are transformed into resinous acids, subjecting them to the action of solutions of alkalies or their carbonates, or mixtures of these, under ordinary pressure, whereby the resinous acids are dissolved.

764. Manufacture of Carbon Filaments for Incandescing Electric Lamps, *G. Bowron and W. Hibbert, London.—12th February*, 1883. 6*d*

The filaments are made from a mixture of finely-divided carbon and a solution of sugar. The mass is placed in a vessel having a minute orifice, through which it is forced by means of a plunger. Carbonisation is effected in the usual manner.

765. Purifying Gum Copal, &c., *A. B. Rodyk, London.—12th February*, 1883.—(*A communication from J. D. Ross, Singapore.*)—(*Not proceeded with.*) 2*d*.

This relates to the process of washing and casting the gum into blocks.

766. Apparatus in or by which Coal Gas can be Burnt Alone or Enriched by Admixture with Hydrocarbon Vapour, &c., *A. Perkins, London.—12th February*, 1883. 6*d*.

The apparatus is fitted to gas chandeliers and fittings adapted to carry the comet globes, and it consists in leading a pipe from one side of the gas supply cock up through the globe to a chamber at top containing a suitable hydrocarbon, the pipe then passing downwards to the opposite side of the gas supply cock. When the pipe is bent over at top it is narrowed, and an opening is formed on each side, the narrow part in the carburetting chamber. From near the top of one arm of the pipe, a pipe leads down between the two arms, and terminates in the burner. The supply cock can be turned so that the gas passes up through either of the two arms.

767. Attaching Corkscrews and other Articles to Bottles, *F. H. F. Engel, Hamburg.—12th February*, 1883.—(*A communication from E. Berlien, Altona.*)—(*Provisional protection not allowed.*) 2*d*.

The object is to attach corkscrews and other useful or fancy articles to bottles by means of a cover of wood, pasteboard, glass, metal, or other material closing the recess formed to the bottom of bottles.

768. Fastening of Armour Plates, *L. W. Broadwell, Paris.—12th February*, 1883. 6*d*.

This consists in securing armour-plates to ships, forts, or backings by the use of recessed bolts, in conjunction with expanding devices, whereby the ends of the bolts are expanded within recesses in the armour-plates.

769. Match-boxes, *J. G. Stokes, Herne Hill.—12th February*, 1883.—(*A communication from H. de Schwabacher, Paris.*)—(*Provisional protection not allowed.*) 2*d*.

The object is to utilise match-boxes for advertising.

770 Trawling Nets, *W. B. Wilson, Aberdeen.—12th February*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to an appliance for effectually spreading the net.

771. Manufacture of Screws, *H. H. Lake, London.—12th February*, 1883.—(*A communication from the Harvey Screw Company, Incorporated, New Jersey.*) 6*d*.

This relates to machines for rolling the threads of screws, and consists in shaping the adjacent or working faces of a curved stationary die and a cylindrical rotating die, so that they approach each other at the portion where the point of the screw is formed, and the inclined ribs on the faces of the dies are continued over the inwardly-extending or approaching surfaces, whereby a spiral rib will be continued to the front of the blank, thus forming a "gimlet-pointed screw." A further improvement consists in the use of two or more revolving cylindrical dies with corresponding curved stationary dies adjustable with relation to each other to enable the blanks to pass freely from one pair of dies to the next.

772. Mechanism for Sounding Bells, *G. Porter, London.—12th February*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to the arrangement of the mechanism for actuating pneumatic signalling apparatus.

773. Bread, *H. H. Lake, London.—12th February*, 1883.—(*A communication from T. Montérichard, Paris.*)—(*Not proceeded with.*) 4*d*.

Water is placed in a boiler and grain is placed in a wire gauze holder and immersed in the water, which is then caused to boil for about an hour, when the grain is removed and drained, the water when cool being used to mix the flour and for the fermentation in making bread.

774. Spinning and Doubling Cotton, &c., *W. and C. G. Bracewell and A. Pilkington, Barnoldswick, Yorkshire.—12th February*, 1883. 4*d*.

This relates to frames with fixed and loosed tubes, the former acting as a bearing for the spindle, and on the latter the bobbin is placed, and it consists of an adjustable projection or overlap outwardly applied in such a manner as to be readily turned on or off a flange on the loose tube, whereby the latter may be readily removed from or secured steadily in position on the fixed tube, and to reduce unnecessary drag or resistance to the loose tube, its upper end may bear against the spindle or against a collar or ring freely mounted on the top of the fixed tube.

775. Consuming Smoke in Furnaces, *J. H. Johnson, London.—12th February*, 1883.—(*A communication from La Compagnie du Chauffage Industriel, Paris.*) 8*d*.

This consists essentially in causing the furnace door to regulate the supply of air to the furnace when it is opened and closed. Various arrangements for effecting this are described.

776. Self-acting Excavators or Dredgers, &c., *T. Whitaker, Horsforth, Yorkshire.—12th February*, 1883. 6*d*.

This relates to the parts of self-acting excavators which operate in opening and closing the same, and to the lifting apparatus used in conjunction therewith. Any ordinary crane can be used by adding a discharging frame or hook, suspended from the jib at a suitable elevation above the wagon or barge to receive the dredged material. A chain or rod is attached to the frame or hook and extends to the driver. To the opening or closing bar of the excavator a rod is fixed with a crosshead at its upper extremity, constructed to engage readily with the discharge frame or hook. Catches are fixed on the frame of the excavator and engage with and support the opening bar when suspended by the hoisting chain, but release it when the excavator rests on the ground.

778. Brushes, *C. Jack, London.—12th February*, 1883. 4*d*.

This consists in fitting hair brushes with a reservoir to hold any suitable liquid, which may be discharged in suitable quantities by touching or pressing a spring lever to open the discharge orifice.

779. Lubricating Apparatus for Spindle and other Bearings, *W. Cunningham, Dundee.—13th February*, 1883.—(*Not proceeded with.*) 2*d*.

This relates to means for preventing the exposure of the oil more than is absolutely unavoidable to the reception of dust, &c.

780. Potato Steamer, *C. F. Bower, London.—13th February*, 1883. 4*d*.

A perforated tin or wirework receptacle receives the potatoes, and is placed in an ordinary saucepan, catches being provided to enable the receptacle to be suspended in the top of the saucepan above the water, or it may rest at the bottom of the saucepan and be immersed in the water as desired.

781. Gas Motor Engines, *H. Townsend and B. and E. C. Davies, Bradford.—13th February*, 1883. 6*d*.

In a horizontal engine two cylinders are arranged, so

that one end of each forms a working cylinder in which the charge of air and gas mixed is ignited while the other end of each acts as a compressing cylinder. In one form the two working cylinders are at the same relative end of each cylinder, that farthest from the crank shaft, while the compressing cylinders are both at the end nearest the crank shaft, and are so arranged that the compressing cylinder of one supplies the charge to the working cylinder of the other by a passage between the cylinders also serving as a reservoir. The two pistons are connected by rods and cranks to the fly-wheel shaft, and when one is at one end of the cylinder the other is at the opposite end of the other cylinder, and a charge can be ignited at each stroke of the engine, both outward and inward.

