THE DEPRECIATION OF FACTORIES.

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

No. III.

To facilitate a correct estimate of deterioration it is expedient in most undertakings to divide the property into classes, and to deal separately with each. Sometimes it is preferred to write off one average rate from the whole of the sunk capital, and if the average happens to be a fair one, the method has the advantage of simplicity. But simplicity is its only merit, and it has many drawbacks. Buildings, machinery, and loose tools generally require very different rates; and although a fair average may have been established, it will evidently be affected by the vicissitudes of particular years, and if not modified may lead to considerable error. For instance, the manufacturing operations of one year, or series of years, may have told more severely on certain parts of the plant or buildings than on others, and if the wear and tear due to the operations have not been sufficiently noted, estimates for future work of a similar kind, which allow only the previous depreciation rate, may prove erroneous. There are frequent cases of factories engaged in multifarious operations where a certain total result of profit is achieved, concerning which little or no investigation is made to ascertain to which branch of manufacture it is due. And in the absence of a proper analysis, the most remunerative class of operations may be neglected or contracts taken in other branches at prices which would show a loss if the deterioration of plant due to them were properly allotted. As a corollary to the foregoing, it is dangerous to establish an average rate, because it has been found appropriate in some other factory apparently similar, unless the circumstances are exactly alike.

It is usual to write off a percentage, not of the original value, but of the balance of the preceding year. Thus if at the end of the first year 10 per cent. has been written off £100, then the 10 per cent. will be written off £90 next year, and so on, the additions made within the year going, however, to neutralise such reductions, and in most cases to increase the actual capital value. When dividing into classes the capital sunk in a manufacturing business, it is desirable, on the one hand, to have various distinct categories, because estimates of cost in regard to future operations or contracts can be made correctly only with a knowledge of the deterioration due to them, and because the work of one department may involve a very different rate to that of another. On the other hand, a minute subdivision is generally impracticable and inconvenient. The following is an example of the classification frequently adopted in factories:—Preliminary expenses; land, including adaptation; buildings and wharves; fixed plant and machinery; steam engines, boilers, and furnaces; small loose plant and tools; horses.

In establishing a new manufactory there is often an outlay of capital for preliminary expenses, giving no actual return in buildings, plant, or other tangible property. Such are the legal expenses attending the purchase or expropriation of land, or connected with the formation of a joint-stock company, and in some cases even the expenses of obtaining an Act of Parliament. Outlay of this kind may be just as necessary to the purpose in view as any other part of the expenditure, and may have been foreseen and reckoned on as part of the invested capital. While, however, the earnings of the factory may, so long as they continue, afford a profit on such accessory outlay, it may be quite valueless as an asset in case the undertaking is wound up or sold, and therefore it is generally deemed prudent to cancel gradually this portion of the capital by writing off some of it annually out of the earnings. Strictly, this may be considered as a sinking fund, but it is sometimes dealt with as part of the general depreciation. If the undertaking has been purchased as a going concern, and a specific sum paid for goodwill, somewhat the same considerations will arise for this item also. No rule can be set down for a rate of depreciation for this purpose. If the amount be small, it may be wiped off at once out of the earnings of the first few years, or it may form a legitimate object to which to apply the surplus profits of a prosperous year. On the other hand, there are cases where it would be unfair as between partners to cancel out of present earnings an outlay which was necessary to the establishment of the factory, and of which, therefore, future earnings might justly bear a share. Generally it may be said that preliminary expenses should be written off at a more rapid rate than the deterioration in plant. From three to five years is a usual period. Where the expenses have been incidental to the purchase of land which has since undoubtedly risen in value, such an increment may be held to sufficiently balance the item, which may then need no other consideration, as a sale at any future time would recoup the original outlay. So long, however, as the facts are correctly recorded in the books—so that in the case of changing partnership or sale of shares the reduction in the burden of capital can be taken into account, and the value of the shares enhanced accordingly—the writing off of all preliminary expenses is a distinct advantage.

Land occupied by a manufactory generally maintains its full value, and no provision for depreciation is necessary. In England, especially in large towns, the tendency is towards a growth in value; the factory itself may have become the centre of an industrial population engaged in kindred and contributory trades, while the construction of railways and other facilities for transport may largely increase the value of the site. More than this, the expenditure for clearing and preparation of the site, as well as the formation of roads and wharfs may have added a more than corresponding value to the land. Where a factory originally built in an open neighbourhood has been long established it may have become so surrounded by a growing town as to have acquired value as a site for other classes of buildings entirely disproportioned to its original purpose; and in large cities it constantly occurs that a factory may be dismantled, and the site sold for a price high enough to pay for the building of a larger and better factory elsewhere on a more commodious though less central site. While, however, it may be equitable in the case of a change of partners or business to re-value the site or take into account its prospective value, this increment should not be mixed up with the annual accounts of the undertaking further than to justify the maintaining the capital value of the land itself without depreciation. But although the tendency is generally upwards, there are occasionally cases where land may depreciate in value. Thus, the growth of the town, or the opening out of railways and roads in another direction, or a change in the locality of the trade may have left the site isolated or unfavourably placed. From these causes it might prove necessary, if the factory were to be sold, to dismantle it in order to render the land available for a more appropriate purpose. Therefore, even while the manufactory was a going concern it might be prudent, where such a liability appeared probable, to write off something from the original value of the land, so as not to leave the burden of the loss to those who might be proprietors at the time of change. Sometimes a depreciation is necessary, not because of any real falling off in value, but because the land was bought in a time of inflated prices. As a general rule, however, no depreciation rate is needed for the capital sunk in land and in the cost of adaptation.

Buildings may be considered to include all structural additions to the land, and, therefore, not only workshops and offices, but wharfs, railways, and tramways, may for the present purpose be placed in one category. It very often happens that in the accounts of manufactories no allowance is made for deterioration of buildings, it being considered that if kept in proper repair they are permanent. The term of endurance depends primarily on the solidity and quality of the original work, and then on the attention paid to repairs. But besides current repairs, there must also be partial renewals from time to time at intervals far apart in the early years of the undertaking, but shorter as the factory grows older, which would tell heavily, and perhaps unfairly, on those who happened at the later period to be proprietors, unless some provision had been made by writing off some of the value in the early years. In reckoning the proper rate of depreciation for buildings of brick or stone, they may be divided broadly into two classes, as those subject only to ordinary deterioration from time and weather, and those which suffer also from abrasion, concussion, or other incidents of working. In an engineer's factory, for instance, the pattern shops, fitting shops, lofty chimneys, storehouses, and offices might come in the first division; while the foundry, smithy, and, in some heavy trades, the machine shops and erecting shops might, as being liable to rougher usage, be placed in the second. And even in lighter trades, if quickly-running shafting or machinery be attached to the walls or roof framing, the effect on the building may be considerable. If proper attention be paid to the roof covering as well as to the painting of ironwork and woodwork, the expenditure being all made out of revenue, a depreciation rate of 1½ per cent. would suffice in the first-class so reducing every original £1000 to £635 in thirty years, and a rate of 4 per cent. might be appropriate for the second-class, reducing every £1000 to £638 in eleven years. If, then, at the end of these thirty and eleven years respectively £200 be spent in a thorough renewal—as of roof framing, chimneys, window sashes, and in the renovation, where necessary, of brickwork—this new expenditure might be properly added to the capital value, which would then stand at £835, and the process of depreciation go on again. In most factories an average of 2½ per cent. for buildings will generally be found appropriate if due attention is paid to repairs. Such a rate will bring down a value of £1000 to £468 in thirty years, and then a reasonable sum spent on a thorough renovation may be added to the capital value, and the rate of depreciation go on. Buildings of wood or iron would require a higher rate, ranging from 4 to 10 per cent., according to the design and solidity of the buildings, the climate, the care with which they were periodically painted, and according, also, to the usage they were subjected to. Thus, strong wooden buildings in a cold dry climate might last almost as long as brick structures, while light wooden sheds in England would not last one-sixth as long. So, also, the cheaper kind of iron buildings on light columns, with loosely fitted roof framing and covered with corrugated iron, galvanised but unpainted, would in a damp climate be so wasted by rust and shaken by the wind, that they would be quite worn out in from ten to twenty years, the old materials being almost worthless. In factories where such operations as melting, hammering, and rolling of iron are carried on in buildings of this sort, a depreciation rate of 5 per cent. would be quite inadequate, and even substantial brick buildings subjected to the vibration due to steam hammers and the strains of heavily loaded cranes might require, even though current repairs were effected, a rate of 5 per cent. to allow for occasional thorough renewals. In any case the object in view in deciding upon the system and rate of depreciation should be to have always a book value within that which a fresh valuation would give, and periodical valuations may be required to show whether an increased or diminished rate was necessary for the future. The question as to how far current repairs and renewals would alone meet the case depends, as has already been stated, a good deal on the size or extent of the factory. Thus in a large and long-established works, a certain proportion of the whole might be renovated and even re-built every year, and this, if done out of revenue, would render a depreciation rate unnecessary. But in a small factory, or one recently established, such renewals might not become necessary for many years, and a depreciation rate, dividing the loss over many years, would be needed to accumulate a fund for future application. The risk of error is greater when divided over many years than in those cases where the annual expenditure shows clearly the fleeting value of the buildings. Furnaces and ovens, which wholly or in part are actually destroyed by the operations of manufacture, obviously demand a special system of depreciation or reserve fund, particularly where they are too few to provide an annual average of renewals. Wharves and railways should be maintained out of revenue, but unless they be of large extent, so that there will every year be an average expenditure for renewals, a rate of depreciation will also be necessary, which will, in effect, serve as a reserve fund. For instance, if there be works of this kind having an original cost of £1000, a rate of 5 per cent. will in ten years reduce the value to £600. If at that time £200 be expended on actual renewals, such as sleepers, rails, and masonry, this new outlay may be properly added to the book value, and the same rate of depreciation be continued. Where the quantity of rails is sufficient to class as a separate item, it is generally considered prudent to write the value down to that of old iron or steel, and there leave it, the capital being brought back to its original value by future renewals. The considerations which arise from a limited tenure, or in regard to fixtures as between landlord and tenant, have been already referred to, and sometimes involve legal questions which need not be dealt with here.

THE "GLADSTONE" EXPRESS LOCOMOTIVE—L. B. & S. C. RAILWAY.

No. I.

We propose in this and a succeeding article to describe a new express locomotive recently put to work on the London, Brighton, and South Coast Railway, and to supply information concerning its performance. We believe that such a detailed account of a modern first-class locomotive, and of the work which it can do, cannot fail to prove extremely interesting to all our readers, and useful to many of them. The engine in question has been designed and constructed by Mr. W. Stroudley, M.I.C.E., and locomotive superintendent of the line. It will be seen as we proceed that the engine differs in many respects from ordinary locomotives; but it may be safely said that there is a good reason for every novelty, or departure from existing practice. An external view of the engine will be found in our impression for September 7th, page 193, and last week we gave end views and cross-sections. This week we publish, as a supplement, a longitudinal section of the engine and a plan. The tender forms the subject of a separate illustration.

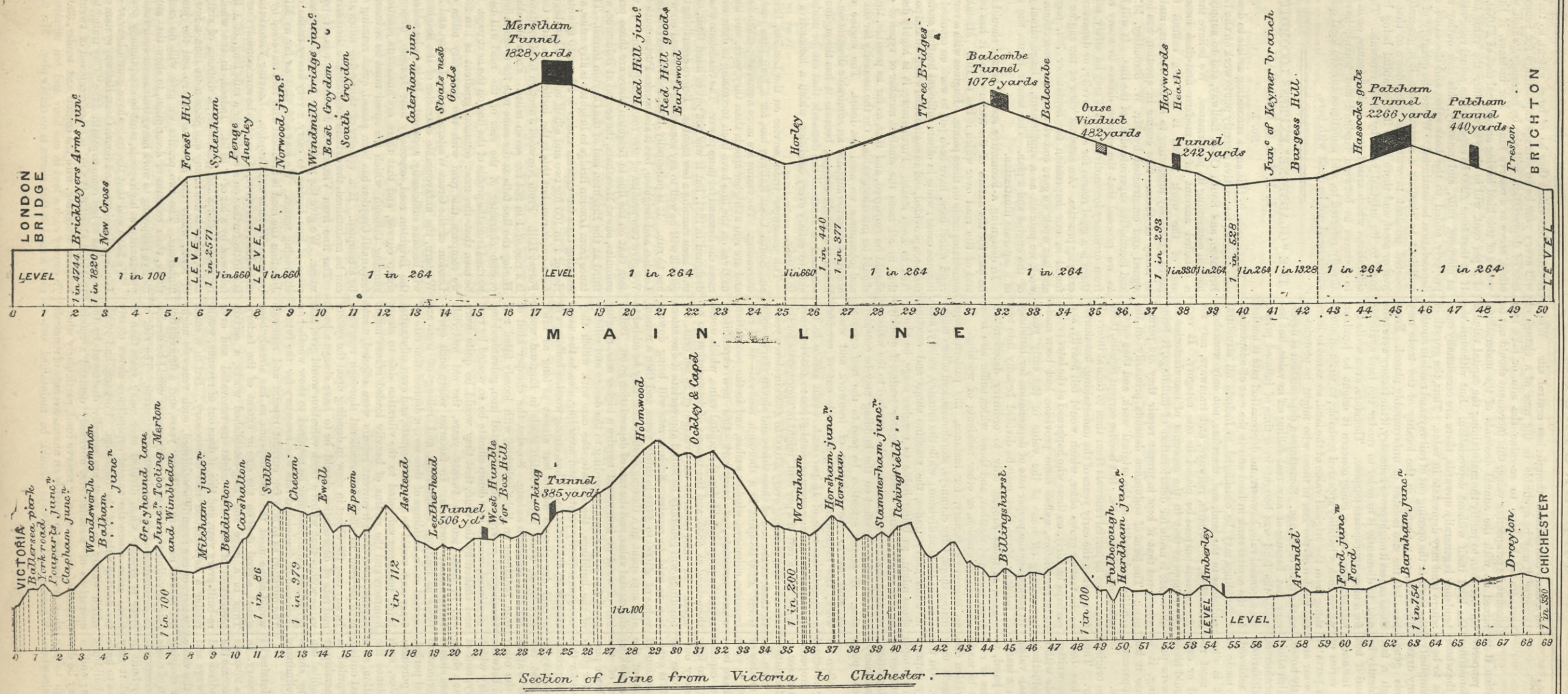
In designing a locomotive special regard should always be had for the nature of the traffic which it has to work, and of the road over which it has to run. Mistakes are sometimes made on these points. Engines with a very long, rigid wheel base, have been put to work on crooked roads, in some cases; while in others sufficient heating surface has not been provided, and an engine otherwise good and powerful fails to keep steam. Furthermore, it is highly desirable that in all cases the smallest number of types of engine should be employed, and that, as far as possible, the parts should be interchangeable. On the necessity for simplicity and cheapness we need not insist. The engine we are about to describe supplies an admirable illustration of the lesson we would enforce, because it has throughout been schemed to meet all the demands that can be made on it, and to satisfy every condition which a locomotive ought to satisfy.

The passenger train service on the London, Brighton, and South Coast Railway has, for a long time past, been increasing. The trains are more numerous, much heavier, and are run at higher speeds than they were, and the locomotives on the line have been increasing in dimensions to meet the demand for more power. The Gladstone was really designed in 1881, but it was not put in hand then, and has only been running a few months. Before describing the engine it will be well to say something of the road on which it has to run. It is principally intended for service between London and Brighton, but it also works Portsmouth trains. We give two profiles of the roads in question. It will be seen that on the line to Brighton there are three principal summits, one at Merstham, the second at Balcombe, and the third at the Brighton end of the Clayton tunnel. The distance from London Bridge to Brighton is fifty miles, and the running time for express trains is 1 hour 10 minutes. A rise of 1 in 100 for two and a-half miles is a bad beginning for a quick run, but this is the incline from New Cross to Forest Hill. From Norwood Junction to Merstham there is a rise of 1 in 264 for seven miles. From Merstham to Horley the line falls at the same rate for seven miles. The precise character of the rest of the road will be easily learned from the profile of the line on the next page. It will be seen that the most common gradient is 1 in 264. If we compare this road with the first fifty miles out of London of the Great Western, or the London and North-Western, the unfavourable character of the Brighton line will become sufficiently apparent. It is to be added that the Brighton road, especially near London, abounds in sharp curves, and that there are numerous junctions, in running through which the speed must be reduced. In fact, until Croydon has been passed, quick running cannot be attempted. If a velocity of thirty-five miles an hour can be maintained, the drivers congratulate themselves.

The line from Victoria to Portsmouth is, if possible, worse. We give the profile of it as far as Chichester, this piece of line having to carry a very heavy traffic during the racing season. We may add, that as far as Mitcham Junction the road is identical with that traversed by trains between Victoria and Croydon. Leaving Victoria there is an incline, on a curve, of 1 in 64 to be surmounted; then there is a little further on a bank over a mile long, of 1 in 166, followed by a bit of 1 in 94. Indeed, in the whole line between Victoria and Chichester, a distance of sixty-nine miles, there is not in any one place more than a few yards of level, while the curves are sharp and the junctions numerous. The two profiles we give will do more, we think, than columns of description, to show that any locomotive proposing to work heavy trains over such roads with punctuality, at high speeds, must be exceptionally powerful.

We have said that the trains have grown heavier on the London, Brighton, and South Coast Railway system of late, and it has at last come to pass that the "City train," leaving Brighton about 8.45 a.m., is often composed of twenty-five vehicles, weighing, with the engine and tender, 350 tons. To convey such a load in one hour and ten minutes over such a road as that shown is no child's play. Mr. Stroud-

PROFILES OF THE LONDON AND BRIGHTON AND LONDON AND PORTSMOUTH RAILWAYS.