782. CANS FOR MEAT, FISH, BUTTER, CONCENTRATED MILK, &c., AND APPARATUS FOR OPENING THE SAME, *T. G. Dolby, Dulwich.—13th February*, 1883. 6*d*.
A shoulder is formed round the inside of the can near top, and the cover rests on this shoulder, and has a turned up flange which fits against the part of the can above the shoulder. A ∩-shaped ring fits over the edge of the can and the flange of the cover, and by pressure a tight joint is made. The ring can be loosened by a few blows with a hammer. Another arrangement describes the ∩-shaped ring as being in one piece with the cover and one leg prolonged so as to rest on the shoulder in the can to which it is soldered, leaving the bend above the top of the can, so that it can readily be severed by means of a fixed cutter, and a cutter actuated by a hand lever, between which the bend is inserted.

783. PICKERS FOR LOOMS, *R. and T. Fielden, Walsden, Lancashire.—13th February*, 1883. 6*d*.
This relates to improvements on patent No. 197, A.D. 1870, the object being to secure the loose strip of buffalo hide forming part of the foot of a picker by the outside covering piece of the picker.

786. CLEANSING THE TUBES OF FEEDING BOTTLES, TOBACCO PIPES, &c., *J. P. Bark, Bootle.—13th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to the employment of a current of water under pressure.

787. BREAKING PIG IRON, &c., *J. Evans, Gaythorne, Lancashire, and S. Mason, Leicester.—13th February*, 1883. 2*d*.
A strong hook is reciprocated by a crank or cam and draws the pig iron against two jaws until it is broken into pieces.

788. RAILWAY BRAKES, *A. M. Clark, London.—13th February*, 1883.—(*A communication from J. van D. Reed, New York.*) 10*d*.
This relates to automatic railway brakes operated by friction gear and other mechanism from one of the axles of its carriage, but which are made continuous in their character by a chain connecting the brake mechanism of one carriage to another. It consists in the combination with friction drum and brake-applying mechanism of draught mechanism, arranged to bring the friction brake-applying mechanism into action and compensating lever mechanism, whereby the pull received by the draught mechanism of one car is caused to be transmitted to the like mechanism of an adjoining car without loss of power or motion. When the brake is accidentally broken apart the draught mechanism automatically causes the brakes to be applied to the cars at either side of the point of rupture.

789. MALTING, &c., *E. de Pass, London.—13th February*, 1883.—(*A communication from C. Golay, Paris.*)—(*Not proceeded with.*) 2*d*.
The object is to maintain the grain at the most convenient degree of temperature and dampness suitable for its germination in either thick or thin couches.

790. CORRUGATED BOX IRONS FOR PLAITING HOSIERY FABRICS, &c., *J. Gautherin, Paris.—13th February*, 1883. 6*d*.
Two irons are employed, one fixed and one movable by hand, the surfaces of both being curved or undulated according to the plait or frill to be produced on the fabric.

791. SECONDARY OR STORAGE BATTERIES, *T. Rowan, London.—13th February*, 1883. 6*d*.
Relates to dividing the vessel into a number of cells by walls of insulating material, which may be either perforated or plain.

792. DYNAMO-ELECTRIC MACHINES AND ELECTRIC MOTORS, &c., *T. Rowan, London, and S. Williams, Newport.—13th February*, 1883. 6*d*.
The disc armature consists of two thin discs of vulcanite, in which are formed hollow spaces for containing the coils of insulated wire, those on one side being wound to overlap those of the other side. The commutator has two sets of plates placed end to end, one set being set slightly in advance of the other to correspond with the overlap of the one set of coils. In another form of generator a number of helices of wire are mounted opposite to each other on two frames, and a corresponding number of steel magnets are pushed in and out of the helices by means of cams actuated by a central toothed wheel.

793. CONSTRUCTION OF VALVES WHEREBY A CERTAIN AMOUNT OF AIR MAY BE ADMITTED INTO CASKS CONTAINING LIQUIDS, &c., *W. Branford, Dennington.—13th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to the general construction of a self-closing valve.

794. MACHINE FOR SHEARING SHEEP, &c., *W. R. Lake, London.—13th February*, 1883.—(*A communication from C. Carpentier, Paris.*) 6*d*.
This relates to the combination of ordinary shears with a special arrangement of mechanism for imparting movement thereto without the necessity for employing both hands, as is the case with the shears ordinarily used.

795. FASTENINGS FOR PURSES, &c., *F., H., and F. Dowler, near Birmingham.—13th February*, 1883. 6*d*.
This relates to fastenings in which a stud fixed on one part of the article enters an eye fixed on the other part, and is engaged and disengaged by gentle pressure, and it consists in forming the stud of a hollow cup form, and the eye of a corresponding form.

798. LATCHES, AND SECURING KNOBS OR HANDLES TO THE SPINDLES OF LOCKS AND LATCHES, *W. B. Shorland, Barton-on-Irwell.—14th February*, 1883. 6*d*.
The latch is held in the raised position into which it is lifted when the door is opened until the door is closed again, when it is released, by which means the incline on the catch is dispensed with. Handles are secured on spindles by forming a cavity in the boss of the handle, so as to give space for a cone-headed screw to bend a forked part of the spindle into the cavity. Knobs are secured to latches by inserting a rose in the door, and which forms a bearing for the knob to turn in, the eye of the latch also fitting the rose, and the knob having a part cut out to fit the latch.

802. CONSTRUCTION OF BUTTER WORKERS, *T. Bradford, Manchester.—14th February*, 1883. 6*d*.
The special features of the invention consist in the peculiar construction and arrangement of a roller carriage, whereby it can readily be inserted and fixed in working order to the table, and also in the mode of exercising pressure by means of a suitable spring upon the roller for the more efficient working and salting of the butter.

803. WALLS FOR BUILDINGS, *W. Mullett, Brierley-hill, Staffordshire.—14th February*, 1883. 4*d*.
The walls are formed with opposite sides or parts spaced apart, and composed principally of "stretcher" bricks, and bonded or tied at intervals by vertical series of "header" bricks formed with a transverse groove or air passage at the part where they cross the space intervening between the two sides of the wall.

805. CONSTRUCTION OF ORDNANCE, *G. A. Cassagnes, Paris.—14th February*, 1883. 6*d*.
The cylindrical hoops used to strengthen the ordnance internally are made with internal and external surfaces of a conical form, when several layers are superposed, the inclination of the superposed cones being placed inversely, and care being taken to cross or alternate the joints, whereby the hoops are compelled to participate in the longitudinal resistance of the gun, as well as in the transverse resistance.

806. KNITTED LOOPED FABRICS, *H. Kiddier, Nottingham.—14th February*, 1883. 10*d*.
This relates to straight knitting frames fitted with traversing thread carriers, and it consists in the use of grooved or rim cams in place of plain surface cams for operating certain parts, whereby a greater speed can be obtained.

807. PLASTIC COMPOUND, *O. Schreiber, Berlin.—14th February*, 1883.—(*Void.*) 2*d*.
The inventor mixes 20 per cent. of pulverised silicic acid with 35 per cent. of pulverised magnesia, 3 per cent. of plaster of Paris, and 2 per cent. of flour of wheat, rye, or bran, and he adds to this mixture 40 per cent. of magnesic chloride, while continually stirring.

808. TREATING FELT, PARTICULARLY APPLICABLE TO THE MANUFACTURE OF FELT HATS, *J. Isherwood, Denton.—14th February*, 1883.—(*Not proceeded with.*) 2*d*.
The object is to economise steam and reduce labour in the stiffening process.

810. GAS COOKING STOVES, *J. Russell, Reading.—14th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to improvements in gas cooking stoves whereby the gas supply is automatically diminished by being partially turned off, either by the opening of the door or on the removal from the oven of the joints or other articles being cooked, and, on the door being shut and a lever pulled underneath the latch, or on a joint or other article being placed in the oven, the supply of gas is automatically turned on.

812. DOMESTIC STOVES AND GRATES, *H. Thompson, Canonbury.—14th February*, 1883. 6*d*.
A part of the back of the stove is pivotted in a chamber at the back of the grate to which the fuel is supplied, so that the fuel rests on the pivotted part of the back, which is acted upon by a weight so as to press the fuel forward towards the fire-bars as it is consumed.

813. FASTENINGS FOR BOOTS, SHOES, GLOVES, &c., *F. J. Brougham, London.—14th February*, 1883.—(*A communication from G. Klotz, Dresden.*) 6*d*.
The edges to be brought together are provided with bars, one edge of which is constructed so as to form together a pair of flanges, folds, or rebates, which are secured together by a locking device pushed over the bars.

814. LOCKS AND LATCHES, *J. Kaye, London.—14th February*, 1883. 6*d*.
This relates to improvements on patents No. 4873, A.D. 1877, and No. 1643, A.D. 1880, in which the doors are opened and closed by pushing or pulling the knob or handle, and it consists, First, in having the knob fixed to the door and actuating the latch by pushing the spindle which projects through the knob; Secondly, in the combination of a rim lock on the push-and-pull principle with an adjustable striking plate in the staple or catch of the lock, to provide for the shrinkage of the door; Thirdly, to a night latch on the push-and-pull principle, the push being accomplished from the outside by a flat key. Other improvements are also described.

815. RAIL SCREWS, &c., *T. Matthews, London, and W. Bayliss, Wolverhampton.—14th February*, 1883. 6*d*.
The chief object is to so construct the screws that the chairs, rails, or other articles secured by them may from time to time be tightened to the sleepers or other parts of wood, without twisting or turning the shanks of the screws.

816. SINGLE-ACTING HIGH-SPEED STEAM AND OTHER MOTIVE POWER ENGINES, *P. B. Elwell and T. Parker, Wolverhampton.—14th February*, 1883. 10*d*.
This relates to several improvements in the general construction of the engines.

817. BRASS BOBBIN WINDING ENGINES, *J. Mosley, New Basford.—14th February*. 1883. 4*d*.
This relates to certain methods of effecting automatic action in brass bobbin winding engines.

818. SPOKED WHEELS FOR RAILWAY AND OTHER VEHICLES, *E. Dearden, Sheffield.—14th February*, 1883. 6*d*.
This relates to the manufacture of "broad-back" spokes, and consists in rolling them in bars and reducing their ends by hydraulic pressure instead of by hammering; also to a machine for bending the spokes to the required form by hydraulic power, and to means for glutting or welding up the spokes and rim at the junction, which are also applicable for the purpose of welding or dabbing on single spokes.

819. SLEEPING BERTHS OF RAILWAY CARRIAGES AND STEAMBOATS, *T. F. Craven, Sheffield.—14th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to mechanism for raising and lowering berths.

820. MACHINES FOR DRESSING TEXTILE FABRICS, *W. R. Lake, London.—14th February*, 1883.—(*A communication from Monsieur Luthringer, Lyons.*) 6*d*.
This relates to the employment of two rollers or cylinders, between which the material receives the dressing, not directly, but through the medium of lower rollers, in a quantity which can be regulated.

822. COUPLING APPARATUS FOR RAILWAY VEHICLES, *W. R. Lake, London.—14th February*, 1883.—(*A communication from C. C. Mark, Flint, U.S.*) 6*d*.
This consists, First, in the connecting together of the couplings at each end of a vehicle, so that the draft is communicated directly from coupling to coupling rather than to the vehicle; and Secondly, in the peculiar construction of the various parts and their combination and operation.

823. FIRE-ARMS, *F. Beesley, London.—14th February*, 1883. 6*d*.
The object is to utilise the explosion of the cartridge or its equivalent, or the recoil of the gun consequent on such explosion, for the purpose of automatically effecting the cocking of the hammer or its equivalent, ready for the next discharge.

824. EXTENSIBLE FIRE-ESCAPE LADDERS, *A. M. Clark, London.—14th February*, 1883.—(*A communication from D. D. Hayes, San Francisco.*) 6*d*.
This consists in a fire escape extension ladder constructed with a turntable connecting the ladder with the truck, so that the direction of the ladder can be changed without moving the truck.

826. PREVENTING THE TRANSMISSION OR RADIATION OF HEAT THROUGH THE ROOFS OF HOUSES, &c., AND EXCLUDING RAIN, *W. Blakely, Bournemouth.—14th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to the arrangement of an internal lining.

828. APPARATUS FOR COMPRESSED AIR MOTORS, *R. Bolton, London.—15th February*, 1883.—(*A communication from C. W. Potter, New York.*) 6*d*.
The object is to so control the expansion from the high pressure at which it is stored in the reservoir to the working pressure, that such expansion may be utilised by causing it to take place in an injector, through which the expanding air draws with it into the cylinder an additional volume of air from the atmosphere, thus supplying to the engine a larger amount of air at working pressure than would have been produced merely by the expansion of the storage air.

829. WATER TAPS, *W. J. Dunderdale, Huddersfield.—15th February*, 1883.—(*Not proceeded with.*) 2*d*.
This consists in the use or employment of two taps—or a double tap—one placed above the other, the valves of which are operated by the same spindle, and so arranged that when one valve is opened the other valve is closed.

830. TREATMENT OF THE WASTE LIQUOR PRODUCED IN PICKLING IRON, *L. Howell, Taibach.—15th February*, 1883. 2*d*.
This relates to means of utilising the waste liquor produced in pickling iron.

831. FUSIBLE PLUGS, *J. Graham, East Greenwich.—15th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to the construction of a fusible plug the object being to provide a fusible plug which shall have no parts "tinned," so that the plug can be easily and quickly taken to pieces and examined without having to break any joints.