Section of Line from Victoria to Chichester.

ley, in dealing with the problem of traction set before him, has always worked steadily forward, his engines, so to speak, growing out of each other; and thus we find on the line no wonderful differences of type originating within comparatively short periods. As far back as 1878, Mr. Stroudley designed and made six engines, with cylinders 17½in. diameter, and 26in. stroke. These engines are coupled in front, the four driving wheels being 6ft. 6in. in diameter. In working order the engine weighs thirty-six tons. The slide valves are placed between the cylinders, the centres of which are 2ft. 2in. apart. The exhaust ports are split in two by a bridge, and the lower half of the port communicates with the blast pipe by a curved passage cast round the cylinder, the upper half exhausting in the usual way. The cylinders are the largest that can be got into an inside-cylinder engine, with the slide valves between them. Even these engines, powerful as they are, cannot keep command of the fast trains in heavy weather; so Mr. Stroudley schemed the engine we illustrate. The cylinders of the Gladstone are cast together in one piece, and are 18½in. diameter by 26in. stroke—Mr. Stroudley was, we believe, the first to adopt cylinders cast in one for locomotives—the distance from centre to centre is only 2ft. 1in., and this permits the crank webs to be 5in. thick, gives an inside bearing for the main axle 8in. long, and leaves plenty of room for the excentric sheaves. Another advantage derived from this mode of casting cylinders is, that it permits the valves to be placed in an inverted position, and with the steam ports leading out of the bottom of the cylinder; the curves of the ports being very easy, and the exhaust almost direct up the chimney. This also drains the water out of the cylinders, and does away with the necessity for waste cocks, and the whole of the oil and moisture escaping from the cylinders, lubricates the valve faces in such a manner that the wear of the slide valve is almost nil. To supply these great cylinders, each filled with steam over 500 times a minute at sixty miles an hour, the boiler was increased in diameter to 4ft. 7in., and the fire-box increased in length to 6ft.; the wheel base remaining the same as that of the engines referred to above, viz., 15ft. 7in. The boiler has no fewer than 331 tubes, and has a total heating surface, together with the fire-box, of 1500ft.; and the fire-grate surface is about 21ft. The water spaces are 3in. at the bottom, tapering upward to about double at the top, the side plates being pocketed forward, as shown in our engraving, to enlarge the tube plate. The large number of tubes give a large area or calorimeter for draught, enabling the engine to work with a very small amount of blast pressure. This arrangement distributes the weight on the wheels as under:—

	Tons.	cwt.
Leading wheels	13	16
Driving wheels	14	10
Trailing wheels	10	8
Total	38	14

The general features of the design are now before our readers, and before going further it will be well to stop here for a moment to consider some of the questions which suggest themselves for discussion. If we turn to the practice of locomotive superintendents on several other lines, we shall see that Mr. Stroudley has made a departure for himself. On nearly all the railways in the kingdom engines of a more and more powerful type have been built, and in nearly all cases the bogie has been adopted. Thus we find it on the London, Chatham, and Dover, and South Eastern Railways, and the London and South-Western Railway, in the south, and on the Great Northern, the Midland, and the Great Eastern in the north. Mr. Webb, of Crewe, is, with the exception of Mr. Stroudley, almost the only locomotive superintendent who has not adopted the bogie. If we consider the figures which we have just given, we shall find in them one explanation of the course adopted by Mr. Stroudley. The Gladstone is the lightest engine for its power now running. As we shall show further on, it has exerted in round numbers 1100 indicated horse power in regular work, and $\frac{1100}{774} = 1{\cdot}42$—that is to say, the engine gives out 1·42-horse power for every hundredweight, and this is, we venture to think, an unparalleled performance, as far as locomotives are concerned. We cannot cite any bogie engine with the same cylinder and boiler, which weighs less than 44 tons. But to be on the safe side, we may say that a bogie would have added about 4 tons to the weight of the engine, besides very

greatly increasing its cost. It may be urged that the engine would have run much more smoothly with a bogie than without it. To this we reply that after a not limited experience on locomotives on various lines, we can say that the Gladstone is the easiest engine at all speeds up to sixty-five miles an hour on which we have ridden. It takes curves at least as quietly as any bogie engine; and there is a remarkable absence of the jumping, and oscillating and thumping over the road, with which every one who has ridden much on foot-plates is only too familiar. Not only has Mr. Stroudley rejected the bogie, he has done what for many years was held to be not only improper but dangerous, and uses a leading wheel no less than 6ft. 6in. in diameter, or at least 2ft. higher than is usually deemed right. It is not easy to see why large leading wheels have been denounced. We believe the idea is that the flanges of a large wheel are better calculated to climb up a rail and escape than the flanges of a small wheel, but there is really nothing in the argument. No bogie, at all events, could make the Gladstone run more easily than it does. Besides the saving effected in weight and cost, there were other reasons operating to the rejection of the bogie. One of these was that the bogie would have been an innovation on the Brighton Railway. Not indeed that it should be rejected for that cause alone, but the cause was sufficient to render its introduction undesirable unless excellent reasons could be shown to exist for its adoption. No such reasons did exist, however. In designing the Gladstone, Mr. Stroudley's object was to attain the greatest amount of power at the same time retaining standard pieces. This engine, therefore, differs but little from any other of his standard engines. Long experience proved that the members, such as piston and connecting rods, axles, boxes, valve motion, and other details, have worked without showing the slightest sign of weakness, and entirely without failure, so that Mr. Stroudley could afford to increase the diameter of the cylinder without increasing the weight of any of the moving parts. These details are, therefore, of the same dimensions generally as those which have been adopted for other engines. There have been, however, some slight modifications introduced, which have been found by experience to be of great value. As we have said to have built an engine of the same power with a bogie at the front or back end, would have entailed a very great increase in the weight and in the cost; it would also have complicated the machine and done away with the uniformity of the system. But to enable the engine with a rigid wheel base to move easily round curves a special arrangement of draw-bar is employed consisting of a T piece fitted with a wheel at each end similar to a blacksmith's crane. This works on a curved path made in the back of the frame under the foot-plate, the centre of which is struck from the centre of the space between the leading and the driving axles. On the back buffer beam a curved plate struck from the same centre rubs against a flat surface of cast iron which is fitted on the front of the tender, the draw-bar passing through the centre of this central rubbing piece, the whole being absolutely rigid. An elastic washer of rubber is placed in a wrought iron circular case on the back of the tender buffer beam, which has a piston, through which the draw-bar is passed, and screwed up with a ratchet handle. This, when set up to a moderate extent, permits the engine to move free of the tender as the curvature of the road requires. Concerning the merits of the large leading wheel, it may be pointed out that as the heaviest weight in the natural construction of the machine comes at the leading end, and as the greatest weight is required for safety at the leading end, if the leading and driving wheels are equally weighted, and the trailing weight kept as light as possible, the engine will pass round a curve with very much greater ease than when the weights are equal at both ends, as is the case when the engine is coupled backwards, as it is, of course, the trailing wheel which urges the leading wheel to leave the rail; and if the leading wheel had less weight than the trailing one, it might do so at the first opportunity. Coupling forwards permits a larger boiler and fire-box to be used than could otherwise be got in, and a shorter coupling rod. The system, therefore, of coupling large wheels forward has so many advantages that it is not quite easy to see why the old system is still continued in this country with all but tank engines. With a view to reduce the wear of the leading wheel flanges, Mr. Stroudley has for many years arranged a pipe leading from the bottom exhaust, and which bends round and shoots against the outer side of each leading wheel. The cold wheel condenses the steam, and keeps the flange well lubricated, and no doubt adds to the ease with which the engine traverses curves in dry weather.

The principal dimensions of the Gladstone are as follows:—

Cylinders (1 in 11½ inclination)—	
Diameter of	1ft. 6½in.
Stroke	2ft. 2in.
Length of ports	1ft. 3in.
Width of steam ports	0ft. 1⅝in.
Width of exhaust port.	2in.
Distance apart of cylinders from centre to centre	2ft. 1in.
Valves (1 in 15 inclination)—	
From centre to centre of valves	1ft. 5in.
From centre to centre of valve spindles	1ft. ¼in.
Lap of slide valve	⅜in.
Lead	1/16in.
Maximum travel of valve	3¾in.
Motion—	
Link, radius	4ft. 7in.
Link, centres	1ft. 5in.
Intermediate valve rod, diameter	3½in.
Valve spindle, diam.	2in.
Excentric rods, length	4ft. 7in.
Excentric pulleys, dia.	1ft. 4in.
Width of forward excentric	2⅞in.
Ditto backward ditto	2 1/16in.
Throw of excentric	5/16in.
Connecting-rod centres	6ft. 6in.
Diam. of piston-rod	2⅜in.
Slide block, length	11in.
Slide block, width	3in.
Frames (steel)—	
Distance apart	4ft. 1½in.
Thickness of frames	1in.
Distance of foot-plate from rail	4ft.
Width of foot-plate	7ft. 6in.
Thickness of foot-plate	¼in.
Boiler—	
Centre of from rails	7ft. 5in.
Length of barrel	10ft. 2in.
Diameter outside	4ft. 6in.
Thickness of plate, iron	½in.
Thickness of smoke-box tube plate	1in.
Lap of plates, circular seams	2½in.
Pitch of rivets	2in.
Diameter of rivets	¾in.
Longitudinal seams—	
Double butt straps, double rivetted	9½in. wide by 7/16in. thick.
Diameter of rivets	¾in.
Pitch of rivets	3¾in.
Strength of joint, 82 per cent. of strength of plate.	
Fire-box shell (iron)—	
Length outside	6ft. 8½in.
Breadth outside, bottom	4ft. 1in.
Depth below centre line of boiler at back	4ft. 3in.
Ditto at front	5ft. 6in.
Thickness of front plates	⅝in.
Ditto back plates	⅝in.
Ditto side and top plate	½in.
Distance of copper stays apart	3⅜in.
Diam. of copper stays.	⅜in.
Inside fire-box (copper)—	
Length inside, bottom	5ft. 11⅜in.
Breadth ditto	3ft. 4⅜in.
From top of box to inside of shell	1ft. 4in.
Thickness of plate	⅜in.
tube plate	⅜in. & 1in.
Depth of box inside, front	5ft. 10in.
Ditto, back	4ft. 6⅜in.
Tubes (steel)—	
Number of	331
Length over all	10ft. 8½in.
Diameter, outside	1¾in.
Thickness, No. 14 b w.g.	
Diameter of blast pipe	4⅜in.
Height from top of blast pipe to bottom of chimney	1ft. 6½in.
Height of top of chimney from rail	13ft. 2in.
Heating surface—	
Of tubes	1372·92 sq. ft.
Of fire-box	112·48 sq. ft.
Total	1485·40 sq. ft.
Grate area	20·65 sq. ft.
Wheels and axles—	
Diam. of driving wheel	6ft. 6in.
Diam. of leading wheel	6ft. 6in.
Diam. of trailing wheel	4ft. 6in.
Distance from centre of leading to driving wheel	7ft. 7in.
Distance from centre of driving to trailing wheel	8ft.
Distance from driving wheel to front of fire-box	1ft. 10⅝in.
Distance from leading wheel to front buffer plate	5ft. 10in.
Distance from trailing wheel to back buffer plate	4ft. 4in.
Crank axle (steel)—	
Diam. of wheel seat	8½in.
Diam. of bearings	8in.
Diam. at centre	7⅜in.
Diam. of crank journal	8½in.
Distance between centres of bearings	3ft. 11½in.
Length of wheel seat	7 1/16in.
Length of journal	8½in.
Length of crank journal	4in.
Trailing axle (iron)—	
Diam. at wheel seat	8½in.
Diam. at bearings	8in.
Diam. at centre	6½in.
Length of wheel seat	7 1/16in.
Length of journals	8⅜in.
Leading axle (iron)—	
Diam. at wheel seat	8½in.
Diam. at bearings	8in.
Diam. at centre	7in.
Length at wheel seat	7 1/16in.
Length at bearing	8in.
Centre to centre of bearings	3ft. 11½in.
Thickness of all tires on tread	3in.
Width of all tires on tread	5½in.
Diameter of outside coupling pin	4in.
Length of ditto	4½in.
Throw of ditto	9in.
Weight of engine in working order—	
Leading wheels	13 tons 16 cwt.
Driving wheels	14 tons 10 cwt.
Trailing wheels	10 tons 8 cwt.
Total	38 tons 14 cwt.
Tender—Tank—	
Length outside	20ft.
Breadth outside	6ft.
Depth outside	3ft. 6in.
Thickness of side plates	5/16in.
Thickness of top plates	5/16in.
Thickness of bottom plates	5/16in.
Total capacity in gall'ns	2250
Coal bunker capacity	2 tons.
Frames (steel)—	
Distance apart of	4ft. 1½in.
Thickness of frames	⅜in.
Distance of foot-plate from rail	4ft.
Width of foot-plate	7ft. 6in.
Thickness of foot-plate	5/16in.
Wheels and axles—	
Diam. of centre wheels	4ft. 6in.
Ditto of leading wheels	4ft. 6in.
Ditto of trailing wheels	4ft. 6in.
Distance from centre of leading to centre of centre wheels	7ft.
Distance from centre of centre wheels to centre of trailing	7ft.
Axles—	
Diam. at wheel seat	7½in.
Diam. at bearings	7in.
Diam. at centre	6½in.
Distance between centres of bearings	3ft. 11½in.
Length of wheel seat	7 1/16in.
Length of journal	8⅜in.

Weight in working order—	tons.	cwt.	qr.
Weight on leading wheels	9	2	1½
Do. centre wheels	9	2	1½
Do. trailing wheels.	9	2	1½
Total weight	27	7	0

ARC LAMPS AT THE VIENNA EXHIBITION.

No. II.

Although as measured by the quantity of light supplied, most of the lighting work at the Exhibition is done by arc lamps—naturally so because of the large spaces to be lighted up—still the arc lamps can hardly compete in interest with their rivals, incandescent lamps. This arises chiefly because incandescent lighting is still in its most youthful and most rapidly growing stage, while arc lighting may be said to have passed beyond this exciting period of development. We are far from asserting or believing that arc lighting is becoming antiquated. On the contrary, we believe that wherever very large spaces have to be lighted, arc lamps will always remain the pleasantest, the cheapest, and the most efficient means of lighting. They have still, therefore, in our opinion, a great commercial future before them. For that reason also we believe that a great deal remains still to be done in improving them, because it must be confessed that even with the best self-regulated lamps, the cost of attendance, cleaning, and renewal of the carbons is very heavy. The whole system of keeping them in order—the whole of that from which the annual working expenses arise—is still in a high degree clumsy and barbarous as considered from a scientific point of view. There is still room for great advances of mechanical, if not of high scientific, interest in the methods of steady self-regulation and self-feeding for a long period of time. Some improvement has certainly been attained in recent times; but the attention of electric engineers has been so concentrated on incandescent lighting of late that the rival system has suffered more neglect than it deserves, and there is thus comparatively little progress to report.

The chief arc-lamps of interest shown in the Exhibition are the Gramme, the Jablochkoff, the Pilsen, the Brush, the Siemens, the Gérard, the Schwerd, the improved Soleil, the new lamp of Egger and Kremenezky, the new lamp of F. Klostermann, of Paris; and a curious, somewhat complicated, but ingenious one, designed by Wladimir Tschikoleff, of St. Petersburg. There are also several designs of so-called semi-incandescent lamps, in which the light is produced at a loose contact between two carbon points, which rest against each other with a pressure that can be regulated either by hand or automatically. On this latter class we have no space to dwell. It is not likely ever to come into extensive practical use, although some lamps of this style were considered great successes at the time they were first produced.

The Gramme lamp is used in the Exhibition by Messrs. Brückner, Ross, and Consorten, of Vienna, and by Heilmann, Ducommun, and Steinlen, of Mühlhausen, in Alsatia. This lamp is so well known that we do not need to illustrate it. The frame of the lamp is in two pieces. The upper maintains a constant position, and supports a clockwork; the lower consists of a bridge—which forms the bottom of the lamp, and supports the holder for the lower carbon—and of two vertical brass rods, which, as it were, form the sides of the frame, and which can slide to a limited extent up and down in vertical holes in bosses upon the upper part mentioned above. This lower portion is held up by springs, so that when no current passes the carbon points rest against each other. The vertical brass rods pass through two electro-magnets excited by the current as soon as it passes, and to the upper ends of these rods is attached a crosspiece of soft iron, forming an armature to the magnets. This is drawn down to the magnets on contact being made, and carries the lower portion of the frame down with it, so as to separate the carbon-points the required distance for the arc, this distance being about 2½ mm. The close contact of the armature bridge with the tops of the electro-magnets acts as a gauge for the distance apart of the carbons. The whole current does not go through the carbons. Part is led by a shunt through another electro-magnet. As the carbon points burn away the resistance rises in the arc circuit, and a greater proportion of the current goes through the shunt magnet, whose field therefore becomes stronger. At a certain limit, corresponding to the limiting suitable distance apart of the carbon points—2½ mm.—this magnet becomes strong enough to draw down a lever which disengages the clockwork. As soon as the clockwork begins to move, it lowers the part of the upper frame in which the upper carbon is held, thus bringing the carbons once more nearer each other. As soon as they have approached sufficiently to lower again the resistance of the arc circuit to the normal limit, the shunt current has fallen off in strength so far that the shunt magnet releases the lever, which falls and, engaging in an escapement, stops the clockwork. This movement of the clock continues only for a fraction of a second at one time, and thus the distance apart of the carbons is kept constant within narrow limits.

Brückner, Ross, and Consorten have forty of these lamps in various positions in the Exhibition. The upper carbon, which is the positive pole of the arc, and which is used up faster than the other, is made ½in. in diameter, and the lower or negative carbon is made only ⅜in. The lamps burn for seven or eight hours at the rate of 1¼in. of length of carbon per hour, of which about one-third represents the shortening of the negative carbon and two-thirds that of the positive.

Heilmanoff, Ducommun, and Steinlein, besides lighting fifteen of the above-mentioned Gramme lamps having a total of 1900 Carcel lighting power, drive about a dozen lathes and other machine tools by two Gramme electro-motors.* We omitted to mention this exhibition in our general description of the Exhibition, but may do so here in passing. It is interesting as being the only example of the driving of engineer's workshop machinery in the Exhibition. It would be more interesting if the machines did more work and were not simply driven back and forward empty. This firm in ordinary circumstances claims an average efficiency of 55 to 60 per cent. in the electric transmission of power.

We have described fully the principle of action of the regulating apparatus of this well-known lamp, because all other arc lamps are regulated in a very similar manner, and a repetition of minute explanation will not now be necessary in our mention of other lamps. Whenever several lamps are placed in series in one circuit the principle of using the magnetic field of a shunt circuit, whose strength varies inversely as that of the arc circuit, as the power to actuate the regulating mechanism, is an almost invariable one. It was the invention of the shunt regulating apparatus that rendered it practically possible to put arc lamps in series. This was impossible so long as the regulation depended directly on the strength of the main circuit, because this is affected not only by the varying resistance of each lamp, but by the sum of all the lamp resistances.

There exists considerable confusion of mind with regard to the operation of this principle. The regulating apparatus is frequently talked of as if either the electro-motive force between the lamp terminals, or else the total current through the lamp, were a constant quantity. If the electro-motive force remained constant, the current through the shunt would also remain constant, and it would have no regulating influence. The whole current, also, never remains constant. We think, therefore, that it may be useful to many of our readers to explain, as exactly as possible, before proceeding further, the law according to which this regulation takes place, the more so because, so far as we know, an investigation of this law has not hitherto been published.