833. GALVANIC BATTERIES, *F. Walker, London.—15th February* 1883. 2*d*.
The object is to construct portable batteries by employing an excitant formed as a paste.

834. MATCHES AND BOXES OR RECEPTACLES FOR SAME, *G. W. von Nawrocki, Berlin.—15th February*, 1883.—(*A communication from Messrs. F. Gerken and G. Goliasch and Co., Berlin.*) 6*d*.
According to this invention the matches are provided at or near the bottom with the igniting composition, and at the other end with a friction composition for igniting purposes. Another part of the invention relates to the box for containing the matches.

835. TOBACCO PIPES, *J. R. S. Backhouse, near Leeds.—15th February*, 1883.—(*Not proceeded with.*) 2*d*.
The object is to provide an arrangement for receiving and directing the nicotine away from the stem.

837. COFFEE-CUPS, *C. D. Abel, London.—15th February*, 1883.—(*A communication from M. D. Pasvouri, Smyrna.*) 6*d*.
This consists in securing detachable handles to coffee-cups made of thin porcelain, whereby they are less liable to be broken both in the manufacture and in subsequent use.

838. BEATING, CLEANING, AND BRUSHING CARPETS, &c., *C. Hinksman, Bloomsbury.—15th February*, 1883. 10*d*.
Two rollers are mounted a certain distance apart and caused to revolve in the same direction. One end of the carpet is attached to one roller and partly rolled thereon, and the other end is attached to the other roller, and between these rollers others are mounted, over which endless bands pass and rest on the back of the carpet, the front side being downwards. An intermediate roller supports the carpet below, and beneath it a shaft is mounted and carries flexible beaters of wire rope, which are caused to strike the carpet as it travels from one roller to the other. The carpet may be afterwards passed between rotary brushes.

839. APPARATUS FOR DESTROYING INSECT VERMIN, *A. A. Akerman, London.—15th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to a small steam boiler, heated by a spiral lamp for the generation of high-pressure steam, for destroying insect vermin.

840. APPARATUS FOR BENDING OR FORMING LEAD, COPPER, AND OTHER SUITABLE METAL TUBING INTO BENDS, COILS, AND SPIRALS OF VARIOUS SHAPES AND DESIGNS, *T. Drake, Huddersfield.—15th February*, 1883. 8*d*.
The drawing shows a machine for bending pipes into a spiral. One end of the pipe is connected to the spirally grooved roller A which is mounted in brackets supported in the framework, and is caused to revolve by suitable gearing. Above this roller is a screw shaft

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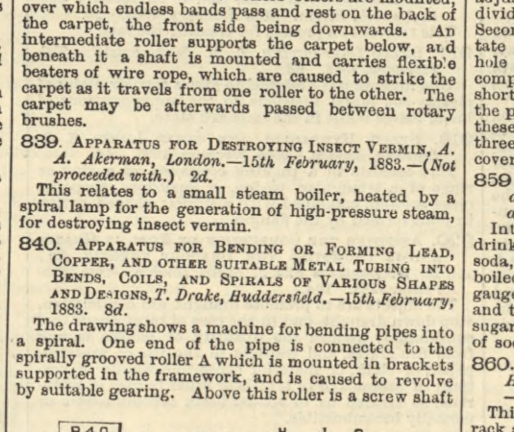

G also caused to rotate by gearing, and upon it is a box nut H having a weighted lever connected thereto and provided with a grooved anti-friction pulley J, which bears on the pipe and forces it into the spiral groove in roller A.

842. APPARATUS FOR WORKING GRABS, BUCKETS, AND SIMILAR LIFTING AND SELF-DISCHARGING INSTRUMENTS, *J. H. Wild, Leeds.—15th February*, 1883. 8*d*.
This relates to an apparatus by the aid of which the inventor claims to raise, temporarily suspend, discharge and lower grabs, tipping buckets and other diggers, or self-discharging receptacles, by means of a single chain controlled by one man.

843. APPARATUS FOR HOLDING DRY PLATES OR FILMS BEFORE, DURING, AND AFTER EXPOSURE, AND FOR CHANGING THEM IN THE PHOTOGRAPHIC CAMERA, *T. Samuels, Monken Hadley.—15th February*, 1883. 6*d*.
This relates to an apparatus in the nature of a combined dark back and holder for containing a number of dry plates or films superposed or placed in front of one another, and for automatically bringing the said plates or films successively up the same plane or position for exposure, and for receiving and packing away the said plates or films after exposure.

844. TREATMENT OF SULPHURETTED HYDROGEN SO AS TO OBTAIN SULPHUR THEREFROM, *P. J. Worsley, Bristol.—15th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to the obtaining sulphur from sulphuretted hydrogen by its combustion with a limited proportion of oxygen or of atmospheric air, either at the ordinary or at an elevated temperature.

845. MACHINERY FOR THE MANUFACTURE OF PIPES FOR SANITARY OR OTHER PURPOSES, *H. Tugby, Woodville.—15th February*, 1883. 6*d*.
This relates to machinery or apparatus for the manufacture of pipes for sanitary or other purposes by a process continuous from the raw clay to the finished pipes, consisting of the combination of the grinding, pugging, and moulding machine or machines arranged to operate conjointly.

846. SADDLE BAR, *M. Macleod, Malmesbury.—15th February*, 1883. 6*d*.
This consists in adapting the saddle bar as ordinarily constructed to turn in any direction except downwards, with the pull or strain exerted upon the stirrup leather by displacement or dislodgment of a rider, or from other cause, so that the leather may be released either over or backwards from engagement with the bar in a manner corresponding to that in which it is at present released by a backward pull or strain only.

847. APPARATUS FOR TREATING STEEL INGOTS, *J. Gjers, Middlesbrough-on-Tees.—15th February*, 1883. 6*d*.
This relates to improvements in apparatus of the kind described in specification of patent No. 1089, dated 7th March, 1882, and consists partly of a pit for equalising the heat of steel ingots constructed in a mass of brickwork with an upper part or mouth constructed to support a cover above the level of the top of the ingot, and also to support at a short distance above the said cover a second cover, so as to enclose a space between the two covers.

848. LAWN TENNIS BATS, *F. H. Ayres, London.—16th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to the manner of lacing the net, and making the reticulated part of the catgut which strikes the ball.

849. APPARATUS FOR QUICKLY REDUCING THE SPEED OF A SHIP WHEN UNDER WAY OR VEERING IT, *W. B. Tully, Chowdean.—16th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to the arrangement of drag boards.

850. ELECTRICAL SELF-REGISTERING MONEY TILLS, &c., *B. W. Webb, London.—16th February*, 1883. 1*s*.
Apertures are provided for each denomination of coin. The coins on their passage down shoots complete the electrical circuits of electro-magnets, and these cause the registering dials to be operated.

851. CONSTRUCTION OF FASTENINGS FOR BOOTS, &c., *C. Crowther, Manchester.—16th February*, 1883.—(*A communication from E. A. Quincke, Ludenscheid Germany.*)—(*Not proceeded with.*) 2*d*.
This relates to the construction of a buckle fastening.

852. STOPPERING BOTTLES, *J. C. Schultz, London.—16th February*, 1883. 6*d*.
This relates to a stopper provided with a flat dove tail stem or T-piece adapted to engage with the bottle whereby its withdrawal is prevented.

854. SCREW PROPELLERS AND PARTS OF VESSELS ADJACENT THERETO, *R. M. Steele, London.—16th February*, 1883. 6*d*.
This relates partly to placing one of twin propellers behind the other, so as to enable the two shafts to be brought considerably closer together.

855. APPARATUS FOR MARKING OUT TENNIS COURTS, *H. Smith, London.—16th February*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to a dial affording the means of recording the distances measured combined with an apparatus for marking right-angled offsets and a folding frame holding a colour reservoir intended to feed a travelling wheel, and so mark the lines required, and when said wheel is travelling cause the recording device to move and show the distance travelled and indicate the position at which the right-angled offsets are to set out.

858. COLLECTING RAIN WATER, *C. G. Roberts, Surrey.—16th February*, 1883. 6*d*.
This relates to improvements on patent No. 3996, A.D. 1878, and consists, First, in providing means for adjusting the passage through the partition which divides the pivotted tank into two compartments; Secondly, in making the strainer removable, to facilitate cleaning; Thirdly, in means for adjusting the hole through which the water issues from the first compartment of the pivotted tank; and Fourthly, in shortening the outlet pipes from the straining box and the pipe from the pivotted tank, and suitably shaping these vessels and the receiver vessels so as to bring the three close together in compact form, each acting as a cover to the one below it.

859. INDELIBLE INK, *H. A. Dufrené, Paris.—16th February*, 1883.—(*A communication from Messrs. Fonseca and Co., Paris.*) 2*d*.
Into an iron boiler is placed about 140 litres of drinkable water, 2 kilos. 250 grammes carbonate of soda, 12 kilos. of divided logwood, and the whole is boiled until the liquid marks 3 deg on the acid gauge. The mixture is then passed into a strainer, and to it is added about 7 kilos. of refined white fine sugar, 2 kilos. of black aniline and 1 kilo. 900 grammes of soot. The whole is then boiled.

860. RISING AND FALLING PIANO STOOLS, &c., *W. Hemingway, Halifax, and W. Bottomley, Brighouse.—16th February*, 1883. 6*d*.
This relates partly to the employment of a pivotted rack and a stop.

861. PILLAR, DOOR, AND OTHER LETTER BOXES, *H. Devine, Manchester.—16th February*, 1883.—(*Not proceeded with.*) 2*d*.
The object is to render it impossible to withdraw a letter from the aperture after it has once been inserted.

863. CONSTRUCTION OR ARRANGEMENT OF MORTICE LOCKS, &c., *A. W. Pocock, Wandsworth.—16th February* 1883. 4*d*.
This relates to the construction of mortice locks with two distinct boxes or barrels, but connected by a face or front plate.

864. APPARATUS FOR THE MANUFACTURE, DRYING, AND PACKING OF WHITE LEAD, PARTS OF WHICH ARE ALSO APPLICABLE TO THE PACKING OF OTHER SUBSTANCES, *J. C. Martin, Richmond.—16th February*, 1883. 6*d*.
The First part relates to that part of the manufacture of white lead which consists in converting metallic lead into flattened drops or splashes, or into a granulated condition, by dropping molten lead upon a dry moving surface, or upon the surface of a revolving cylinder. The Second part consists of an apparatus having for its object the more effectual and easy drying of white lead in a more or less powdered or granular condition, the prevention of waste, and the escape of deleterious dust from the apparatus during the operation of drying. The apparatus forming the Third part of the invention is for the purpose of closely packing, in casks or other packing cases, white lead or other materials capable of being consolidated by the action of the apparatus.

865. MANUFACTURE OF METALLIC DOWELS, *W. D. Player, Birmingham.—16th February*, 1883. 6*d*.
This consists in making dowels by stamping or raising and cutting from sheet metal, instead of casting them.

870. PIANOFORTES, *C. Camin, Berlin.—16th February* 1883. 6*d*.
The inventor claims a treble bridge for pianofortes generally, consisting of the combination of the bridge with a strip carrying the strings, also lower edges or strips, so as to form a channel in connection with the sound board.

871. INCANDESCENT LAMPS, AND APPARATUS EMPLOYED IN CONJUNCTION THEREWITH, *O. E. Woodhouse, F. L. Rawson, and W. H. Coffin, London.—16th February*, 1883. 8*d*.
This invention relates to special forms of lamps and their fittings, particularly adapted to surgical purposes.

872. SOFTENING, UNHAIRING, SCUDDING, PURING, UNGREASING, AND PRESERVING HIDES AND SKINS, *A. M. Clark, London.—16th February*, 1883.—(*A communication from J. L. Moret, Paris.*) 4*d*.
The inventor claims the manufacture and employment in and for the softening, unhairing, scudding, puring, ungreasing, and preserving hides and skins, of a composition prepared with caustic soda, or a mixture of caustic soda and caustic or American potash, together with realgar orpiment (disulphide or trisulphide of arsenic), to which quicklime may be added if required, for application as specified, the sulphides being either added to the solution of the alkali or alkalies, or produced in the process of making the composition.

873. APPARATUS FOR HOLDING ROPES OR LINES USED IN THE NAVIGATION OF SMALL SAILING BOATS, &c., *A. E. Maudslay, Littlebourne.—17th February*, 1883. 6*d*.
This relates to the general construction of the parts.

876. LOCK-STITCH SEWING MACHINES, &c., *L. Silverman, Westminster.—17th February*, 1883.—(*Complete.*)—(*Void.*) 6*d*.
This relates more especially to an improved thread bobbin or cop to be employed for the production of what is known as the under thread; also to the shuttles for carrying such improved bobbins or cops through the loops formed by the upper thread, and to certain modifications in sewing machines to adapt them to the employment of the said bobbins or cops and shuttles.

875. REDUCING METALS FROM THEIR ORES OR CHEMICAL COMPOUNDS, &c., *J. Clark, Kensington.—17th February*, 1883. 6*d*.
The object is to obtain the intense heat necessary in reducing metals from their natural ores or from chemical compounds by concentrating the rays of the sun

by means of a large and powerful lens or reflecting mirror, to a focus, while at the same time a suitable gaseous or other re-agent is blown upon the heated ore.

877. Billiard Tables, *J. Reap, Grove Park, Surrey.—17th February*, 1883. 4*d.*
This relates to a method and apparatus for raising and lowering a table.

879. Beds or Berths for Ships, *J. Hamilton, jun., and R. McIntyre, Glasgow.—17th February*, 1883. 8*d.*
This relates to means for simplifying the framing or supports and other parts of beds or berths.