The sensitiveness of the regulation of the light-giving power of an arc lamp may be considered as dependent upon three things. First, it depends upon the rapidity with which the electric resistance of the arc varies with the amount of light it radiates. The greater the ratio of the variation of this resistance to the corresponding variation of the light radiation, the more sensitive is the regulation. Secondly, this sensitiveness is the greater the more rapidly the intensity of the magnetic field, due to the shunt circuit, varies in proportion to the variation of the arc resistance. This intensity is proportional to the magnitude of the shunt current, and also to the number of coils the shunt circuit makes round its electro-magnet. By increasing the number of coils the field is made more powerful, and the variation of its power is correspondingly magnified, but the ratio of the increase of magnetic intensity to the normal intensity remains the same whatever be the number of coils. It is this latter ratio that measures the sensitiveness. Therefore, although a large number of coils may be desirable in order to provide force sufficient to overcome the frictional and other mechanical hindrances to the motion of the regulating mechanism, still, in considering this second factor in the total sensitivenesss of the lamp, we have to confine our attention to the law according to which the magnitude of the shunt current varies with the arc resistance.

The third factor consists in the mechanical delicacy of the mechanism by means of which the increase or decrease of the magnetic force due to the shunt circuit is made to shift the carbon points nearer or further apart.

All these factors are of paramount importance. It is in the third factor that the chief apparent difference occurs between various lamps, and we will describe the different mechanisms used in the lamps at the Vienna Exhibition, so far as novelty or recent improvement makes them interesting at the present time. The first factor depends on the quality and size of the carbons used, and on their arrangement, as influencing the shape in which the points are consumed. A lamp may be designed and constructed perfectly with regard to the second and third factors of sensitiveness, as explained above, but if bad carbons be

* These fifteen lamps are fed by three dynamos, which we will illustrate separately. One dynamo feeds three lamps, each of 200 Carcels power; second feeds four lamps of 175 Carcels; and a third eight lamps, each of [illegible] Carcels.

used in it, its light will be unsteady. If, as the points burn away, flakes or other fragments become suddenly detached; if the shapes of these points change irregularly as they are consumed, from want of homogeneity of quality in the carbon stick, then no regulating apparatus, however perfect in itself, will prevent "blinking" and general unsteadiness in the light. The great importance of using carbons of dense and perfectly homogeneous quality is now very generally recognised by manufacturers, but unfortunately consumers are not yet sufficiently alive to it.

The second item of sensitiveness, namely, the ratio of the variation of the shunt current to that of the arc resistance, can be investigated mathematically. From what follows, in which the algebraic equations are illustrated by numerical examples, it will be seen that in this respect a considerable difference exists between a lamp which is the only one in the circuit and one which is one only of a series coming "one behind the other," as the Germans say. In the first case the one lamp considered in the following equations offers a very large proportion of the whole resistance in the circuit, and a variation in its resistance causes a large variation in the current if the electro-motive force be maintained uniform. This is the case to a much smaller extent if the lamp is only one of a series. In both cases we will consider that the electro-motive force between the terminals at the dynamo of the outside circuit is maintained uniform. Also evidently in the present investigations the proper supposition to make is that the resistance of the whole of the outside circuit, except that of the particular lamp considered, remains constant while this latter varies. Call E the constant electro-motive force between the dynamo terminals of the external circuit; R the constant resistance of all this circuit with the exception of one particular lamp, whose resistance call R_1. This R_1 is due to two branches—the main arc circuit, whose resistance call $r = \frac{1}{k}$, and the shunt circuit, whose resistance call $\rho = \frac{1}{\gamma}$, where k and γ are the "conductivities" of these two branches. Here ρ and γ are constant, while r and k vary as the carbon points are consumed. Also $R_1 = \frac{1}{k+\gamma}$.

Then we find,

$$\text{whole current through lamp} = \frac{E}{R+R_1} = \frac{E(k+\gamma)}{R(k+\gamma)+1}.$$

$$\text{Current through carbons and arc} = \text{whole current} \times \frac{k}{k+\gamma} = \frac{E\,k}{R(k+\gamma)+1}.$$

$$\text{Current through shunt} = \text{whole current} \times \frac{\gamma}{k+\gamma} = \frac{E\,\gamma}{R(k+\gamma)+1}.$$

The only variable in these expressions is k.

The ratio of variation of shunt current to variation of arc resistance,

$$\text{or } \frac{d\,(\text{shunt current})}{dr} = -\frac{1}{r^2}\,\frac{d\,(\text{shunt current})}{dk} =$$

$$\frac{E\,R\,\gamma\,k^2}{\left\{R(k+\gamma)+1\right\}^2} = \frac{E\,\frac{R}{\rho}}{\left\{R\left(1+\frac{r}{\rho}\right)+r\right\}^2} = \text{say D.}$$

The proper measure of the electrical sensitiveness is the ratio of this latter expression—the differential co-efficient—to the magnitude of the shunt current. Call this differential co-efficient D. Then

$$\frac{D}{\text{shunt current}} = \frac{1}{r\left(1+\frac{r}{\rho}+\frac{r}{R}\right)}.$$

Take the following numerical examples to illustrate the meaning of these equations:—

Example I.—Resistance of the single lamp about half that of the whole external circuit.

Data: R = 10, r = 10, ρ = 100, E = 190 volts;
$\therefore$ R_1 = 9·09, R + R_1 = 19·09.

Whole current = $\frac{190}{19{\cdot}1} = 9{\cdot}95$;
Arc do. = 9·05;
Shunt do. = ·90;
$\frac{d\text{-shunt current}}{dr}$ = D = ·043; and $\frac{D}{\text{shunt current}}$ = ·048.

Thus, if r increased from 10 to 10·1, shunt current would increase from ·90 to ·904; or, if r increased from 10 to 15, shunt current would increase from ·90 to 1·11.

Example II.—Single lamp resistance again about half the whole external resistance.

Data: R = 10, r = 10, ρ = 500, E = 200;
$\therefore$ R_1 = 9·80, R + R_1 = 19·80.

Whole current = 10·10;
Arc do. = 9·90;
Shunt do. = ·20;
D = ·0098;
$\frac{D}{\text{shunt current}}$ = ·049.

If r increase from 10 to 10·1, shunt current would increase from ·20 to ·20098; or, if r increase from 10 to 15, shunt current would increase from ·20 to ·249.

Example III.—Single lamp resistance about $\frac{1}{12}$ whole external resistance.

Data: R = 100, r = 10, ρ = 100, E = 1000;
$\therefore$ R_1 = 9·09, R + R_1 = 109·09.

Whole current = $\frac{1000}{109{\cdot}1} = 9{\cdot}17$;
Arc do. = 8·34;
Shunt do. = ·83;
D = ·07;
$\frac{D}{\text{shunt current}}$ = ·083.

If r increase from 10 to 10·1, shunt current would increase from ·83 to ·837; or, if r increase from 10 to 15, shunt current would increase from ·83 to 1·18.

Example IV.—Single lamp resistance again about $\frac{1}{12}$ whole external resistance.

Data: R = 100, r = 10, ρ = 500, E = 1000;
$\therefore$ R_1 = 9·80, R + R_1 = 109·80.

Whole current = 9·10;
Arc do. = 8·92;
Shunt do. = ·18;
D = ·016;
$\frac{D}{\text{shunt current}}$ = ·088.

If r increase from 10 to 10·1, shunt current would increase from ·18 to ·1816; or, if r increase from 10 to 15, shunt current would increase from ·18 to ·259.

Example V.—Same as in IV. with all resistances halved.

Data: R = 50, r = 5, ρ = 250, E = 500;
$\therefore$ R_1 = 4·90, R + R_1 = 54·90.

Whole current = 9·10;
Arc do. = 8·92;
Shunt do. = ·18;
D = ·032;
$\frac{D}{\text{shunt current}}$ = ·177.

If r increase from 10 to 10·1, shunt current would increase from ·18 to ·183; or, if r increase from 10 to 15, shunt current would increase from ·18 to ·34.

Comparing now Example I. with II. and III. with IV., it becomes evident that the sensitiveness is not materially altered by changing the resistance of the shunt, so as to alter the proportion of the current that runs through it. What small difference this effects is in the direction of having greater sensitiveness with the weaker current through the shunt. Again, comparing I. with III. and II. with IV., it may be seen that, other things being equal, the sensitiveness is much greater when many lamps are arranged in series than when the whole external resistance is furnished by only one or two lamps. Once more comparing IV. with V., one may deduce that by halving all the resistances throughout the whole external circuit, and at the same time halving the electro-motive force, so as to obtain the same current as before, the sensitiveness is doubled. Here it must not be forgotten that the whole energy absorbed in the circuit is also halved, and the light produced therefore reduced in a still greater ratio. This is not, therefore, pointed to as a practicable method of obtaining sensitiveness in the regulating apparatus.

It appears then that, so far as sensitiveness of the regulation is concerned, arc lamps are best arranged as many as possible in series, the dynamo being worked to give a high electro-motive force, but that no greater sensitiveness is obtainable by modification of the ratio between the arc and the shunt resistances. Evidently, then, so far as the good regulation is in the power of the designer, it depends chiefly upon the quality of the carbons—over which, indeed, the designer has, properly speaking, no direct control, but which is a matter to be attended to by the consumer—and upon the mechanical delicacy of the regulating mechanism. Those arc lamps termed "candles," in which the two carbon sticks are laid parallel and side by side, require no such regulating apparatus as above described. If the carbon points are consumed equally, they always remain at the same distance apart. This equal consumption can only be attained by using an alternate current. The most noteworthy example is the Jablochkoff lamp.

The Jablochkoff candle has undergone no change in design of late, and, therefore, we need not stop to describe it, its construction being well known. We need only remind our readers that it is only suited for an alternate current. This was an advantage, perhaps, at the time of the invention of the Jablochkoff candle, so far as the generation of the current was concerned, and there was also the other and chief advantage that the two carbons were equally and symmetrically consumed, and that no regulating apparatus was necessary for the continuous adjustment of the length of arc. This latter remains to the present day an advantage in point of simplicity of construction possessed by no other lamp used in the Exhibition except the Soleil or Sun, but that the desired result, namely, that of constancy of length and resistance of arc, and consequent steadiness of light, is not so perfectly attained by this as by some other lamps that have not the same simplicity of construction, is amply demonstrated by a comparison of the behaviour of the Jablochkoff with other lamps at the Vienna Exhibition. We regret this the more, that we confess to a particular personal liking for the beautiful violet rays that first streamed out their enchanting brilliancy in Paris. We are sorry to be aware that feminine taste is in opposition to ours, because the ladies' vote on this question must always be a particularly influential one.

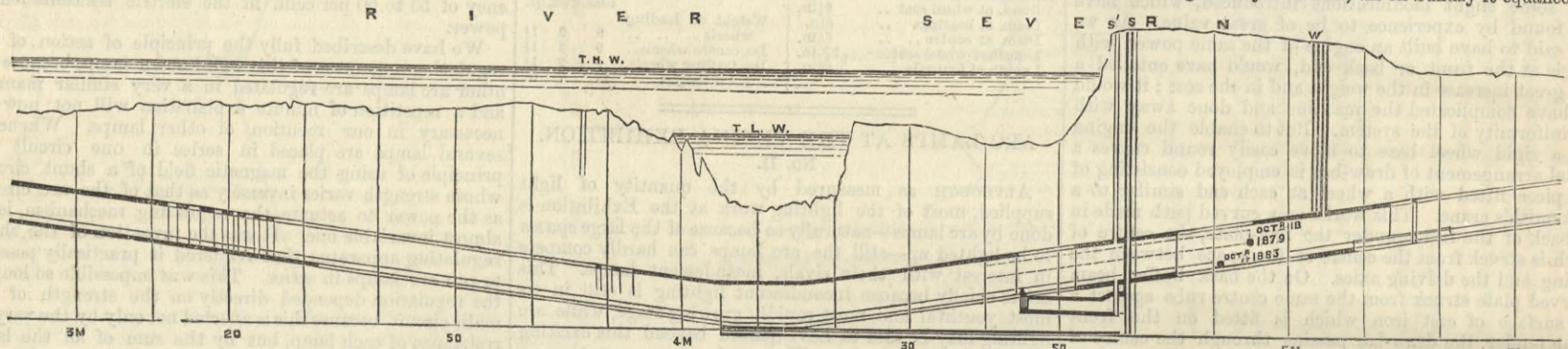
THE SEVERN TUNNEL.

In October, 1879, just four years ago, the progress of the Great Western Railway Company's tunnel under the Severn was stopped by a heavy influx of land spring water, which entered the works through a large fissure about 350 yards inland from the river on the Portskewett side. Of this an account was given in our impression for the 24th October, 1879. After this the contract for the work was placed in the hands of Mr. T. A. Walker, and it has proceeded since without material hitch. Another great spring has, however been tapped, or perhaps more correctly it may be said that water from the same springs and underground reservoirs has again breached the tunnel rock, and filled the whole of the work below the level of the breach. On this page will be found a sketch to scale of part of the tunnel section showing the Monmouth side, the deepest part of the river, the Shoots, the pumping shafts S and S, winding shaft W, drainage headings, old and new, and, by round block dots, the positions of the 1879 and of the 1883 breaches, by which the works have been flooded. This second influx of water took place at 6.50 p.m. on Wednesday, the 10th inst., without any previous sign of water in that particular part of the works; a large quantity burst in in the bottom heading about 260 yards west of the main shaft on the Monmouthshire side. The water ran at first 9ft. wide and 3ft. 6in. deep, but after running about two hours it began to slacken and run at a lower depth. It continued, however, to pour into the works at an average rate of about 30,000 gallons per minute for twelve hours, the pumps at this point lifting only 11,000 gallons per minute, and the balance of 19,000 gallons spreading through the works.

The inflow gradually slackened, till on Sunday it equalled the quantity thrown by the pumps, which then held the water at about 130ft. from the surface of the ground. After so holding it for twenty-four hours, they began slowly to gain, and up to Wednesday night had lowered it 4ft. 6in.

A contracting engineer seems ever ready to think that things might always be worse. Mr. Walker says, "Only one mile and a-half of the tunnel is affected by this inflow," and speaks cheerfully of the matter, because with the other three miles work is being actively pushed on. Walls have been constructed in two places across the tunnel and in the heading, and provided with doors. By this means the part which is flooded could be shut off to clear the works of water below the doors. This could be done in about a week, but as the pumping at this point has already reduced the head at the next shaft, so that the pumps there have been slowed two strokes each per minute, Mr. Walker is unwilling to lose the gain obtained without further trying to overcome the whole of the inflow. Some minor assistance in raising water was to be set to work yesterday, but if additional large pumps are necessary they will require probably two months for erection. We are glad to learn that as far as can be told the works are not damaged in any way, and the next few days will decide which course must be taken.

It is not altogether a matter of certainty as to where the water which has now drowned the works has come from, because although the breach is so near that of 1879, as shown in the section, the ponds and springs which were drained in that year into the tunnel have long since been kept dry by the large pumping power which has been at work during the past four years, and not only these ponds and springs, but the river Nevyn is drained for a distance of about five miles. Thus it would appear that a source not previously drawn upon has been tapped, whether it be springs from some considerable distance or underground reservoirs. There seems, however, good reasons for expecting that the source will soon be exhausted, and that under the energetic management of Mr. Walker, his large staff and his four thousand men will soon get over the difficulties. The lining has been completed in those parts shown in black section.



SECTION OF MONMOUTHSHIRE PART OF SEVERN TUNNEL.

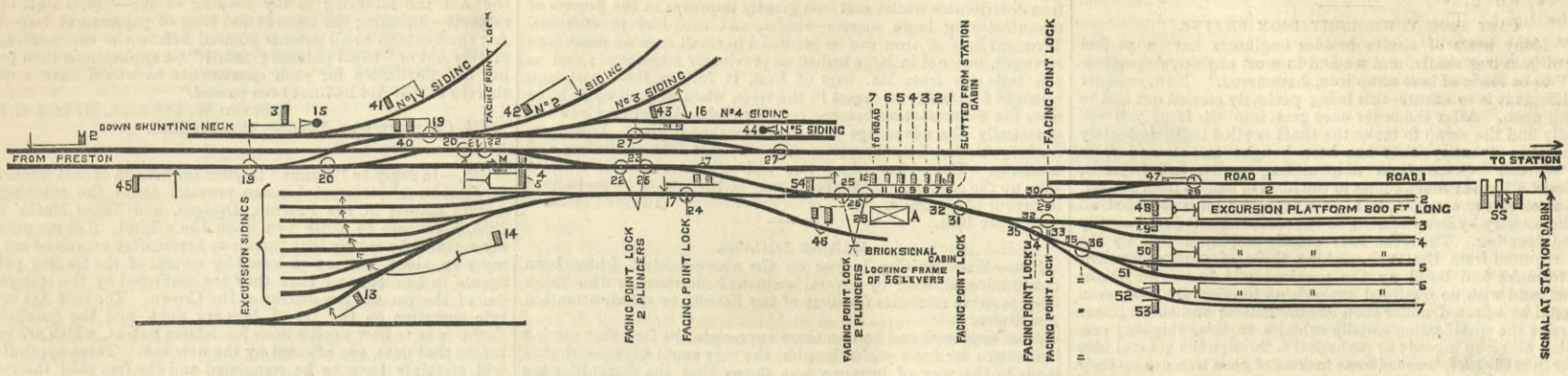
COMPLETE MILL AND PLANT FOR MAKING PORTLAND CEMENT.

The engraving which we give on page 303 is illustrative of the general arrangement of a building and the necessary plant erected by the Pulsometer Engineering Company for the manufacture of Portland cement, the capacity of the mill being fifty tons per day. Other engravings and particulars we shall give in another impression.

University College, London: Lectures on Chemical Technology during the Session, 1883.—Prof. Charles Graham, D. Sc., will deliver lectures on the following branches of applied chemistry:—"Heating and Lighting," on Tuesdays at 3 p.m., beginning October 9th; "Metallurgy," on Thursdays at 3 p.m., beginning October 11th; "The Alkali Trade," on Tuesdays at 3 p.m., beginning January 15th; "Agricultural Chemistry," on Thursdays at 3 p.m., beginning January 17th; and on "Brewing" on alternate Mondays at 4 p.m., beginning October 8th. The laboratories for practical instruction in the above and other branches of applied chemistry are open from October 3rd to the middle of July. Each student works independently, and can join at any time for one or more months. The laboratories, and each course of lecture, are open to all without examination or required attendance on any other lecture given in the college.