880. Construction, Arrangement, and Working of Clocks or Time-keepers, &c., *J. A. McFerran, Manchester.—17th February*, 1883. 8*d.*
This relates to the general arrangement, construction, and working of clocks or time-keepers for the purpose or exhibiting uniform time at several points.

882. Boot and Shoe Tips, *J. Foster, Kettering.—17th February*, 1883. 4*d.*
This consists in making the tips bevelled or wedge shape in cross section, and that the inner edge is higher or thicker than the outer edge; and further, in making them hollow and with a rim on the underside.

884. Preservation of Smoked Fish, *H. J. Haddan, Kensington.—17th February*, 1883.—(*A communication from O. Syllwasschy, Leipzig.*) 2*d.*
This relates to a process for rendering smoked fish palatable, and for preserving the same for a long period

885. Apparatus to be used when Playing Accompaniments on Organs, Harmoniums, and similar Instruments, *H. J. Haddan, Kensington.—17th February*, 1883.—(*A communication from M. van Goch, Breda, Holland.*)—(*Not proceeded with.*) 2*d.*
The object is to enable unskilled persons to play on organs or similar instruments the accompaniment of choral songs or hymns.

889. Cooking Stoves or Ranges for Gas and Solid Fuels, *T. Fletcher, Warrington.—17th February*, 1883. 6*d.*
The object is to enable ovens to be used for cooking by the simultaneous or alternative use of gas or of the ordinary fuel without structural alteration of the range or stove.

890. Maintaining the Proper Level of Water in Steam Boilers, *H. H. Lake, London.—17th February*, 1883.—(*A communication from the Automatic Safety Boiler and Engine Company (Incorporated), New Haven, U.S.*) 6*d.*
This relates to apparatus for automatically supplying water to steam boilers or removing it therefrom so as to maintain a constant level, and it consists in the combined action of two pumps. A is one pump cylinder and B its plunger. X is a valve working in the inlet waterway and opening towards the plunger. C is the second pump cylinder, the piston of which is connected to the plunger B so as to work with it. The passage Y leads from the boiler at the water level to pump C, and in it is a valve Z opening into passage L leading to the lower part of pump C, so that the piston in rising will draw water from the boiler, and in descending force the same through valve M to the top of cylinder C, and from the latter a pipe N leads

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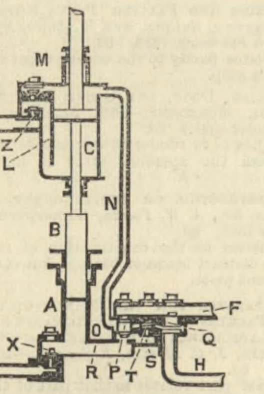

to a chamber O near the outlet passage F from the pumps to the boiler, a double valve P working between chamber O and passage F, and the passage R from pump A to a chamber S below chamber O; and between chamber S and chamber O is a valve T. H is an overflow passage from chamber O fitted with a valve Q, the upper larger end of which is exposed to the boiler pressure in passage F. When the pump C draws water from the boiler it will cause the communication between chamber O and passage F to close, and the water from pump A will pass by valve T to passage O, and by raising the differential valve Q, pass to the overflow passage H instead of to the passage F leading to the boiler.

892. Apparatus for Preventing Fluctuation of Gas in Mains or Pipes from which Gas Engines are Supplied, *C. G. Beechey, Liverpool.—17th February*, 1883. 6*d.*
This relates to an apparatus to prevent the fluctuation which is chiefly due to repeated inflation or expansion and recoil or contraction of the india-rubber bag or equivalent device which is employed as a sort of reservoir or gasholder between the main or supply pipe and the gas inlet of the engine.

894. Apparatus for Clipping Horses or other Animals, *J. C. Mewburn, London.—17th February*, 1883.—(*A communication from Messrs. F. Guillaume et Cie., Paris.*) 2*d.*
This relates to the construction of the apparatus, so that it can be readily taken to pieces.

895. Apparatus for Starching Collars, &c., *S. Barrett, Keighley.—19th February*, 1883.
The object is the arrangement for starching collars and other materials in such a manner, that during the operation of starching, the articles are exposed to the view of the attendant.

897. Production of Phosphoric Acid and Phosphates and Utilisation of Slags, *T. Twynam, London.—19th February*, 1883. 4*d.*
The inventor claims the process of obtaining separately phosphoric acid and phosphate of lime from metallurgical slags containing oxide of iron, by precipitating ferric oxide in combination with part of the phosphoric acid, by means of chalk, and subsequently precipitating the phosphate of lime remaining in the solution.

899. Joint or Union Contact for Electric Fittings, *W. Defries, London.—19th February*, 1883. 6*d.*
The ends of the conductors are drawn through holes in a plug of insulating material. One end terminates in a small helix and rests in the centre of the plug, the other end, formed into a circular hoof, rests in a groove and is concentric with the helix. The plug is contained in a line on to which fits a coupling having a piece of insulating material provided with corresponding central and side contacts respectively connected to the conductors contained in the fittings.

900. Water Heater used in Connection with Circulating Hot Water Pipes for Greenhouses, &c., *W. Carrington, Openshaw, and W. H. Bowers, Gorton.—19th February*, 1883. 6*d.*
This relates to the arrangement and construction of water heaters or low-pressure boilers, in which the water is surrounded by a large area of heating surface, and the combustion of the fuel so efficiently effected that emission of smoke is nearly or entirely prevented.

905. Fire-grates, *J. Dunbar, Coalbrookdale, Shropshire.—19th February*, 1883. 6*d.*
The object is to make the same fire-grate capable of being used with openings of different sizes in the chimney-pieces, and it consists in making the panels or cheeks adjustable laterally.

906. Looms for Weaving, *J. W. Cotton and H. Barnes, Burnley.—19th February*, 1883. 6*d.*
This consists of a means or apparatus whereby lengths of cloth having a heading and fringe at one or both ends thereof may be woven continuously without the necessity of stopping the loom.

907. Apparatus for Steeping Grain, *C. D. Abel, London.—19th February*, 1883.—(*A communication from Dr. L. Mautner R. von Markhof, Vienna.*)—(*Not proceeded with.*) 2*d.*
This relates to a new steeping process which enables the grain to be successively steeped into the water and subjected to the action of the atmosphere, by which process all the grains are subjected for an equal length of time to the action of the water, and are uniformly softened.

910. Apparatus for Concentrating and Heating Wines, *S. Pitt, Sutton.—19th February*, 1883.—(*A communication from the Cie. Industrielle des Procédés, Raoul Pictet, Paris.*) 6*d.*
The treatment consists in cooling the wine until ice is deposited from it, and the arrangement of the apparatus is such as to economise the refrigerant and to facilitate the operation.

911. Motors Worked by Air, Gas, Steam, &c., *G. M. Capell, Passenham.—19th February*, 1883. 8*d.*
This relates to the construction of rotating wheels, as applied to air, gas, steam, or other fluid motors or pumps, and consisting of outer and inner wings mounted on a cylinder or drum, which latter is provided with apertures, or portholes.

914. Keyless Watches, &c., *C. Lange, London.—19th February*, 1883. 6*d.*
The object is to increase the strength of the attachment between the watch and chain, and render the winding "pendent" more easily manipulated.

915. Utilising Raw Vegetable Fats and Matters for Artificial Butter, &c., *C. A. Meinert and P. Jeserich, Berlin.—20th February*, 1883. 2*d.*
This relates to a process for treating the fats.

917. Bread Loaf-cutter, *T. M. Ford, Bristol.—20th February*, 1883. 6*d.*
This invention is designed to give a regular series of cleanly-cut radial incisions to the upper portions of bread loaves while in the unbaked state.

918. Steam, Hydraulic, and other Joints, *E. D. Penning, London.—20th February*, 1883. 4*d.*
This consists in a packing composed of a ring or rings of a triangular, wedge, or analogous shape in cross section, combined with a similar shaped cavity in joint formed by the flanges.

920. Assisting the Combustion of Fuel in Grates and in Promoting the Draught therein, &c., *H. W. Davidson and J. Speir, London.—20th February*, 1883. 10*d.*
The objects are to promote draught, aid combustion, stop down draught, and in the case of bituminous coal considerably reduce the quantity of smoke in and from fire-grates, and consists in the use of asbestos, paper, or cloth, or material consisting wholly or partially of asbestos or of textile or other fabrics or materials, so treated as to render them incombustible or partially incombustible.

923. Sash Fasteners, *T. J. Mullings, London.—20th February*, 1883.—(*Not proceeded with.*) 2*d.*
The object is to provide a fastening which is automatically locked by the act of shutting the sashes.

924. Electric Meter, *A. S. Buller, St. Andrews, N.B.—20th February*, 1883. 5*d.*
Two platinum plates are immersed in a vessel containing acidulated water, and connected to the main conductors through a known resistance. The gases generated by the passage of the current cause mercury to rise in a tube and complete the circuit of an electro-magnet whose armature moves, by a pawl, the counting mechanism. At the same time the circuit of an induction coil is completed, the spark from the secondary coil of which ignites the gaseous mixture and permits of the descent of the mercury.

925. Button Fastenings, *J. Imray, London.—20th February*, 1883.—(*A communication from A. McKevit, Chicago, U.S.*) 6*d.*
This relates to fastenings with a screwed shank attached to the body, and which is passed through the fabric and secured by a nut, and it consists in forming two collars on the shank with an intermediate space sufficient to receive the fabric in which the button-hole is formed.

927. Secondary Batteries, &c., *O. J. Lodge and J. S. Pattison, Liverpool.—20th February*, 1883. 4*d.*
The inventors wash the negative or spongy lead plate in ammoniac salts, or a hot alkali to get rid of the sulphate of lead; and to prevent the formation of the sulphate metallic zinc is immersed in the acid liquid of the cell, and makes metallic contact with the lead plate. The zinc may be used as a supporting plate or rod.

928. Apparatus Applicable for the Pointing and Firing of Guns, *H. J. Haddan, London.—20th February*, 1883.—(*A communication from A. Bouilly, France.*) 4*d.*
A mercury tube and series of contact points are so arranged as to fire the charge when the gun is trained to the desired angle.

931. Printing Telegraphs, *H. J. Allison, London.—20th February*, 1883.—(*A communication from S. D. Field, New York, U.S.*) 8*d.*
This invention relates to that class of instruments the type wheels of which have imparted to them a tendency to continuously rotate, which is, however, converted into a "step-by-step" motion by a magnetic escapement. The instrument is provided with two type wheels mounted on independent shafts and "unison" lever, together with their various controlling mechanisms.

933. Construction or Arrangement of Blocks or Frames by a Moulding Process Suitable for Walls, &c., *W. Lee and D. F. Beale, Maidstone.—20th February*, 1883. 4*d.*
This relates to the construction of building blocks having two sides at right angles to each other, the top and bottom ends or surfaces having grooves or channels.

937. Construction of Railway and other Wheels and Mode of Fixing such Wheels on their Axles, *W. Eyre, Sheffield.—20th February*, 1883. 6*d.*
The object is the construction of wheels from a plate of wrought steel or iron, thereby rendering them more durable and less liable to break than when cast as usual; also an improved mode of fixing such wheels upon their axles.

938. Steam Boilers and Safety Combination therewith, &c., *J. Hall, Manchester.—20th February*, 1883. 6*d.*
The object is, First, to combine in one apparatus an automatic spring spiral safety valve, water gauge, and automatic water float, the two latter pointing to one level at the same time by an index on the float rocking shaft, and the water in a vertical gauge glass with a mud collector at the bottom of the combination, and a mud cock to draw off the refuse matter. Fig. 1 shows this arrangement. The float works in vessel A as the level of the water varies, and actuates pointer B working over a suitable index; and connected to vessel A is the gauge glass C. On top of gauge C is a steam pressure gauge D, E being the steam pipe from the boiler. F is the safety valve above the vessel A. I is the mud collector, and H the discharge cock. The back pressure valve J is for retaining the water in the boiler in connection with water pipe K and stop valves L and L^1, both of which may be closed to close any part of the combination for repairs. The pet cock M is for letting off air when starting the injector N for feeding the boiler with water through main O and O^1, and then through the back pressure valve J and stop valve L^1 into the boiler. P is the steam pipe from the boiler to the injector, Q the water supply pipe, R the steam spindle for starting the injector, and S the overflow pipe for discharge of air and water when starting the injector. The invention further relates to the construction of the double lifting

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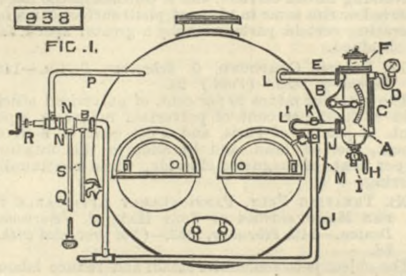
FIG. 1.



and forcing injector shown in Fig. 2, and consists, First, in forming the water supply orifice A^1 of less diameter than usual—that is, about one-third, or say, by a standard No. 5 injector of 5 millimetres, the water supply orifice should be 10 millimetres; and Secondly, in the hollow steam lifting spindle B^1 for creating a vacuum when starting the injector. When the small coned end of the spindle is brought down into orifice D^1 about half way the spindle collar E^1 is lifted off the seat of the steam nozzle C^1, and the steam entering B^1 creates a vacuum in the small orifice or passage D^1, which lifts the water through the supply orifice A^1 from or below the injector. By these means the water can be lifted double the height as in the ordinary injector, and by

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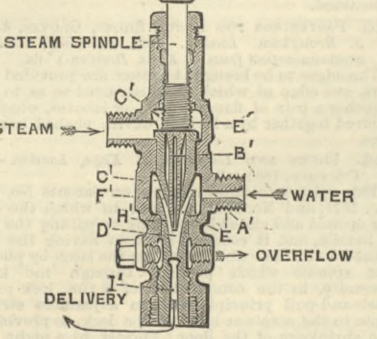
FIG. 2



drawing spindle B^1 two or three threads further back the coned part F^1 will be brought inside steam nozzle C^1, and the steam will then pass by the parallel part H^1 into the orifice D^1, commingling with the water in proper proportions—that is, by the aid of the coned part F^1 being regulated up or down sufficient to force the water through a second orifice I^1 into the boiler to suit the various steam pressures.