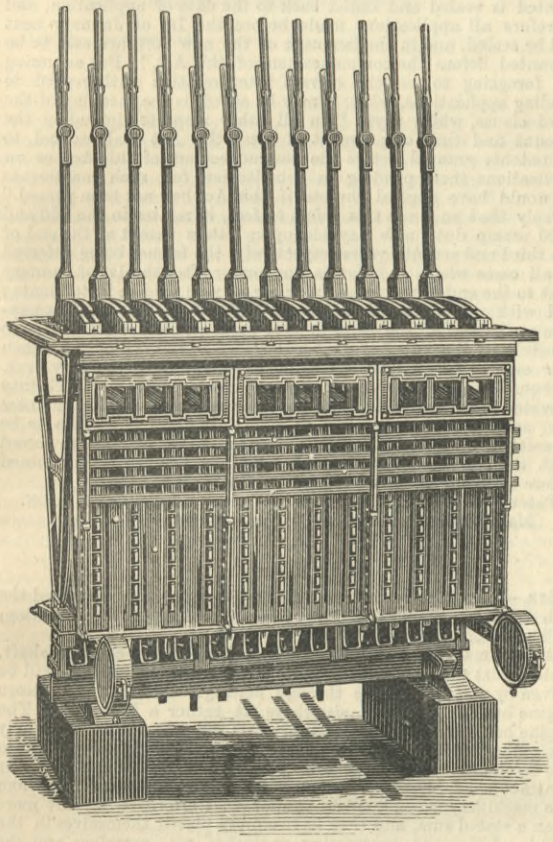
ARRANGEMENT OF SIGNALS AT TALBOT ROAD STATION, BLACKPOOL.

THE RAILWAY SIGNAL COMPANY, ENGINEERS.



THE accompanying illustrations represent signal gear, constructed by the Railway Signal Company, at Blackpool. The diagram shows the new excursion platforms that were brought into use on Bank Holiday, the 14th of May, for accommodating the extensive excursion traffic which flows into Blackpool, especially during Whit-week. The diagram shows the lines of rail and the arrangement for signalling the same. The signal cabin is placed where it is marked A on the plan, and is 31ft. 7½in. long, 12ft. wide, and 15ft. high from rail to floor level. The locking frame in this cabin consists of fifty-six levers, fifty of which are working levers and six spare levers for any future use.

The engraving below shows the arrangement used by the company for effecting the interlocking of the levers. The sliding locking bars used in this apparatus are of channel iron, section 1in. by 1in., and in the channels are rivetted the studs for effecting the interlocking. The sliding bars are very accessible, and easily taken out, either for cleaning or making any alterations to the locking, without disturbing any other portion of the apparatus. The locking is actuated by means of motion plates connected to the levers with slots in them, having inclined terminations. The first small movement of the lever thus gives motion to



the locking gear for the purpose of locking, and the last movement of the lever when pulled over completes the motion and effects the unlocking. The motion plates are geared into vertical bars with projections cast upon them, which projections engage when required with the studs on the sliding bars, and so effect the locking or unlocking. The motion is given to the sliding bar by bell cranks, which turn upon a centre fixed on a casting between the vertical bars, one end of the crank being connected to a vertical bar, and the other end to a sliding locking bar. The advantages claimed for this locking frame are, fewness of parts, simplicity, uniformity, and strength, the weight per lever being about 3½ cwt.

The signal work at Talbot-road station, consisting of the signal cabin, twenty-one signals, locking frame, with fifty-six levers, the whole of the connections to eighteen pairs of points, and nine facing point locks and the whole of the signal connections were made, fixed, painted, and opened for the Whit-week traffic, in four weeks from the date of receiving the order, and the whole of the tremendous traffic of the Whit-week holidays and ever since that time has been worked without hitch or delay.

WARNERKE'S POCKET ACTINOMETER.

A DESCRIPTION of Warnerke's sensitometer for testing the relative rapidity of photographic dry plates was published by us in a recent impression. Another instrument of his deserving attention is the actinometer. The actinometers in general use for testing the illuminating power of gas and similar purposes are inapplicable in photography because of their bulk. An instrument is wanted which can be carried in the pocket, and used at any moment in the open air without loss of time. Mr. Warnerke made a close study of the action of the actinometers of Becquerel, Woodbury, and others before designing his own. In Warnerke's actinometer the property of phosphorescence is utilised, a phosphorescent body being exposed to light, and the intensity of the luminosity set up being then measured.

Figs. 1, 2, 3, and 4 represent the instrument and its various portions. A is a circular disc 2½in. diameter, in which calcium sulphide is hermetically sealed between two glasses. The brass tube B, with the partition C, are so attached to A that A can be rotated with the fingers. The partition C has a circular hole in it ½in. in diameter, through which light is allowed to pass when desired to excite the then-exposed portion of the phosphorescent substance below. The lid D is hinged to the tube B, which holds a small magnifier E and indicator G. The latter standing against a certain number on the rim A, shows what part of the disc has been excited. The brass tube H, which fits inside the tube B, has a bottom J, made of two discs of thin glass, beween which is inserted semi-transparent material, which is so distributed as by transmitted light to appear as a series of circular discs of increasing opacity, each showing a number. There are ten such discs, but L and K have no numbers. K is transparent and colourless, L is transparent and of a green colour. Fig. 1 represents the instrument complete, Figs. 2, 3, and 4 represent its separate parts. To use the actinometer the lid is raised, and the transparent disc K brought over the opening C, so that the light acts on the calcium sulphide beneath. The proper length of exposure to light is then given, after which the lid D is closed, and while the numbers are examined by the eye through the magnifying glass in the tube H is revolved; consecutive numbers are then seen,

FIG. 1

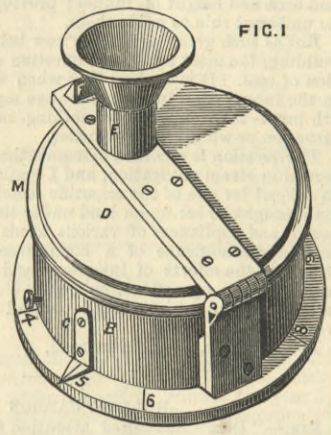


FIG 2

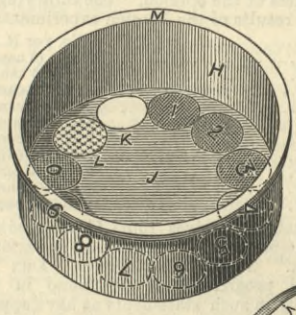
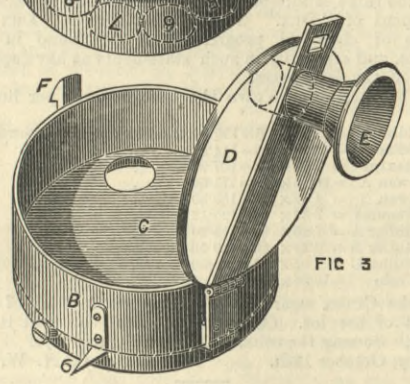


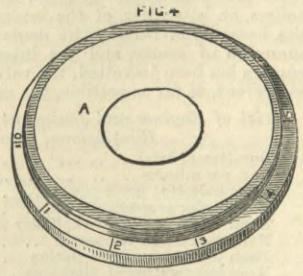
FIG 3



but they diminish in intensity until a disc is reached, the number of which cannot be distinguished; the number of this disc indicates the intensity of the light.

When the next observation is made a fresh surface of the calcium sulphide is exposed to light by bringing it into position by the rotation of the lower rim till the indicator G points to the next number. Ten fresh exposures can thus be made. If it be required to make more, and portions of the disc are still luminous, that luminosity may be extinguished by allowing light to shine on the calcium sulphide through the aperture L holding the material for extinguishing the residual phosphorescence.

FIG 4



Certain red, orange, and green glasses and transparent liquids will extinguish the luminosity of excited calcium sulphide. From observations made by Edmund Becquerel, the following is the rate at which calcium sulphide loses luminosity after exposure to light :—

Time.	Intensity.	Time.	Intensity.
0 secs.	1·	545 secs.	0 006280
35 ,, ...	0·076300	700 ,, ...	0 004582
75 ,, ...	0 034883	930 ,, ...	0·003084
125 ,, ...	0·026752	1110 ,, ...	0·002586
170 ,, ...	0 017899	1305 ,, ...	0 001996
265 ,, ...	0 011744	1525 ,, ...	0·001736
420 ,, ...	0·007765	1725 ,, ...	0 001488

Thus for the first thirty seconds the phosphorescence diminishes rapidly, but afterwards more slowly. Hence observations are made with the photometer in from half-a-minute to one minute after the exposure of the sensitive surface.

Mr. Warnerke has another way of preserving calcium sulphide from moisture and gases than enclosing it in a glass cell. He mixes it with paraffine wax, and it then seems to be very permanent in its properties.

A NEW RAINBAND SPECTROSCOPE.

THE complaint that certain persons could not see the rainband in the spectrum with the earlier English pocket rainband spectroscopes, either in consequence of its faintness or the want of experience is using the instrument on the part of observers, has been removed when the latter possess ordinarily clear vision, by a new spectroscope designed by Mr. R. P. Grace, and manufactured by Mr. John Browning. The following cut explains the principle of the instrument :—A B is a brass tube between 6in. and 7in. long,

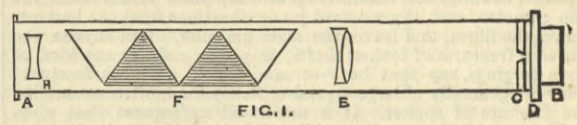
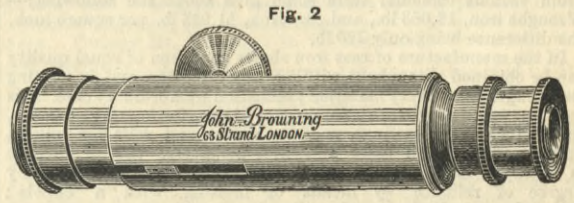


FIG. 1.

with a piece of plain glass, worked parallel, at the end B. The slit is at C; the width of this slit can be varied by turning the ring D in front of it. E is an achromatic lens which is placed at the distance of its own focus from the slit. F is a compound direct vision prism, containing five prisms, two of which are of 90 deg., and made of the densest flint glass; these two prisms are shaded in the cut. The other three prisms are of light optical crown glass. All the prisms are cemented together with Canada balsam and castor oil. They serve the purpose of bringing the rays into a straight line, and preserving the surfaces of the flint glass from oxidation. This flint glass is of a remarkable nature, of a slightly yellowish green tint; blocks of it feel as heavy as lumps of metal, and it oxidises rapidly from the large proportion of lead it contains. Prisms of 90 deg. are beyond the limiting angle between glass and air, consequently not a ray of light could enter them were it not for the action of the crown glass prisms which are cemented to them. Thus, in this instrument large dispersion is obtained in small compass. H is a double concave lens of crown glass, so that in point of fact a portion of the instrument is a Galilean telescope.

The peculiarity of this spectroscope is that it shows the rainband as separate lines, and enveloped in shadow when the band is very strong. When the band is weak the lines are still there, and are seen fainter on a bright ground. Most persons who fail to see the band can easily distinguish the separate lines. The focussing is done by means of a novel arrangement with a milled head, so as to suit the vision of each observer. This

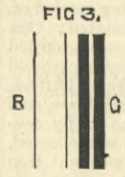
Fig. 2



milled head is represented in the accompanying cut—Fig. 2—which also gives an idea of the external appearance of the whole instrument. This diagram is to scale, and is exactly half the size of the new rainband spectroscope itself.

By the aid of Fig. 3 an idea is given of what should be looked for when using this rainband spectroscope. The two thick lines in the cut represent the double line D, always present and prominent in the orange of the solar spectrum; R is towards the red end of the spectrum, and G towards the green. The two fine lines towards R are variable. When fine weather may be expected they are invisible; when rain is imminent they become very strong. At times, when a heavy downfall may be anticipated, they are enveloped in shadow, and the space between the D lines is filled up, so that at such times this group of lines with the band becomes the most prominent object in the solar spectrum.

FIG 3.



In using the spectroscope it should be directed towards a white cloud, not too high above the horizon, and in the direction from which the wind is blowing. In the matter of mechanical construction, half a turn of the milled head pushes out the eye piece to its full extent; this is done by means of a lever arm, linked on to the brass tube carrying the eyepiece by a light curved connecting rod of brass.

LAUNCH OF PADDLE TUG BUFFALO.—A steam paddle tug was launched on the 8th inst. from the yard of Messrs. Hepple and Co., North Shields—length B.P., 100ft.; breadth, 17ft. 9in.; depth, 9ft. 3in. This vessel has been built under the superintendence of Mr. J. F. Flannery, for service in Algoa Bay, South Africa, and is expected to steam ten knots per hour, and will have a pair of surface-condensing side-lever engines.

A GIGANTIC ORGAN.—The largest organ probably ever constructed was lately completed at Ludwigsburg. It is destined for the cathedral church at Riga. There are in it 7000 pipes, 124 stops, with pedals, &c., proportionately numerous. A very complete swell arrangement allows the increase and diminution of sound to be effected with singular perfection and delicacy of effects. The filling of the pipes could not be carried out by organ blowers, but is effected by machinery worked by a gas engine of 4-horse power. This organ is 20 metres high, 11 metres broad, and 10 metres deep —about 65½ft., 36ft., and 33ft. respectively. The largest wooden pipe is 10 metres (32¾ft.) high, and its cubic contents are 70·6 cubic feet; while by a curious contrast the smallest pipe is made only a centimetre and a-half high—little more than ½in.—and is attached to the greatest one.

LETTERS TO THE EDITOR.

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

CAST IRON V. WROUGHT IRON SHAFTS.

Sir,—Many users of shafts besides engineers have a perfect horror of cast iron shafts, and we find in most engineers' specifications, "to be made of best scrap iron, hammered." Now, consider how difficult it is to ensure this being perfectly carried out and to be relied upon. After the order once gets into the forge you will generally find the scrap to make the shaft is piled indiscriminately from a large quantity that has been bought and stacked from many sources. Some from shipbuilding yards, boiler yards, smithies of all kind; much comes in the form of ballast from abroad, where most of our common iron goes to, and a lot is collected all over the country by scrap dealers, so the various kinds get generally grouped together. Then the lads usually employed pick up the pieces required from the ruck, picking those of most convenient shape to make and build up the required pile to size or weight required, and with no qualified supervision to select the best, even if it could be selected under such circumstances; and the engineer who draws the specification usually submits to this, thinking perhaps that all scrap is good; or perhaps it is through the general idea that scrap is the best, because some makers of good iron use up their own scrap, and hence sell it as extra quality in consequence of its undergoing an extra process. But it is well known amongst practical forge men that we do not get this in forged shafts. Well, supposing we get some good scrap and some bad in a shaft; of course, the weakest part is the measure of strength. Then the piles get to the forge; there they are heated, hammered, then piled again, heated, hammered, piled again, and so on as often as required, according to the size of the shaft or any other forging required. Of course, the larger the shaft the oftener and more numerous the times of process, and who shall shall say that in one of these fifty or a hundred heatings some one portion does not get burned or over-heated, and there lose its nature and strength? When such occurs, there again is the measure of strength of the shaft when completed, and even notwithstanding the shaft may be all of good iron, and no bad scrap. It is also a well-known fact the repeated heatings and hammerings of scrap-made shafts make the iron granular, even the constant jar or vibrations from the hammer breaks the fibres, and leaves the mass granular. Can anyone who has seen fractures of broken shafts, or piston rods, or any kind of large forgings, say that he ever saw one of a fibrous fracture? They are generally of large crystal or flakey kind, often resembling the fracture of spelter. It is not at all unfrequent that when making a long forging the cold end farthest from the hammer jars and breaks off through the vibrations passing through the mass of iron. If it is preferred to have a hammered iron shaft, why not make it in what ought to be the best known way, by using such iron as will be most likely to produce something approximating to the desideratum? Is it not shown that scrap is unreliable at first, to say nothing about the fact that by working it frequently it loses its nature, and is hence reduced in tenacity or strength.

Hence, it is contended that wrought iron scrap used to produce a large shaft loses its initial strength. If wrought iron is to be preferred for a shaft, it should be made by prepared iron from the puddling forge. This should be done by puddling best pig iron, and producing puddle balls ready for the hammer, and the iron should be puddled somewhat raw, as it is termed, meaning that somewhat more cinder should be left in, so as to be of use in the forgings to be made from it. It should, after hammering, be rolled into convenient sized square bars; these should then be fagotted together according as required, and so prepared for the heating furnace in the forge. The cinder thus left in the prepared puddle bars is then useful in liquifying the metal in its progress of producing the shaft, inasmuch as the iron heats more thoroughly through, and is not so liable to burn, and the iron from such bars works up in forging nearer to the approach of fibrous iron, as it would be if dry scrap were used, and therefore a much softer and thoroughly welding heat is produced—which is less liable to laminations, which is another most important matter, as these again often occur in wrought shafts—and a more nearly homogeneous piece of iron in the shape of a forging obtained. The difference in the strength of wrought and cast iron to resist torsion is not so much as other modes of applying the strains or loads. From various torsional tests some give about the following:—Wrought iron, 12,063 lb., and cast iron, 11,943 lb. per square inch, the difference being only 120 lb.

In the manufacture of cast iron shafts good iron of equal quality can be obtained throughout without any difficulty, and in melting its strength can be very materially increased with ordinary care. It is well known, that where air furnaces are in use for foundry purposes, to produce large castings, such as shafts and rolls for rolling, armour plates, and steel and iron generally, the air furnace is always used. Large rolls cannot be made with any degree of reliance by means of melting with a cupola; and when melted in the air furnace castings are much stronger, more dense, and have the maximum wear. These—the rolls—are always cast vertical, and the shafts, too, should be where there is the proper convenience, and, in addition to the vertical column of metal forming the casting, a large and high head of metal is cast on its top—which is afterwards cut off—to assist in producing the density, and also for facility in feeding the casting during the process of its shrinkage and cooling, this being carried on until the metal settles and becomes thoroughly consolidated. One may say, is not the iron in process of melting liable to become burned by overheating? The answer is, no, with the most ordinary care and skill. Iron can be melted in the air furnace without being burned, and by this process it is much improved in density, toughness, and strength; whereas wrought iron, being subject to so many contingencies of overheating and all the concomitants enumerated, becomes entirely changed and reduced from what wrought iron should be in its ordinary state, to a weak, unreliable, and unsafe material when manufactured into large bodies by heating and hammering. The writer has known a few instances over a long period of years in which cast iron shafts which had been at work very many years, having heavy work to do, have broken and been replaced by wrought iron ones, but these have very soon succumbed to the heavy work, and been again replaced, this time by cast iron ones, with success. Until somewhat of late years cast iron shafts were generally used in the driving of heavy rolling mills and forges in Staffordshire and all over the country with the greatest success, and it will no doubt be admitted that there is no kind of machinery more subject to violent changes and strains than such machinery. Just carry one's observation only to what cast iron rolls have to stand in rolling mills—say, for instance, a plate mill train. First there is the, say, 300-horse power engine transmitting its cumulative power into a fly-wheel about 22ft. diameter and about 45 tons weight, running 48 revolutions per minute, then a pinion wheel on the fly shaft, bringing down the speed of the train of rolls to 24 revolutions per minute, a further cumulative power. All in full work, running, say, empty, suddenly a plate of iron is put into the rolls, the strain being so great that instantly one can perceive the momentum of the fly-wheel reduced. Without running through any figures to ascertain what must have been the effect to so sensibly reduce the cumulative power of this great wheel and engines, it is apparent that the shafts must be undergoing an immense strain, especially the last from the prime mover, which is the second motion, or that immediately connected to the mill train. Then the whole train receives also these constant and severe shocks, *i.e.*, the coupling spindles, boxes, wobblers on rolls and roll neck bearings. There are occasional breakages of the first and second, the rolls rarely breaking from these constant and actual strains. The supposed dimensions of engines and mill machinery mentioned in the forgoing were some of certain machinery and mills constructed and erected by the writer in this country, and many similar instances can be supplied if necessary.

Large wrought scrap shafts become much weaker in the course of manufacture. Cast iron shafts, cast vertically from air-furnace, and made of good iron, very materially increase in strength in course of manufacture; or, to put it in other words, the wrought iron deteriorates whilst cast iron greatly improves in the process of manufacturing large masses—shafts, and such-like productions. Wrought bars of iron can be produced in small sizes of maximum strength, but not in large bodies, as previously mentioned; and as the tests are from 1in. bars of iron, it follows that, although wrought iron is the strongest in the tests, when worked up to large sizes the circumstances become entirely changed, and cast iron has practically the advantage in a most marked degree. Therefore, for large shafts, &c., the writer says, use cast iron for safety and economy. The writer hopes this will induce more able men to take up the subject, as perhaps he may be thought to be prejudiced in favour of his trade.

Ironfounder.

October 10th.

MARINE BOILERS.

Sir,—Since writing to you on the above subject, I have been communicated with by several eminent boilermakers, who think they perceive remedies for some of the defects to which attention was drawn.

Most engineers and boilermakers appreciate the fact that marine boilers are far from perfection, but the very small advance that is made in the way of improvement shows that the difficulties are not easy to overcome. The multitubular cylindrical boiler now in general use occasionally gives a great deal of trouble, and suffers more from inequality in the rate of expansion to which it is subject, than from the pressure of steam it is required to sustain. If the present form of boiler is to be maintained, it is but reasonable that some rules should be observed in arranging and working it. I have frequently come across ships having engines of equal power which have differed greatly in many important points, such as amount of heating surface, dimensions and number of furnaces, and area and height of funnel; proving that engine builders have no universal rule to guide them.

But as such great strides are now being made in ship and engine building, the most important question of all must be the consumption of coal. It is obvious that when there is one-third more heat in the funnel than in the tubes—see my letter in your issue of the 7th inst.—there must be something radically wrong in the construction or working of the boiler.

The question is one that demands the serious attention of all concerned in steam navigation, and I would suggest that it would be a fit subject for one of the scientific societies to take up. A marine boiler might be set up on land under similar conditions as on shipboard, and appliances of various kinds tried under the direction and superintendence of a committee. This, no doubt, would stimulate the efforts of inventors, and if funds were required to carry out the operations, no doubt a large number who feel an interest in the subject would be glad to subscribe, among whom would be

W. A. Martin.

Pocock-street, Blackfriars-road,
London, S.E.

HOLLOW CARBON LAMPS.

Sir,—"Dux" has called attention to an inaccuracy, but at the same time he makes one which if not contradicted may lead many readers to an erroneous conclusion. It is quite true that the Cruto hollow carbon lamp was shown at Munich, it is the opposite of true that "a greater percentage of Cruto lamps can be lighted per horse-power than any other existing systems of incandescent lamps." I fully believe that both the Cruto and the Bernstein lamps are altogether upon a wrong principle, but I am open to conviction, and trust that time will prove the correctness or incorrectness of the opinion. The following are the figures giving the official results of the Munich experiment:—

Lamps	No. per H.P.
Edison B	23·36 (8 candles)
Edison A	9·05 (16 candles)
Maxim	3·89 (28 candles)
Swan A	17·18 (10 candles)
Swan B	4·52 (40 candles)
Siemens	7·82 (16 candles)
Muller A	7·26 (20 candles)
Muller B	3·39 (50 candles)
Muller C	2·05 (100 candles)
Cruto	10·36 (10 candles)

This authoritative statement gives 10·36 Cruto against 17·18 Swan of the same candle-power—facts altogether at variance with the statement of "Dux." I write contradicting "Dux" because the curse of electrical progress is to be found in ignorant statements, and especially in such statements as have appeared in the pages of the daily press.

It may be interesting to give the candle-power per horse-power thus:—

Edison B	= 23·36 ×	8 = 186·88	candles per horse-power
Edison A	= 9·05 ×	16 = 144·80	,, ,,
Maxim	= 3·89 ×	28 = 107·92	,, ,,
Swan A	= 17·18 ×	10 = 171·80	,, ,,
Swan B	= 4·52 ×	40 = 180·80	,, ,,
Siemens	= 7·86 ×	16 = 125·12	,, ,,
Muller A	= 7·26 ×	20 = 145·20	,, ,,
Muller B	= 3·39 ×	50 = 169·50	,, ,,
Muller C	= 2·05 ×	100 = 205·00	,, ,,
Cruto	= 10·36 ×	10 = 103·60	,, ,,

so that the Cruto, regarded from an efficient point of view, was the worst of the lot. Of course we shall be told it has been improved. So may the others, and in a higher ratio.

Bromley, October 12th. C. H. W. Biggs.

TRIAL OF ENGINES AND BOILERS.

Sir,—I beg to hand you result of a trial of our engines and boilers made this week. I have made several alterations, &c., in the engines and boilers since the trial, the result of which you published in The Engineer of November 3rd, 1882. Chief amongst these are—four Galloway tubes have been put in each flue of the boilers, an alteration of the bridges and fire doors so as to avoid the necessity of leaving the doors partly open to help the consumption of smoke, and the intermediate receiver between the engines has been jacketted, the valve-box covers clothed, &c., so as to prevent, as far as possible, the radiation of heat.

Trial of Engines and Boilers at the Old Steam Flour Mills, Birmingham, October 10th, 1883.

Duration of trial	4 hours
Rev. per minute	45·5
Mean indicated horse-power	249·00
Mean boiler pressure	63 lb.
Mean initial pressure in cylinder	55 lb.
Mean vacuum in condenser	27½in.
Mean temperature of injection	62° Fah.
Mean temperature of discharge	102° Fah.
Mean temperature of feed to boilers	192° Fah.
Total water used per hour	4501 lb.
Total water used per hour for donkey—estimated	30 lb.
Net water used per hour per I.H.P.	18·03 lb.
Total coal burnt	2128 lb.
Total coal burnt per hour	532 lb.
Total coal burnt per hour per I.H.P.	2·016 lb.
Total coal burnt per hour per sq. ft. grate	8·0625 lb.
Total coal burnt per hour per sq. ft. heating surface.	·201 lb.
Water drained from cylinders per hour	None
Water drained from receiver per hour	None
Water drained from receiver jacket per hour	27 lb.
Description of slack	Good rough

Joseph B. Crossley,
Engineer.

Old Steam Flour Mills, Birmingham.
October 13th.

THE NEW PATENT ACT.

Sir,—Replying to "Julius" in your last issue, it must be generally admitted that the working of the Act is ambiguous on the subject of current applications for patents, but by instructions issued from the Patent-office it appears that all applications for patents before the 1st of January next are subject to the present fees and only come under the new Act after being granted, or in other words, "completed." Referring to section 45, subsection 3, of the Act the following is my reading of it:—"(3) In all other respects—including the amount and time of payment of fees—this Act shall extend to all patents granted before the commencement of this Act or" to all patents granted "on applications then pending in substitution for such enactments as would have applied thereto if this Act had not been passed."

Edward W. Furrell, M. Inst. C.E.

124, Chancery-lane, London, October 13th.

Sir,—In reply to "Julius" in your impression of last week, and as considerable misapprehension prevails as to the meaning of certain clauses in the Patents, Designs, and Trade Marks' Act, 1883, I venture to write you upon the subject. Let me premise my remarks by saying that the views hereinafter expressed are not my own alone, but are endorsed by several of the leading patent agents in London, and that they are confirmed by the opinion of one of the present law officers of the Crown. The new Act comes into operation on the 1st of January next, and the question of doubt is as to how applications for letters patent, which are made before that date, are affected by the new law. These applications will certainly have to be completed and the fees paid thereupon under the existing law, for Clause 1 of section 45 says: "The provisions of this Act relating to *applications for patents and proceedings thereon* shall have effect in respect *only* of applications made *after* the commencement of this Act"—viz., January 1st, 1883. The italics are mine. In other words, an applicant for letters patent having applied for provisional protection before the 1st of January next will have to take the further proceedings thereon under the old law. Hence, if he has not given "notice to proceed" with his application he will have to do so in the usual course and pay the £5 duty thereupon, then apply for the warrant of the law officer and for the sealing of the letters patent, paying the £10 duty just as if the new law had not come into operation. This brings him, however, to the point where the patent may be said to be "granted before the commencement of this Act," and no longer pending in its application, and the question remains as to filing the complete specification, which your readers will remember takes place under the old law after the sealing or grant of the patent. This, however, is provided for by Clause 4 of the new law, which in effect says: "All instruments relating to patents granted before the commencement of this Act" shall be filed in the Patent-office. Under the new law the sealing of the patent will take place after the filing of the complete specification.

In interpretating these clauses of the 45th section, it should be borne in mind that a patent both under the old and new law when granted is sealed and dated back to the date of application, and therefore all applications made before the 1st of January next will be sealed, and in the language of the new Act, are said to be "granted before the commencement of this Act." But assuming the foregoing to be the correct interpretation with regard to pending applications, what, it may be asked, is the meaning of the third clause, which says: "In all other respects—including the amount and time of payment of fees—this Act shall extend to all patents granted before the commencement of this Act, or on applications then pending in substitution for such enactments as would have applied thereto if this Act had not been passed." I reply that so far as this refers to fees, it relates to the £50 and £100 stamp duty now payable upon letters patent at the end of the third and seventh years respectively, the former being deferred in all cases where it becomes due on or after the 1st of January next to the end of the fourth year, or may be paid in instalments; and with regard to the latter—or £100 duty—this remains payable at the end of the seventh year upon all old applications—see schedule to the new Act—but is deferred to the end of the eighth year on all new applications made after the 1st of January next. It is quite evident that this third clause does not refer to the £3 duty provided to be paid upon the complete specification under the new law, as this duty is payable upon a document which has to be submitted to an examiner, and which has, in his opinion, to accord with the provisional specification which he has already examined before even the patent can be granted or sealed.

Patent-office, 71, Market-street, John G. Wilson.
Manchester, October 16th.

ENGINE SPEEDS.

Sir,—I have lately designed, and my firm has since obtained the order for a complete plant of machinery, including shafting, pulleys, &c., for a mill.

All the machines will be driven by belting from a common shaft, which must run at 200 revolutions per minute. This shaft will be driven by a steam engine through belting. Unluckily the steam engine has been ordered elsewhere at rather a low price. The engine being ordered elsewhere, my firm did not contract to supply the pulley for the engine shaft, nor its respective driven pulley on the first motion shaft as described above, nor did the engine-maker contract to supply these two pulleys. The private firm for whom the machinery is being made cannot well afford to lay out more than a stated sum, and they have simply placed themselves in the hands of the two contracting engineers, viz., ourselves and the engine maker.

The engine is horizontal, and to have a cylinder 18in. diameter by 32in. stroke. The maker says the fly-wheel he supplies with the engine is 9ft. 6in. diameter, and that the maximum speed he will allow his engine to run at is 65 revolutions per minute. The driven pulley on the first motion shaft for important reasons should not be much less than 4ft. diameter, so that with the engine running at 65 revolutions, to drive the 4ft. pulley at 200 revolutions necessitates a 12ft. pulley on the engine shaft, but the extra expense of a 12ft. pulley the purchaser of the machinery never anticipated.

I suggest to the engine maker to avoid letting the purchaser into unnecessary expense, that he should allow his engine to run at 80 revolutions, and that the strap should be driven off of his 9ft. 6in. fly-wheel on to about a 3ft. 10in. pulley, and so give to this pulley the desired number of revolutions of 200 per minute. But he refuses to drive his engine more than 65 revolutions per minute, for the reason that he considers 80 revolutions an undue speed for his engine of 32in. stroke to run at, and says that if the purchaser requires the first motion shaft to be driven at 200 revolutions through a 4ft. pulley, then the purchaser must pay the extra expense, which, of course, is very great, of substituting for the 9ft. 6in. pulley fly-wheel a 12ft. pulley fly-wheel. An engine of 32in. stroke at 65 revolutions gives a piston speed of 346·6ft. per minute, which now-a-days is considered a rather slow speed. I asked the maker to run this engine at the moderate speed of 80 revolutions per minute, equal to 426·6ft. per minute, and so save the purchaser the extra expense as described, but he refuses to do this, declaring the maximum speed his engine must run to be from 60 to 65 revolutions. Moreover, amongst other machines the engine has to drive several pairs of millstones, which must have a periphery speed of something like 50 per cent. less than that of the engine fly-wheel, to prevent backlash. But with an engine fly-wheel of 9ft. 6in. diameter, at 65 revolutions, the speed of the periphery of the wheel is only 6 per cent. greater than that of the millstones, but if he runs his engine at 80 revolutions with a 9ft. 6in. fly-wheel, then the ratio of periphery speed could pass. But knowing all this, and what I have before described, he will not allow the engine to run more than from 60 to 65 revolutions. What can your readers understand of such an engine maker? Is his engine so badly constructed that it would break down running at the moderate speed of 80 revolutions per minute? Does he want to make something out of supplying a larger fly-wheel at an extra cost? or is he not used to making steam engines, and perhaps does not understand the number of revolutions at which an engine can be run smoothly and well? or am I asking him too much to run his engine of 32in.

stroke at 80 revolutions per minute equal to 426·6ft speed of piston per minute? A.M.I.C.E.

October 16th.

[Our correspondent seems to forget that the engine referred to has been bought at a low price. A good and well-made engine, with a 32in. stroke, may be run with perfect ease and safety at 100 revolutions. We have seen cheap engines, however, which with a 32in. stroke would be best run at about 20 revolutions. No one is more likely to know what an engine will or will not stand than the maker, who is, no doubt, in this case exercising a very wise discretion. What would "A.M.I.C.E." say if his advice was carried out, and the engine broke down during the first week? It seems to us that the purchaser of the engine has been penny-wise and pound-foolish.—ED. E.]

ENGLISH *v.* CONTINENTAL RAILWAY SPEED.

SIR,—In THE ENGINEER of the 21st ult., p. 224, "Commercial" says that "in point of fast running, our expresses are now equalled by those on some of the French railways." He gives as an instance the train leaving Paris at 8.45 a.m. and arriving at Bordeaux at 5.52 p.m., making ten stops, aggregating 48 min., distance 363 miles; also, Calais to Portbon, 827 miles, in 27 h. 10 min., stops lasting over five hours, the first of which gives a speed of 43·80 miles per hour, the latter 37½ miles per hour.

He also refers to a paragraph which appeared in THE ENGINEER some months ago, on "The Comparison of French and English Railway Speed," quoted from the *Annales Industrielles* on data furnished by M. Gerhardt, and which also appeared in the *Times* of October 21st, 1882. M. Gerhardt there gives the "mean speed" on several English and French railways in kilos. per hour, which I have reduced to miles per hour, as follows:—

	Kilos. per hour.		Miles per hour.
English railways.	60	=	37·283
	63	=	39·148
	74	=	45·983
	77	=	47·947
French railways.	59·5	=	36·973
	65·0	=	40·390
	69·8	=	43·373
	70·0	=	43·497

For instance,

1 kilo. = 1093·66 yards
1 mile = 1760 ,,

Then for a speed of 60 kilos. per hour $\frac{1093{\cdot}66 \times 60}{1760} = 37{\cdot}283$ miles per hour.

Now, the following table which I have prepared will, I think, show that the speed on most English railways is still considerably in excess of that on the continental lines. In deducting the time for stoppages I have allowed four minutes for each stop where the length of the actual stop is not given in the time-tables, and three minutes for all other stops, so as to allow one minute for the stop and three minutes for the loss of time in slowing and regaining speed:—

Railway.	Train.	Time.	Stops.	Time—stops.	No. of stops.	Distance.	Speed in miles per hour.
		h. m.	min.	min.		miles.	
Midland	St. Pancras, 5.15 a.m. / Leeds, 10.15	5 0	47	253	8	204	48·39
Great Northern	King's-cross, 5.15 a.m. / York 9.48	4 33	29	244	6	188½	46·15
South-Western	Waterloo, 9.0 a.m. / Exeter, 1.51	4 51	68	223	15	172	46·15
South-Eastern	Charing-cross, 7.40 a.m. / Dover Pier, 9.30	1 50	8	102	2	76½	45·11
L., C., and D.	Victoria, 8.0 p.m. / Dover Pier, 9.57	1 57	12	105	3	78	44·78
L. and N.W.	Euston, 5.15 a.m. / Liverpool, 10.30	5 15	54	261	8	193½	44·44
Great Eastern	Liverpool-street, 5.10 a.m. / Yarmouth, 9.22	4 12	88	164	18	121¾	44·44
Great Western	Paddington, 11.45 a.m. / Plymouth, 6.0	6 15	37	338	6	246½	43·80
L. and N.W.	Euston, 8.25 p.m. / Holyhead, 3.5	6 40	20	380	3	264	41·70
L., B., and S.C.	Victoria, 4.30 p.m. / Brighton, 5.45	1 15	—	—	0	50½	40·54

For instance,

Midland Railway—St. Pancras to Leeds .. .. Miles. Mile. Min. Min. 204 : 1 : : 253 : 1·24 $\frac{60{\cdot}00}{1{\cdot}24} = 48{\cdot}39$ miles per hour.

London, October 2nd. M. M.

CONTINUOUS BRAKES.

SIR,—The collision which occurred at Lofthouse station, on the Great Northern Railway, on the 15th September, is another instance of the danger which follows the use of slowly acting non-automatic vacuum brakes. Here was a short passenger train, consisting of engine, tender, and seven vehicles, running at a speed of twenty to twenty-five miles an hour up a gradient of 1 in 100, yet all the continuous vacuum brake could do was to reduce the speed to about fifteen miles an hour in a distance of forty or fifty yards. Surely if this train had been fitted with a quickly acting, efficient brake, the force of the collision might have been rendered harmless, if, indeed, not entirely avoided. The moment the collision took place the vacuum pipes were broken, and, of course, the brake was rendered useless, as, although it had been applied, it would instantly release itself. The driver in his evidence states that, when the pipes were broken, he "felt the train press the engine forward." Under these circumstances I should be glad if any of your correspondents will explain the concluding remark of Colonel Rich in his report. He says—after referring to the fact that the continuous brakes had not time to act so as to prevent the collision—"but they no doubt prevented the recoil of the carriages, and thus saved the passengers from being more severely injured." At present I fail to see how a non-automatic brake, which had been rendered useless, could prevent the recoil of carriages; and as a matter of fact it is stated that there was a very "sharp recoil." A passenger in the train writes, that collision threw him against one end of his compartment, and then he was thrown across against the other, just as the train was coming to a stand. This appears to confirm the statement that the recoil was not prevented by the brake. CLEMENT E. STRETTON.