940. Electric Cables or Conductors, *A. M. Clark, London.—20th February*, 1883.—(*A communication from L. A. Fontin-Hermann, Paris.*) 6*d.*
To allow of a free circulation of air the wires are threaded through bead-shaped pieces of insulating material, these in turn being held in place within a tubular envelope of non-conducting material.

942. Treating Metallic Ores, &c., for the Separation of the Metals therefrom, *J. H. Johnson, London.—20th February*, 1883.—(*A communication from A. D. Ancel and J. M. A. Thiollier, Paris.*) 8*d.*
This consists essentially in causing the metalliferous substance itself to act as a soluble electrode when immersed in a liquid capable of acting upon the metal.

944. Separation of Gold and other Metals from their Ores, *A. E. Scott, London.—20th February*, 1883. 4*d.*
The metals are separated from their ores in the form of salts, and these are reduced to the metallic state by any suitable method.

945. Tanning Leather by Electricity, *L. Gaulard, London.—20th February*, 1883. 4*d.*
The hides are suspended in a weak solution of tannin, in which are placed the two electrodes connected to a suitable source of electricity. The current is reversed after an interval of eight days.

948. Sewing Machines, *W. Jones, Guide Bridge, and H. Gamwell, Liverpool.—21st February*, 1883 6*d.*
This relates to sewing machines called "elastic" machines, and consists in the mode of constructing the shuttle-driver and its arrangement in the "arm," and in the arrangement of the mechanism for giving oscillatory motion to the shuttle-driver, by which arrangement the sliding toothed rack hitherto used in this class of machines for actuating the shuttle-driver is dispensed with.

950. Knitting Machines, *F. J. Drewry, Burton-on-Trent (executor of W. Morgan-Brown, London).—21st February*, 1883.—(*A communication from G. A. Leighton and S. E. Forsaith, Manchester, U.S.*) 1*s.* 4*d.*
The object is to enable the changes in position of the different cams which actuate the plate and cylinder needles, and also the needle cylinder, to be controlled and effected automatically by a pattern surface when it is desired to change from one to another kind of knitting.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

283,764. Electrical Conductor, *Patrick B. Delany, New York, N.Y.—Filed May 10th*, 1883.
Claim.—(1) A compound electrical conductor consisting of the combination of a strain wire conductor of high tensile strength and capable of enduring the necessary strains, and an envelope, sheath, or covering composed of comparatively fine wire of relatively low resistance. (2) The combination, substantially as set forth, of a strain wire of requisite tensile strength, and an envelope, sheath, or covering of copper wire braided thereon. (3) An electrical conductor, consisting of a central wire or conductor having braided thereon a sheath of comparatively fine wire of rela-

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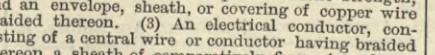

tively low resistance. (4) The compound electrical conductor herein described, consisting of the combination of the strain wire or central core of requisite tensile strength, a sheath of relatively fine copper wire braided thereon, and an outer coating of insulating material. (5) A compound electrical conductor, consisting of a strain wire, its envelope or sheath composed of fine copper wire, and an outside coating of metal, substantially as set forth.

283,830. Apparatus for Pulverising Grain, Ores, &c.—*Francis Taggart, Brooklyn, N.Y.—Filed November 25th*, 1881.
Claim.—(1) In apparatus for disintegrating and comminuting grain and other frangible substances, the feeding and conducting tube or chute having at the end an orifice that is long and narrow, in combination with a chamber for containing air under high pressure, a jet mouth for the issuing current of air, adjacent to

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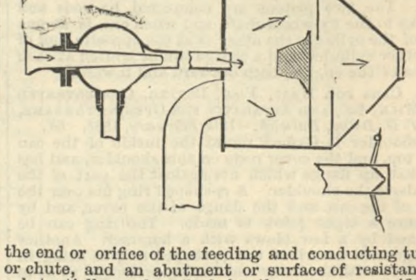

the end or orifice of the feeding and conducting tube or chute, and an abutment or surface of resistance, substantially as described for the purpose specified. (2) The combination in apparatus for disintegrating grain and other frangible substances, of an ejector formed with an elongated orifice of discharge, with a correspondingly elongated abutment, substantially as described for the purpose specified.

284,162. Wrench, *Henry William Atwater, Orange, N.J.—Filed May 24th*, 1883.
Claim.—(1) The combination, in a wrench, of the sliding jaw *f*, the fixed jaw *a*, and the bar *b*, said bar *b* having teeth along on one of its sides, the excentric *h*, having teeth on its periphery corresponding to the teeth of the bar *b*, the pivot for the excentric, a spring to move the excentric and bring its teeth into contact with the teeth on the bar, and a lever for moving the

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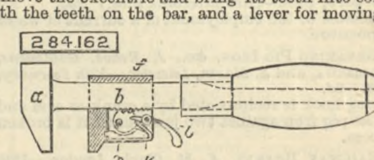

excentric in the opposite direction, substantially as specified. (2) The toothed bar *b*, fixed jaw *a*, and sliding jaw *f*, in combination with the toothed and notched excentric *h*, the lever *i*, with its short end in a notch in said excentric, and the spring *k*, pressing upon the lever, substantially as and for the purposes specified.

284,327. Gear Moulding Device, *Henry C. Rasner and Augustus Walton, San Francisco, Cal.—Filed March 19th*, 1883.
Claim.—(1) In a gear moulding machine, and in combination with a stationary bed and a central hub C, one or more arms C^1 D projecting from said hub, and having a worm or screw and locking device, with extensions E fixed at the other ends of the arms and carrying toothed patterns, as set forth. (2) In a gear moulding machine, a stationary bed A, and a hub C, with a vertical axis B, an arm or arms C^1 D extending

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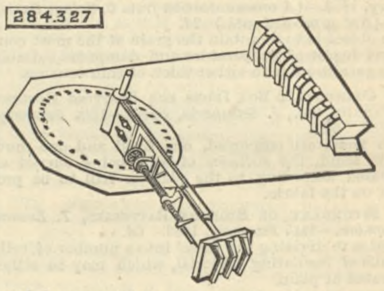

outward from said hub, an extension E, to which a pattern is attached, a worm or screw connected with the arms C^1 D so as to advance or withdraw said extension, and a lock by which this extension is gauged, in combination with a central graduated disc H, fixed with relation to the arms so as to gauge the distance to which the pattern is moved circumferentially for each new operation, as set forth.

CONTENTS.

The Engineer, October 12th, 1883.