40, Saxe-Coburg-street, Leicester,
October 16th.

COMPETITION.

SIR,—If "Alpha and Omega," two competitors for the Bedford Bridge, had first ascertained that the statements they published were facts, they would perhaps be entitled to a portion of the honesty to which they lay claim. If they had taken the trouble to inquire they would have found that the bridge was required to have a width of 200ft. between north and south abutments. Upon this information the design of the "other competitor, named Webster," was made, and is now being carried out.

For the information of "Alpha and Omega," who attempt to prove that the accepted design is actually unsafe, I may mention that the detail plans were not only passed by the engineers of the Local Government Board, but, before being accepted by the authority, were submitted to an eminent engineer in Westminster, who is one of the highest, if not the highest, authority on bridges. His report was most satisfactory, and he stated that the greatest stress on any part of the structure under the heaviest loading would be slightly under 4 tons per square inch.

The wonderful calculation of "Alpha and Omega" for the strength of the corrugated flooring is a monument of erudition, and requires a powerful mind to grasp it; but if the results they have arrived at be even approximately true, scores of railway bridges I could name which have their floorings constructed of these plates of the same proportional strength as the one under discussion ought to have come to grief long ago, with even a quarter of the load to which they are daily submitted; but strange to say, they are still standing as firm and rigid as ever they were.

I may further mention that I do not, like them, gain my knowledge from information as set forth in advertisements, but prefer to consult more reliable authorities; and in the case of the corrugated flooring I had for my guidance the results of some experiments most carefully conducted by an eminent member of the profession.

In conclusion, I wish to say distinctly that I shall not enter into any further correspondence upon this subject.

JOHN J. WEBSTER.

Stephenson-chambers, 25, Lord-street, Liverpool,
October 17th.

SIR,—Having been a competitor for the construction of a new bridge over the Ouse at Bedford, I read with some interest the letter of "Alpha and Omega" in your last week's issue, and I was very much surprised at the want of knowledge there displayed. A corrugated plate, 5in deep, ¼in. thick, and 2ft. 8in. wide, will carry a weight of 3⅓ tons at the centre of a 5ft. span without the metal being strained to a greater extent than 5 tons per square inch. If allowance is made for continuity, the support of the adjacent plates and the partial distribution of the load by the road material, even when one of the wheels of a traction engine is at the centre of the span, a load of not very far short of 7 tons can be supported, this being the maximum weight on the driving wheel of a 20-ton engine. Having due regard to the permanency of the structure, I should not myself have employed a plate less than 6¼in. deep and ⅝in. thick. From the wording of their advertisement in June of last year I, like "Alpha and Omega," understood that the Corporation of Bedford required that the successful competitor should construct the bridge for the sum named in his estimate. In such competitions I do not think it is fair for estimates to be asked for unless indeed they are to be based on certain fixed prices. There are some engineers who do not care to risk their reputations either by the carrying out of works which are not thoroughly substantial, or by exceeding the estimates without being able to give a satisfactory explanation of the cause of their doing so.

29, Victoria-park-road, London, RICHD. PARKINSON.
October 16th.

THE PHONOGRAPH.

SIR,—With reference to the letter of your correspondent, Mr. W. F. Fremersdorf, allow me to inform him that his apparatus would fail in that it would only render the tone or musical pitch of the words spoken without giving the quality of the voice or the consonants. No arrangement which works by make-and-break only can do more than this, for the number of vibrations only will be recorded, while to give a true rendering of the words uttered the shape and depth of the phonographic indentation must be transmitted as well as the rapidity of their occurrence. Perhaps by means of a microphonic contact or tension regulator in connection with the needle of the transmitting phonograph this might be accomplished; but it seems doubtful whether the fluctuations in the current transmitted could be obtained in a sufficiently marked degree to produce indentations on the tinfoil of the receiving instrument, except in the case of a very short line of extremely high conductivity and insulation.

A. G. CAMPBELL SWINTON.

63, Westmoreland-road, Newcastle-on-Tyne,
October 15th.

THE DEFINITION OF FORCE.

SIR,—I hasten to enlighten your correspondent, Mr. Eddy. Professor Lodge has explained that motion is the sole cause of motion. This is my view of the matter. Perhaps Mr. Eddy will kindly state his views on the same subject.

The point at issue is simply this:—Force is said to be the cause of motion. To this I have no objection; but the theory does not end here. Students immediately ask, what is force? They get no answer. If they were told that a railway train was drawn by a locomotive they would naturally ask, what is a locomotive? If we let the matter drop here there would be an end to inquiry. Mr. Eddy may not want to know any more; but the world will go on even though Mr. Eddy stands still.

Most important deductions follow from the statement that motion, and nothing but motion, can produce motion. For example, if this be true there can be no such thing as attraction. No influence can be exerted by matter where it is, on other matter where it is not. Gravity produces motion, therefore gravity must be itself a mode of motion. There can be no such thing as statical energy; all energy must be dynamic or kinetic. Pressure is due to motion. Mr. Eddy will be puzzled to prove that it is not.

London, October 15th. Φ. H.

SQUIRTING BRASS PIPES.

SIR,—In an article upon "Lead Pipe Making Machinery"—Messrs. J. and W. Weems—in THE ENGINEER of October 12th, is an account of an attempt to make brass tubing by hydraulic pressure, the result being that the zinc was separated from the copper. It would be interesting to know what was the temperature of the alloy at the time of being operated upon, together with the heat likely to be generated by the pressure of the ram, as the separation of the two metals in the way described may have been due merely to the difference in their melting points, the heat having been sufficient to melt the zinc at 773 deg. Fah.—412 deg. C.—which would be squeezed out, but not high enough to affect the copper, the melting point of which, 2192 deg. Fah.—1200 deg. C.—is so much higher than that of zinc. J. H. HUXLEY, A.R.S.M., F.I.C.

Sheffield, Oct. 17th.

DESIGNS, SPECIFICATIONS, AND INSPECTION OF IRONWORK.

SIR,—Mr. Webster's letter in your last impression gives me the impression that he has still a great deal to learn, especially as to courtesy with which a scientific discussion should be conducted. He has criticised Mr. H. W. Pendred's paper with little mercy. I have neither the time nor the wish to take up as much of your space as he has done; but I wish to point out that his criticism is simply destructive not constructive, and I think it would be interesting if he would supply some sketches of the way in which he would put bridges together in order that we might know what his notions concerning the proprieties of bridge construction are.

I will only deal with three points. First, as regards angle covers. It is just a fact and not an opinion that specifications are prepared in which angle irons are put on one another as shown, and I have heard it contended that this makes a better job than hollow rolled angles, because the sharp edge of the cover plate cuts into the plate under it, as shown exaggerated in the diagram. I have purposely drawn the diagram as I have in order to show the cutting of the upper into the lower plate clearly. Of course this cutting in is exaggerated. I have also seen the swaging of cover plates specified, and done. If Mr. Webster's experience was greater than it seems to be, he would have raised no question on this point.

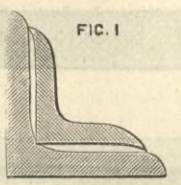


FIG. 1

Concerning drifting, I quite agree with Mr. Pendred, and I would ask Mr. Webster did he ever yet see a bridge put together *in situ* without the use of a drift? and did he ever know a bridge fall down because a drift had been used? An explicit answer to these two questions is desirable. There is only one class of work in which in all my experience I ever saw the use of the drift dispensed with, and that is in locomotive boiler work, where the plates are drilled and rivetted without ever being taken apart. But it is not necessary to use a 7 lb. sledge. Bridge plates are always punched while flat, and then bent to the curve, say, of the upper boom, and when several plates come together as in the sketch the bending throws the holes out, and the pitch should vary, increasing from without; but the difference is so small that it is almost impossible to vary it as much as is needed, and no more, and a drift has to be used to get the holes fair; and I repeat that with punched work in several thicknesses it is absolutely impossible to dispense with the drift or the rimer, and Mr. Pendred points out that a rimer to be worked by a hand wheel would be a great boon to bridge builders.

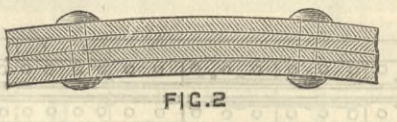


FIG. 2

Lastly, as to the heating of rivets, Mr. Webster ought to know that there is a wide division of opinion concerning whether rivets ought to be heated all the way or not. He forgets that a hot rivet put into a cold hole rapidly chills on the outside, and, save with machine rivetting in drilled plates from which the burr has not been removed, what he has shown in his sketch cannot take place. On the contrary, the great difficulty is to get long rivets to fill the holes properly, and unless they are hot throughout they will not fill them at all. Mr. H. W. Pendred has only echoed the statements of the best authorities when he urges that rivets ought to be heated thoroughly throughout. It would have added to the value of your correspondent's criticisms if he had stated exactly how far a rivet ought to be heated for, say, four ⅝in. plates. It is quite clear that if he is right not more than an inch or so of rivet ought to be heated, or else the metal will find its way between the first joint under the snap. By the way, I may remark that in good work the snap marks never appear on the plate. There is hardly a statement in his letter which is not open to discussion, but I have no doubt this will be seen by others, and I shall not extend this already too long letter. J. M. DORNTON.

Bermondsey, October 15th.

ROLLING SCREWS.

SIR,—In your Notes from Lancashire, page 290 of your last issue, I note the description of a machine invented by a Mr. Fairbairn for rolling screw threads on bolt blanks. I presume this is to be done while the blanks are hot, and if so the description exactly suits a machine invented by, I believe, a Mr. Cameron, of Dublin, and tried by the late Mr. Ashbury in his works at Openshaw in 1856. Mr. Ashbury had a contract for bolts and nuts for fishing the joints of rails, the bolts, ¾in. diameter, with square heads, were rounded down out of ⅞in. square iron by a Ryder's forging machine and headed by hand, and were then passed into the screwing machine to be threaded. The thread formed was very good, and the bolts when tested proved to be stronger than others with the thread cut by dies in the ordinary manner. It was, however, found that unless the blanks were of uniform temperature when placed in the machine, they would not come out of the same size. In the trial referred to above, as the blanks were forged two at a heat, the second was always somewhat colder than the first, and was found in every case to be so much larger that the nuts, tapped uniformly, would not fit, hence the machine failed to accomplish the object in view. Perhaps Mr. Fairbairn in his machine has overcome this difficulty. C. P.

THE S.S. ST. GERMAIN.

SIR,—Some of your readers would like to know, perhaps, that they can have photographs of each side of the ship separately. There is no doubt but the fractures differ greatly, maybe owing to the extra resistance of a portion of the hull or load of the Woodburn. It appears to me that all the information offered through this disaster is worth a careful study, as a trifle more of resistance on the part of the Woodburn would have probably deprived us of all the evidence of the St. Germain. W. R. SCANLAN.

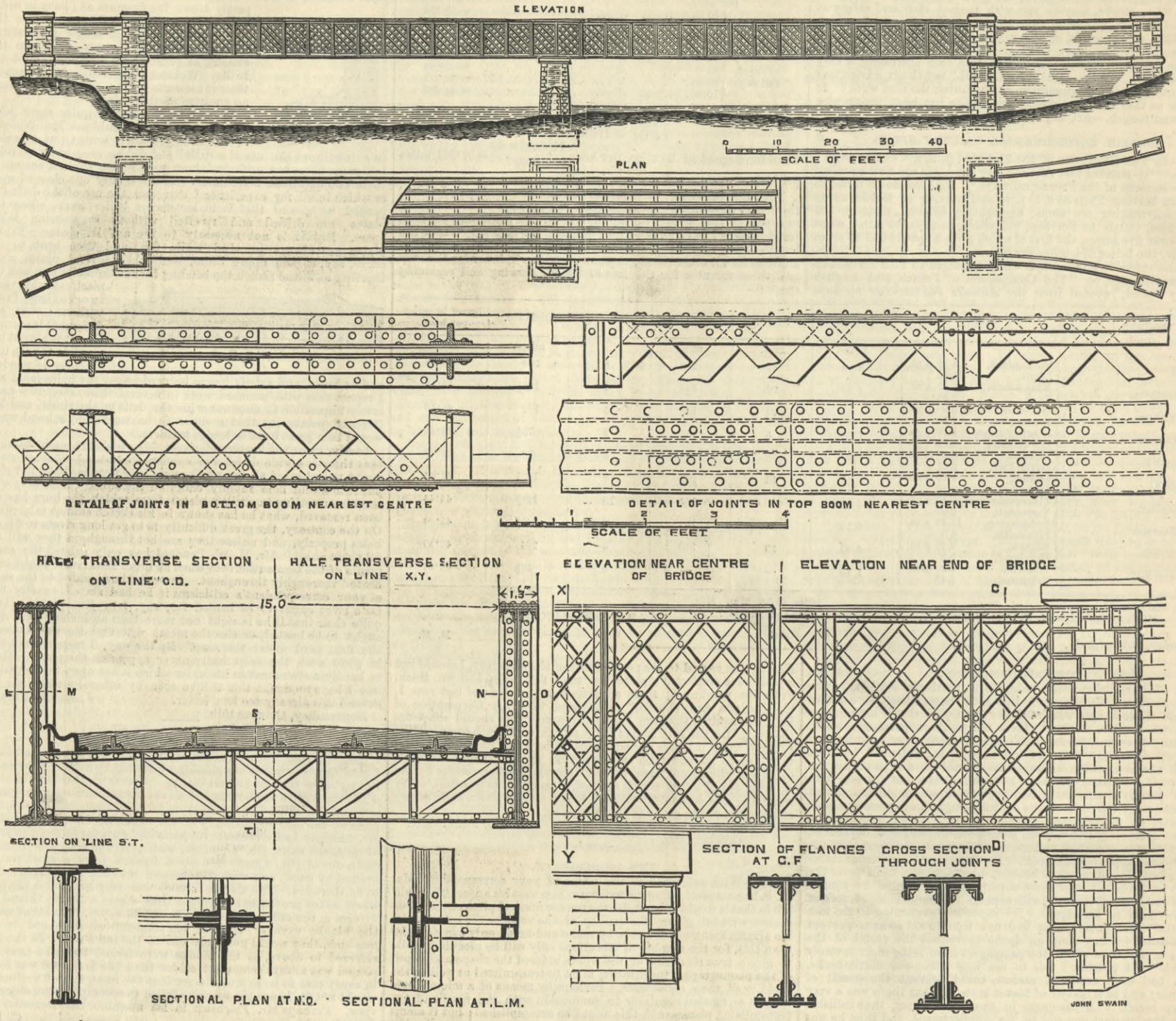
NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—L. M. Green, chief engineer, to the Pembroke, additional, vice Sagar; and H. Laughrin, chief engineer, to the Indus, additional, for service in the Wild Swan.

THE NEW WET DOCK AT MARYPORT.—Rapid progress has been made with the construction of the new dock at Maryport, and on Saturday last the works were inspected by the engineers, Sir John Hawkshaw and Mr. Hayter, who expressed themselves as pleased with the progress that had been made. It is hoped to have the dock ready for the admittance of water by next week, when the work of dredging the channel will be commenced. It is also proposed by the trustees of the town to lengthen the present piers, so as to afford a better shelter for the harbour.

DEATH OF MONS. ALFRED NIAUDET.—We announce with much regret the death of Mons. Alfred Niaudet, a well-known member of the firm of Breguet, of Paris. He was manager of the Société Générale des Téléphones, of the Compagnie Electrique, and of the Société d'Eclairage Electrique, as well as chairman of the Compagnie Internationale Téléphones. He was a member of various scientific societies—amongst others, the Société Française de Physique. He was also elected a foreign member of our own Society of Telegraph Engineers and of Electricians on the 8th May, 1872. His activity and energy were well known, and his authority on questions of electrical science or practice unquestionable. We may quote here a paragraph from a brief notice of his death that appears in the *Revue Industrielle* for Wednesday week. Our contemporary says: "Inventors always experienced a kindly reception at his hands; workmen consulted him to their benefit, whilst *savants* themselves appreciated his experience. An inventor of an electric battery, he was one of the first to foresee the part that would be played by machines in the production of electricity; indeed, he had himself designed a small and very ingenious machine for laboratory use." He wrote several books, amongst which were "Applications du Diapason à l'Horlogerie," published in 1866; "Machines Magneto-Electriques Gramme," published at Paris in 1875, and written in the name of A. Niaudet-Breguet; "Téléphones et Phonographes, étude Complete de ces Inventions," Paris, 1878; "Traité élémentaire de la Pile Electrique," Paris, 1878, of which an English translation was made by L. M. Fisbach, and published in New York in 1870; and "Machines Electriques à Courants Continus," of which a second edition was published in 1881. His researches in dynamos entitle him to a high rank among those who have studied in this direction. He died rather suddenly at the comparatively early age of 48, on the 11th inst.

BRIDGE OVER THE TAFF, PONTYPRIDD, GLAMORGAN.

MESSRS. MAYNARD AND COOKE, WESTMINSTER, ENGINEERS.



THE accompanying engraving represents a bridge built for the Local Highway Board, over the river Taff at Upper Boat, near Pontypridd, Glamorganshire, from the design of Messrs. Maynard and Cooke, engineers, Westminster. The town of Pontypridd, with its surrounding district, has rapidly changed since the time when William Edwards built that celebrated bridge which in one stone arch, the segment of a circle, with a chord of 140ft. and a height, from the spring to the keystone, of 34ft., spans the river Taff near this spot, and many bridges are now required where one formerly sufficed. The river Taff drains a considerable area of inclined surface, which rapidly discharges the water falling upon it; hence the river is very treacherous to temporary erections in it. Structures are very liable to be swept away by a sudden swelling of the torrent, which may be caused to rise 8ft. or 9ft. by a thunderstorm or a few hours' rainfall in the district. Hence the difficulty of setting safe foundations and buildings in such a waterway; and the fact that the celebrated William Edwards twice failed to carry out his designs for a bridge, the first having been swept away by a torrent soon after its completion, and the second falling before it was entirely finished, is some proof of the difficult nature of such a work. It was, in fact, this difficulty which dictated the bold arch above referred to, with its inconveniently steep approaches—approaches so steep as to be quite impracticable for vehicles of the present day.

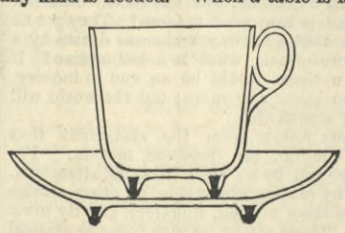
The new bridge has been recently opened for traffic, and consists of a pair of continuous wrought iron trellis girders 7ft. deep, and so placed as to form parapets carrying open braced cross girders 2ft. 6in. deep between them, upon which a deck of $\frac{5}{16}$in. wrought iron rivetted plates stiffened by longitudinal T-irons is carried. This floor is covered with concrete 4in. in thickness, on which is laid the macadamised road metalling. A strong cast iron gutter kerb with suitable gratings, outlets, and stop ends forms a skirting on each side of the road and shields the road metalling from the lattice bars, so that every part of it is accessible for examination or painting. The pier and abutments are all built of stone from the locality, namely, the penant sandstone. The river at this spot is 230ft. wide, the bridge being built in two spans, having a pier in the centre, the foundations are laid 8ft. below the river bed in gravel, and were built in wood coffer dams, the piles of which, after completion of the work were cut off at low-water level and left in the ground. Our engravings sufficiently show the construction and dimensions of the bridge to make it unnecessary to describe it further. The bridge was commenced in March of this year, and completed by the 1st August, the ironwork being manufactured and erected by the Coalbrookdale Company, and the masonry carried out by local contractors.

VERNON'S CHINA AND GLASS.

ONE of the recent additions to the Great International Fisheries Exhibition is a very interesting novelty in china and glass prepared according to Mr. Vernon's patent. This china is intended more expressly for use on board ship, where it will certainly be a great acquisition and save many of the worries and discomforts incidental to ship life, especially in stormy weather.

Most people who have voyaged by sea are familiar with the old arrangement of "fiddles," used to prevent the plates, &c., flying about the table when the ship rolls, and which is generally considered a very clumsy and uncomfortable way of attaining the desired object.

The Vernon Company's china and glass is used just in the ordinary way, and at first sight appears to be the ordinary ware, yet even in the roughest weather no attachment to the table of any kind is needed. When a table is laid with the patent china no ordinary amount of motion, even with jolting, will cause the least movement of any of the articles. This is shown in a most conclusive manner by the inventor at the stand in the Exhibition. Here he has a large table with a complete service on it. The table is pivotted in the centre, and when swung up and down, even to an angle of 45 deg., nothing falls off or moves at all. Its great adaptability to ships' use is further shown by a small Berthon boat in a tank of water. The boat is decked over, and has a small raised table in the centre, with various articles upon it, such as decanters, cups, and saucers. The inventor causes this boat to pitch and roll in the most lively manner, and bump against the sides and ends of the tank, without any displacement of the articles. Another severe test was to place a china tray with one end on the raised table and the other on the bulwarks, overhanging a couple of inches, and on this to put a decanter, the tray being at an angle of nearly 45 deg., and whatever motion was given to the boat the decanter remained perfectly safe in its position.



These very desirable ends are attained in a most simple manner, by the insertion of a ring of india-rubber in the bearing rib of the article, and protruding a little therefrom. In the rib a dovetail groove is formed, and the india-rubber ring is moulded to fit it, and then forced into it. It is made to fit quite tight, and requires no cement of any kind, and yet it is held so well in position that no fair usage can possibly displace it.

The sectional sketch of a cup and saucer above will show plainly how the insertion is made; the black representing the rubber ring. This insertion of india-rubber gives to the pieces a wonderful clinging power to withstand the tendency to slide, as proved by the tests described above, but they can be lifted perpendicularly as easily as ordinary goods.

The best red rubber is used for making the rings, and as it is vulcanised at a temperature of about 300 deg., it is not affected at all by boiling water. Neither will acids nor fats affect it, and ink does not stain it, as shown practically by the inventor. The china, though apparently quite a novelty, has been in use for some little time by the Eastern Telegraph Company in its steamers, and by several others, including some transatlantic and Pacific liners, and has given, we understand, great satisfaction.

THE CALCUTTA EXHIBITION.

THE following particulars regarding the accommodation that will be afforded to intending exhibitors in the several courts attached to the Calcutta Exhibition—which opens early in December—we gather from the *Calcutta Englishman*:—On the right and left of the Museum are situated sheds known as the Chinese sheds, which contain some 3387 square feet, and passing in through the main entrance, the large quadrangle in the centre is reached, with corridors on each side. The corridors allow of 4968 square feet space, top and bottom, the main quadrangle containing 18,000 square feet of space. Passing across the quadrangle, a room on the east of the Museum is reached, which allows 3680 square feet of space; and passing from that room through a door into another running parallel with the Exhibition annexes, is another room allowing of 2800 square feet of space. Through this room we pass into the transept, which runs nearly north and south. This transept allows space to the extent of 2436 square feet. Running to the west of this transept are two long annexes, each 500ft. long, allowing of a total amount of space of 27,360 square feet. At the back of the Museum is a new building, lately imported from England, and which, it is to be hoped, will be completed in the course of a fortnight. This building will allow of space to the extent of 7200 square feet. Passing through these annexes towards the tank, and entering the Transept again, continuing along the passage through the Economic Museum, we come to a room containing space to the extent of 2300 square feet. Adjoining the same room is an annexe, which allows of 5760 square feet. The total space thus at command for European and colonial exhibits, leaving out the grounds devoted to machinery exhibits, is 69,900 square feet clear. Extra space, in the course of completion, amounts to 2600 square feet more.

The machinery sheds being built on the west side of the tank on the Maidan, are to be extended to allow of a total of 34,000 square feet, and in this space the machinery of all nations will be placed.

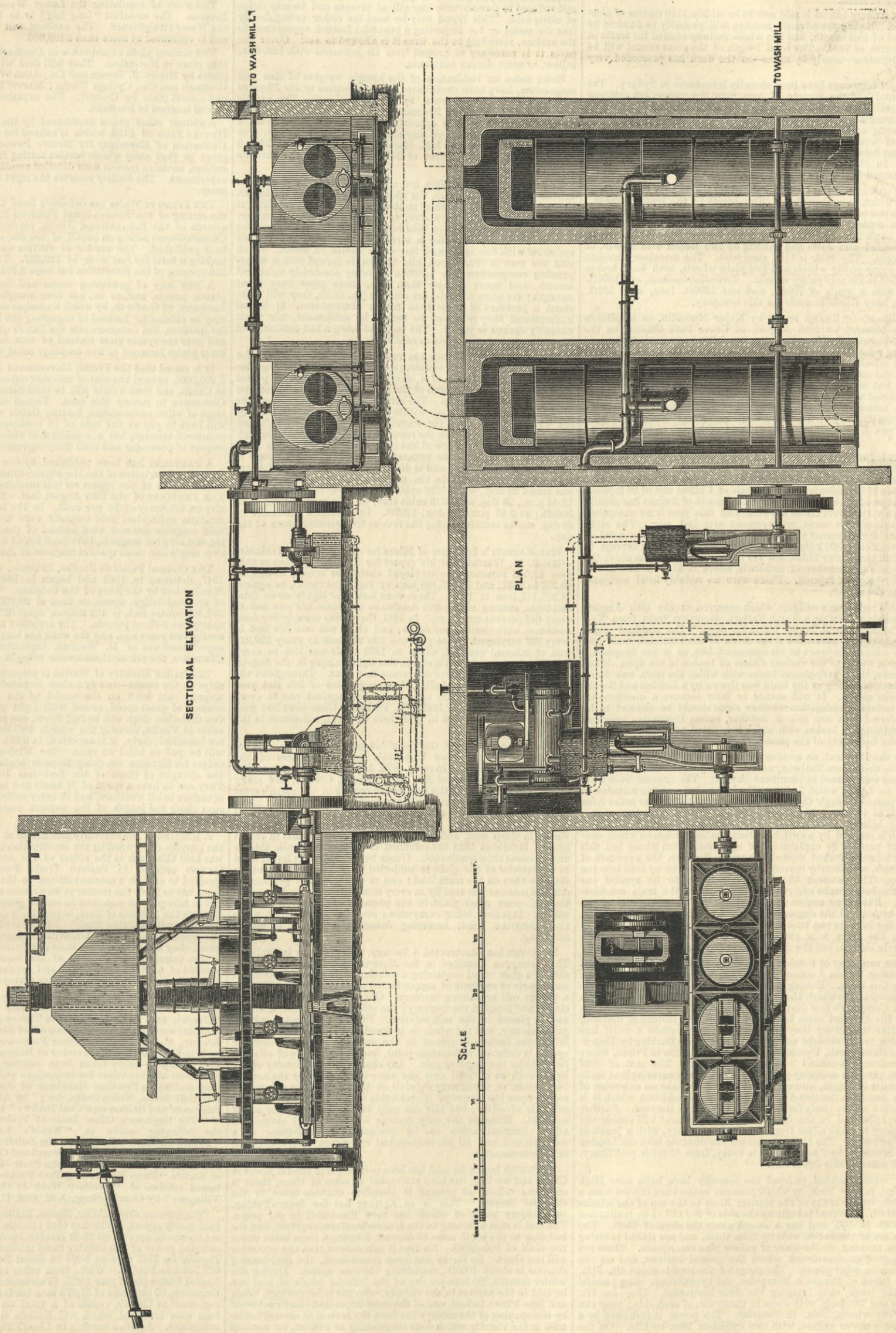
It is also intended to connect the buildings on the Maidan and the Imperial Museum with an over-bridge over the Chauringhi-road, which will allow the public entrance to the Indian court, and allow of an additional 60,000 square feet of space. It is said to be the intention of Messrs. DeCauville and Fowler, and Walsh, Lovatt, and Co., to run portable railway lines in all parts of the space round the courts, for the convenience of visitors visiting the machinery rooms and sheds. The total amount of space at present at the disposal of exhibitors—that is, the amount that will be actually covered by exhibits—is 175,000 square feet.

THE average performance of an American goods car, according to railway statistics, is 1445 ton-miles per week.

COMPLETE MILL AND PLANT FOR MAKING PORTLAND CEMENT.

THE PULSOMETER ENGINEERING COMPANY, LONDON, ENGINEERS.

(For description see page 298.)



RAILWAY MATTERS.

The Midland Railway Company and the Eastern Railway Company have each invited tenders for 500 sets of wheels and axles. It is expected that the work will be taken by a Sheffield firm.

A bridge on the Mexican Central Railway near Aquas Calicutes fell on Sunday last under the weight of a construction train, with two locomotives. Five persons were killed, and the train was entirely wrecked.

The Arlberg tunnel is said now to be within 1180 metres of completion. Boring the advance heading will probably be finished by the end of this month, and the whole railway opened for traffic in the course of 1884. The total length of the great tunnel will be 10,270 metres—nearly 6½ miles—so the work has proceeded very rapidly.

Steam tramways have been recently introduced in Sydney. The "Journal" of the Society of Arts says the motors are obtained principally from America, and are compact, light, and of considerable strength. The carriages are double-decked, the seats on the roof being under shelter. At the close of 1881 there were 11¼ miles of tramway in actual use, the number of passengers during the year being 7,090,125, as against 2,086,897 during the previous year. In 1882 there was a further increase, which is said to be maintained during the present year.

A railway has just been completed for the Arizona Copper Company which is rather steep. The length of the track is 3000ft., with a rise of 1100ft. The track is laid with three rails, with turnout in centre. It works by force of gravitation; the loaded car down hauls the empty car up, and the company has been running two loaded cars down and hauling up two loaded with 1500 lb. of iron rails. The cable is 1⅛in. steel wire. The machinery consists of two grip pulley wheels and two plain wheels, with band brakes attached to the grip pulley wheels. Two other inclines, one 1500ft. long, with a grade of 700ft., and one 1200ft. long, with 580ft. grade, have also been made for this company.

A Board of Trade report by Major Marindin, on a collision which occurred on 19th August, at Grove Park Station, on the South-Eastern Railway, contains the following amongst the concluding remarks:—"I believe this accident to have been due to a slight miscalculation of speed on the part of the driver, who probably did not make proper allowance for the slippery state of the rails; but it might certainly have been averted if the train had been fitted with a continuous brake, and the driver would have had a far better chance of stopping his train if he had been running with the chimney of his engine in front, so that sand might have been run freely on to the rail instead of having to be applied by hand."

The following is a summary of the American railway accidents in August, taken from the *Railroad Gazette*. There were 144 accidents, in which 42 persons were killed and 136 injured; an increase of 5 accidents, but a decrease of 4 killed and of 86 injured, as compared with August, 1882. The month of August has usually made a very unfavourable showing, and this year is no exception, although there is some improvement over last year. The eight months of the current year to the end of August show a total of 1074 accidents, 320 killed and 1148 injured; a monthly average of 134 accidents, forty killed and 144 injured. August was above the average in the number of accidents, above it also in killed, but slightly below in injured. There were no notably fatal accidents during the month.

In his report on a collision which occurred on the 13th August, at Carlisle station, to a North-Eastern excursion train from Keswick to Sunderland, Major Marindin says, "The accident might easily have been prevented if the driver of the excursion train had had a continuous brake at his command, but, as is too frequently the case, owing to the various classes of brakes in use upon different lines, the Westinghouse brake with which the train was fitted was useless so long as the train was drawn by a London and North-Western engine. It will sooner or later become a question for very serious consideration whether stock should be allowed to be transferred from one line to another, unless means are provided for utilising the brakes with which it is fitted, and which are necessary for the safety of the passengers."

On the 11th inst. an accident of an alarming nature occurred on the North-Eastern Railway, near Leeds, by which the lives of fifty persons were placed in imminent danger. The express train from Hull to Leeds, which is due at the latter town at five minutes to two, passed through Crossgates, a roadside station four miles from Leeds, at its usual high rate of speed. Near this part there is a siding belonging to the Waterloo Colliery Company, Limited, which is reached by a switch. Owing to some mistake which cannot at present be explained, the signalman from whose box this branch line is worked moved the wrong lever on the approach of the train, and thereby moved the express from the up road into the siding. The moment the driver saw the error he applied the Westinghouse brake and reduced the speed of the train considerably. But as the engine was crossing a set of points one of the rails broke, and the engine and vehicles following all left the rails, and the luggage van turned over on its side, and thus helped to bring the train to a standstill. Many of the passengers were severely shaken, but the driver and stoker stuck to their post.

The ceremony of turning the first sod of the Barking and Pitsea Extension of the London, Tilbury, and Southend Railway took place this week. Having to make some provision for the greatly increased traffic which the construction of the East and West India Dock Company's new deep water docks at Tilbury will bring to the line, the directors came to the conclusion that instead of doubling the line to Tilbury they would do better to make a relief line running nearly straight across the country from Barking by Dagenham, Hornchurch, Upminster, and Langdon Hills to Pitsea, where the existing Southend line would be joined. The Act of 1882 which gave the company powers to make this connecting line, some 19½ miles in length, also empowered them to make an extension of their line from Southend to Shoeburyness, an addition which it is expected will be ready for use before the end of the year. Further powers obtained in the last session of Parliament will enable the company to make a line from Romford to Tilbury, with a junction at Upminster. The line will shorten the distance between London and Southend by 7 miles—that is to say, from 43 miles *viâ* Tilbury, to 36 miles by this direct line.

A short inclined railroad has recently been built near High Bridge, in New York, by which pleasure seekers are carried from a landing on the banks of the Harlem River to the top of the adjoining bluff. The road is built up the side of the hill at an inclination of 43ft. in 100, and has a length along the slope of 240ft. The rails are of maple 3in. wide by 2½in. thick, and are spiked to string pieces running up the track of yellow pine 8in. square. These are supported on framework where the ground hollows, and on the surface in other places. The gauge of the road is about 4ft. 5½in. The frame of the car is triangular, the hypothenuse being parallel to the track, thus bringing the floor horizontal. They are 6ft. wide and 7ft. long, with doors in the centre of each side; they run on four wheels, 20in. in diameter. The power is furnished by a 50-horse power engine, with two cylinders 10in. by 12in. On the crank shaft are two pinions, 12in. in diameter and 8in. face, engaging with two spur wheels 7ft. in diameter, keyed on the same shaft. This shaft is of hammered iron 6½in. in diameter, and carries, besides the spur wheels, two drums 6ft. in diameter and 3ft. across. The axis of these drums is perpendicular to the line of the track. Around each one is wound two coils of ⅞in. wire-rope, the winding being in contrary directions, so that one car will be raised while the other is being lowered. The second rope is put on to guard against accident. The engines have a link motion and automatic brakes, with strap brakes on the drums, which can be run independently. Either of the gears is of sufficient strength to hold the load should the other break.

NOTES AND MEMORANDA.

The proportion of doctors to the population in different countries is given as follows by the *Siglo Medico*:—France, 2·91 per 10,000; Germany, 3·21 per 10,000; Austria, 3·41 per 10,000; England, 6 per 10,000; Hungary, 6·10 per 10,000; Italy, 6·10 per 10,000; Switzerland, 7·06 per 10,000; United States, 16·24 per 10,000.

For an etching liquid for steel the following is given:—Mix 1 oz. sulphate of copper, ½ oz. of alum, and one half a teaspoonful of salt reduced to powder with one gill of vinegar and twenty drops of nitric acid. This liquid may be used for either eating deeply into the metal or for imparting a beautiful frosted appearance to the surface, according to the time it is allowed to act. Cover the parts it is necessary to protect from its influence with beeswax, tallow, or some similar substance.

Some notes on verification of the atomic weights of zinc and magnesium, have been contributed to the *Archives of the Physical and Natural Sciences*, Geneva, by M. C. Marignac. The atomic weight of zinc, fixed by Erdmann at 65·05 and by Favre and Jacquelain raised to 66, is approximately determined at 65·33, a figure which further analysis may show to be slightly too low. For magnesium, calculated by MM. Marchand and Scheerer at 24 and by others at 24·5, the number of 24·37 results from the author's fresh experiments.

In America paper gas pipes are said to be made by passing an endless strip of hemp paper, the width of which equals the length of the tube, through a bath of melted asphalte, and then rolling it tightly and smoothly on a core, to give the required diameter. When the number of layers thus rolled is sufficient to afford the desired thickness, the tube is strongly compressed, the outside sprinkled with fine sand, and the whole cooled in water. When cold the core is drawn out, and the inside served with a waterproofing composition. In addition to being absolutely tight and smooth, and much cheaper than iron, these pipes have great strength; for when the sides are scarcely ⅛in. thick, they will withstand a pressure of more than fifteen atmospheres. If buried underground they will not be broken by settlement, nor when violently shaken or jarred. The material being a bad conductor of heat, the pipes do not quite so readily freeze.

Professor E. S. Morse has recently described his device for utilising the sun's rays for warming a room. The *Sanitary Engineer* describes it as consisting of a slaty surface, painted black, placed vertically on the outside wall of the building, with flues to conduct the warm air to the inside. The slates are inserted in a groove like glass in a frame. One made within the last year was 8ft. long by 3ft. wide, and was used for warming a library 20ft. by 14ft. and 10ft. high. By this means the room was kept comfortable through the winter, except on a few of the coldest days. When the sun's rays rested directly on the apparatus, the air passing through it was raised about 30 deg., and it discharged 3206 cubic feet of warm air per hour. This was in the morning. At 11.45 a.m. the air was raised 29 deg., when 3726 cubic feet of air were discharged; at 12.45 p.m., 29 deg. and 4019 cubic feet; at 1.55 p.m., 24 deg. and 3062ft.; at 2.45 p.m., 20 deg., 1299ft. In general a difference of 30 deg. can be secured during the four or five working hours of the day.

Her Majesty's Inspector of Mines for the district of Yorkshire—Mr. F. W. Wardell—in his report for 1882, states that in that year 61,548 persons were employed about the mines, as against 60,531 in 1881, and 18,525,406 tons of coal were raised, as against 18,287,141 tons in 1881. There were last year eighty-seven fatal accidents, causing ninety-five deaths, so that one life was lost to every 648 persons employed. In 1881 there were seventy-five fatal accidents, each causing one death; and there was one life lost to every 807 employed. Last year one life was lost to every 199,812 tons of mineral wrought, whilst in 1881 a life was lost to every 249,376 tons wrought. Viewed in this light, mining in the district appears to have been more dangerous last year. Throughout the kingdom the result is similar, the average loss of life last year being one to every 152,161 tons wrought, as against one to every 177,106 tons wrought in 1881. In Yorkshire there were last year 452 mines at work, whilst in 1881 there were 471, a decrease in the year of nineteen.

At a recent meeting of the Paris Academy of Sciences, a paper was read "On the Slow Unheavals and Subsidences of the Ground," by M. Faye. In reply to M. Issel, of Genoa, the author revives the old theories of Elie de Beaumont, Cordier, and many others, and argues that the progressive cooling of the earth's crust goes on at a more rapid rate under water than on dry land. There is nothing hypothetic in this view, which might have been deduced from the thermometric soundings taken fifty years ago by the *Venus* in deep seas, and repeated with similar results in recent times. It follows that the solidified crust may be much thicker under oceans than continents. Hence he concludes the liquid mass in the interior of the globe is subjected to greater pressure under the seas than on the main land; and as this excess of pressure is diffused more or less rapidly in every direction, the less dense continental crust must yield to the pressure exercised on it from within. It is thus being everywhere continually upheaved, while the submarine crust, becoming denser and denser, is slowly subsiding.

M. Sauer has constructed a battery that acts only in sunlight. The battery, as described in the *Electrotechnische Zeitschrift*, consists of a glass vessel containing a solution of 15 parts of table salt and 7 parts of sulphate of copper in 106 parts of water. Within is a porous cell containing mercury. One electrode is made of platinum, and is put in the mercury; the other is of sulphide of silver, and is placed in the salt solution. Both are connected with a galvanometer, and the whole is inclosed in a box when not in use. When the battery is placed in the sunlight, the galvanometer needle is deflected to a certain point, and the sulphide of silver is found to be the negative pole. Any change in the intensity of the light—such as a cloud over the sun—is indicated by the needle. The action of the battery depends on the effect of the chloride of copper upon the mercury. Subchloride is formed, and reduces the sulphide of silver; but this can only take place with the aid of sunlight. Hitherto the only manner in which light seemed to affect electrical action was by increasing the resistance of a selenium cell, and all photo-electrical experiments were based on this phenomenon.

Although boring for coal has been carried out in several places in China, and working has been attempted in some of these, there is only one colliery at present in complete working order in the Celestial Empire. This is at Kaiping not far from Peking, the colliery plant of which has been illustrated in our pages. The coal is said to belong to the true carboniferous system, and the bed dips to the south some 45 degrees, forming a large basin under the Gulf of Pehchihli. No fear is entertained that the measures will run short. So far as has been ascertained, the coal-bearing stratum is about 1000ft., containing thirteen seams. During the winter months 200 tons per day of the inferior kinds of coal can be sold to the natives in the vicinity, who use it for pottery, brick, and lime kilns; indeed, one of the most important results achieved by the opening of the colliery has been the revival of several industries in the vicinity which were languishing or extinct, on account of the surface coal of the district being mostly worked out, and the price of coal being too high to be used with profit. In connection with the colliery is a small railway, the only one in China. Its length is but six and a-half miles, and at the terminus the coal is placed in barges and carried down by canal. After a little opposition the locomotives were allowed to run freely. But ironworks, which it was also intended to start, could not get over the superstitious opposition raised on the score of the proximity of the imperial tombs, and the consequent geomantic disturbances caused by sinking shafts, &c. The iron ore is said to exist in enormous quantities, but it is not easy to work owing to the amount of silica present.

MISCELLANEA.

We are informed that in several pending actions by Mr. Otto—the plaintiff in Otto *v.* Linford, the well-known gas engine case—the defendants have submitted to judgment.

At the recent exhibition of the Royal Cornwall Polytechnic Society, the dead-beat sectioner made by Mr. James P. Maginnis, as described in these columns, was awarded a silver medal, and his universal sector was highly commended.

The work of regulating the Lower Weser has been begun in Bremen. The so-called "long bag" is to be removed, and thus the Weser straightened. The expense will be borne by Bremen, and is estimated at more than £100,000.

The armour-plate experiments in Denmark are now expected to take place in November. They will deal with compound "Ellis" plates by Messrs. J. Brown and Co., Atlas Works; Messrs. Charles Cammell and Co., Cyclops Works; Marvel Frères—a French firm; and a steel plate by Creuzot. The experiments are therefore of special interest to Sheffield.

Amongst other prizes announced by the Society of Arts is the Howard Prize of £100, which is offered for the best essay on the Utilisation of Electricity for Motive Power. Preference will be given to that essay which, besides setting forth the theory of the subject, contains records with detailed results of actual working or experiment. The Society reserves the right of publishing the prize essay.

The Prince of Wales has definitely fixed the 31st of October for the closing of the International Fisheries Exhibition. The list of awards of the International Juries, confirmed and issued by the Commissioners acting on behalf of her Majesty's Government, has been published. The number of visitors on Saturday was 51,973, making a total for last week of 122,267. The total number from the opening of the Exhibition has been 2,201,981.

A new way of producing name and inscription plates, door plates, panels, and so on, has been brought out by Mr. C. L. H. Lammers, of Gosforth, by which a cheaper and more durable article may be obtained. Instead of engraving the letters in a door plate, for instance, Mr. Lammers cuts the letters quite through the plate, and into the spaces glass instead of wax may be inserted. Thin brass plates fastened to iron backings could also be used.

It is stated that the French Government has granted a loan of 2,200,000f. toward the cost of carrying out extensive harbour works at Calais, and that a duty will be established by the Chamber of Commerce to recoup this loan. French and English ships, and ships of other nationalities, leaving Calais with merchandise, &c., will have to pay at the rate of 15 centimes per ton upon their registered tonnage, but a considerable reduction will be made in respect of passenger and mail carrying vessels.

A pamphlet has been published by the Edison Electric Light Company descriptive of the Hopkinson-Edison dynamo, and giving the substance of the report on this machine which was printed in The Engineer of the 10th August last. This machine is said to give an efficiency of 95 per cent. In the larger Edison machines multiple cylindrical field magnets were used, but oval or oblong field magnets are now used instead of these. The cylindrical, or big and long bar magnets, have been found to possess no advantages over single and more massive magnets of shorter length.

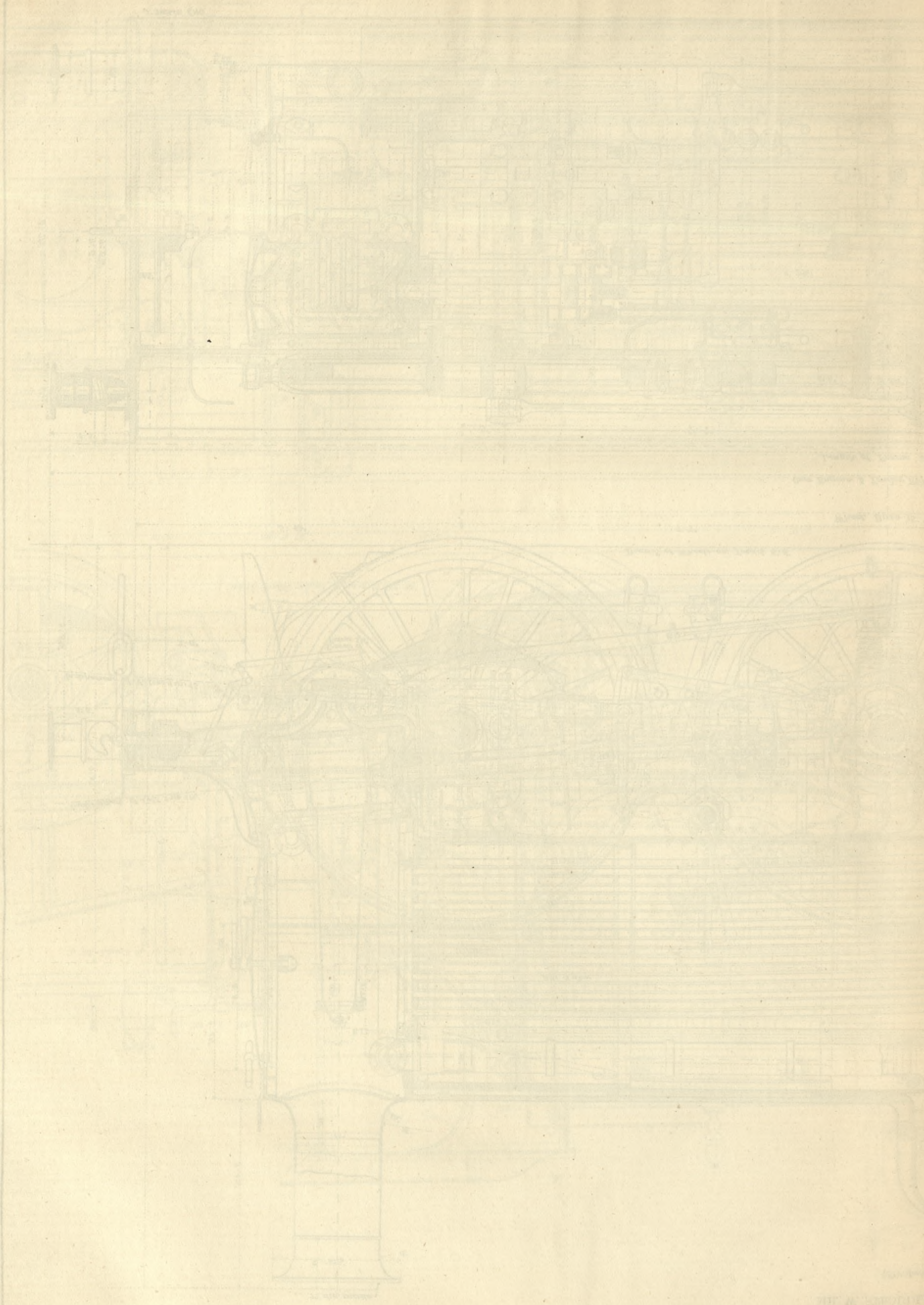
The Colossal Palais de Justice, Brussels, which was projected in 1847, designed in 1862 and begun in 1866, was inaugurated on Monday last by the King of the Belgians. The building, which is of classical design, covers an area of 26,700 square metres, equal 287,407 square feet, is 102 metres, equal 335ft. high, and will cost nearly two million pounds. The architect is M. Poelaert, who died nearly two years ago, and the work has been carried out under the superintendence of M. Wellens, Ingénieur-en-chef des Ponts et Chaussées, the principal contractor being M. de Vestel, of Brussels.

The Italian Ministry of Marine is preparing to place seven new ships on the stocks—two first-class ironclads of the Italia type, a torpedo ram built on the model of the Etna, and four small cruisers of great speed, armed with light guns. The keels of the two first-class ships will be laid down, one at Castellamare and the other at Venice, directly the vessels building in those dockyards are launched, early, it is expected, in 1884. The other five ships will be put in hand at once. The Ministry have further given orders for eighteen sea-going torpedo boats of more than double the draught of those of the first-class Italy already possesses. They are to have a speed of 21 knots and to be able to follow the squadron in all weathers, and to carry sufficient coal to make three runs along the length of the western coast of Italy without requiring a fresh supply.

A meeting of the executive committee of shipowners formed for the purpose of forwarding the construction of a second Suez Canal, was held this week at the offices of the Association of Steamship Owners engaged in Eastern Trade, Fenchurch-street. It was resolved to address a communication to the Government, "urging them not to leave the matter in its present unsatisfactory position, but to take prompt measures to ensure greater facilities for passing through the Isthmus of Suez, so pressingly demanded by the rapidly growing traffic with the East." A letter is about to be forwarded by the committee to Lord Granville, recapitulating the measures which they have taken since their appointment, drawing attention to the increasing importance of the construction as speedily as possible of a second Suez Canal, and repeating their readiness to undertake the necessary preliminary surveys.

A new work, by Robert Hudson Graham, C.E., will be shortly issued by Messrs. Crosby Lockwood and Co., London, entitled "Graphic and Analytic Statics in Theory and Comparison; their practical application to the Treatment of Stresses in Roofs, Girders, Bridges, Arches, Piers, and other Frameworks." With a chapter on Wind Pressures, and a number of Diagrams and Plates to Scale, with examples—many taken from existing structures. The same publishers also announce for immediate publication, "The Art of Soap-making: a Practical Handbook of the Manufacture of Hard and Soft Soaps, Toilet Soaps, &c.;" by Alexander Watt. "The Engineers' and Shipowners' Coal Tables;" by Nelson Foley, author of "The Engineer's Office Book of Boiler Construction." And the following works in "Weale's Rudimentary Series:"—"Farm Buildings: a Treatise on the Buildings necessary for various kinds of Farms, and their Arrangement and Construction, with Plans and Estimates;" by Professor John Scott—being the fourth volume of Scott's "Farm Engineering Text Books—and a revised and enlarged edition of "Sanitary Work in the Smaller Towns and Villages;" by Charles Slagg, A.M. Inst. C.E.

Touching on shipbuilding, Messrs. Bolling and Lowe say in their half-yearly report, "The fact that nine-tenths of the new vessels are steamers, apart from their greater burden, has multiplied the carrying power of this country to an unexampled extent. *Lloyd's Register* for 1882 gave as built in Great Britain, 446 steamers of 672,740 tons burden. While from other sources we find built in United States (fiscal year 1882), 43 steamers of 40,097 tons burden; Germany, 60 steamers of 67,873 tons burden. In addition to those registered at Lloyd's, vessels of a total tonnage of some 400,000 tons were launched, which will include steamers of our leading companies. Again, according to *Lloyd's Register*, there were built in Great Britain 337 sailing vessels of a burden of 138,396 tons, equal average 400 tons each ship; and there were lost 814 sailing vessels of a burden of 210,446 tons, equal average 250 tons each ship. Steam being the motive power of the ship of the present and near future, freights for long voyages will be materially influenced by the existence of coal at or near the ports, and consequently the development of coalfields in Bengal, New Zealand, our Australian Colonies, and elsewhere, becomes doubly important for this country, whose exports so largely consist of manufactured goods, whilst the return cargoes are mostly in raw and bulky materials for manufacture, without calculating the enormous quantities of food we require."

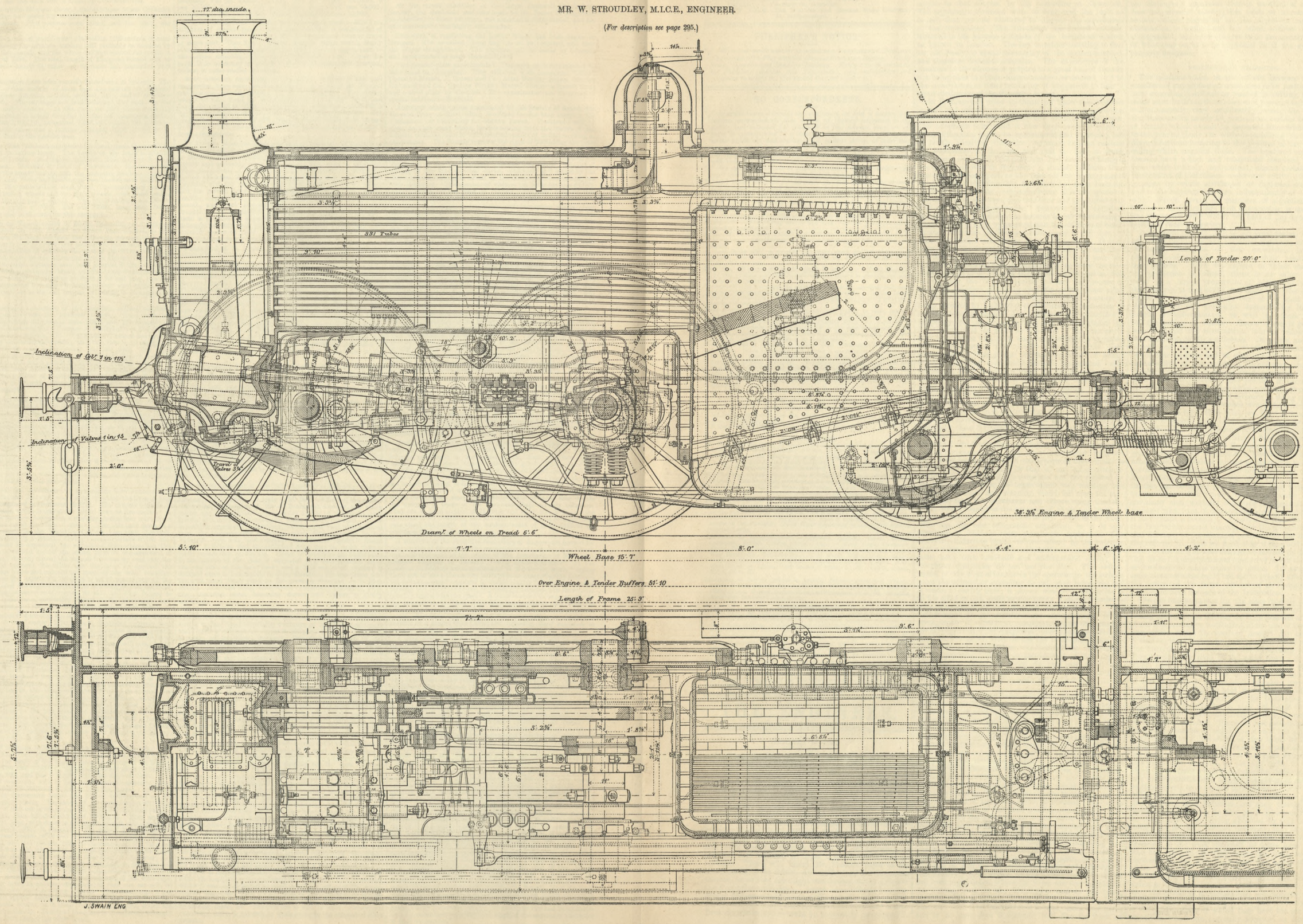


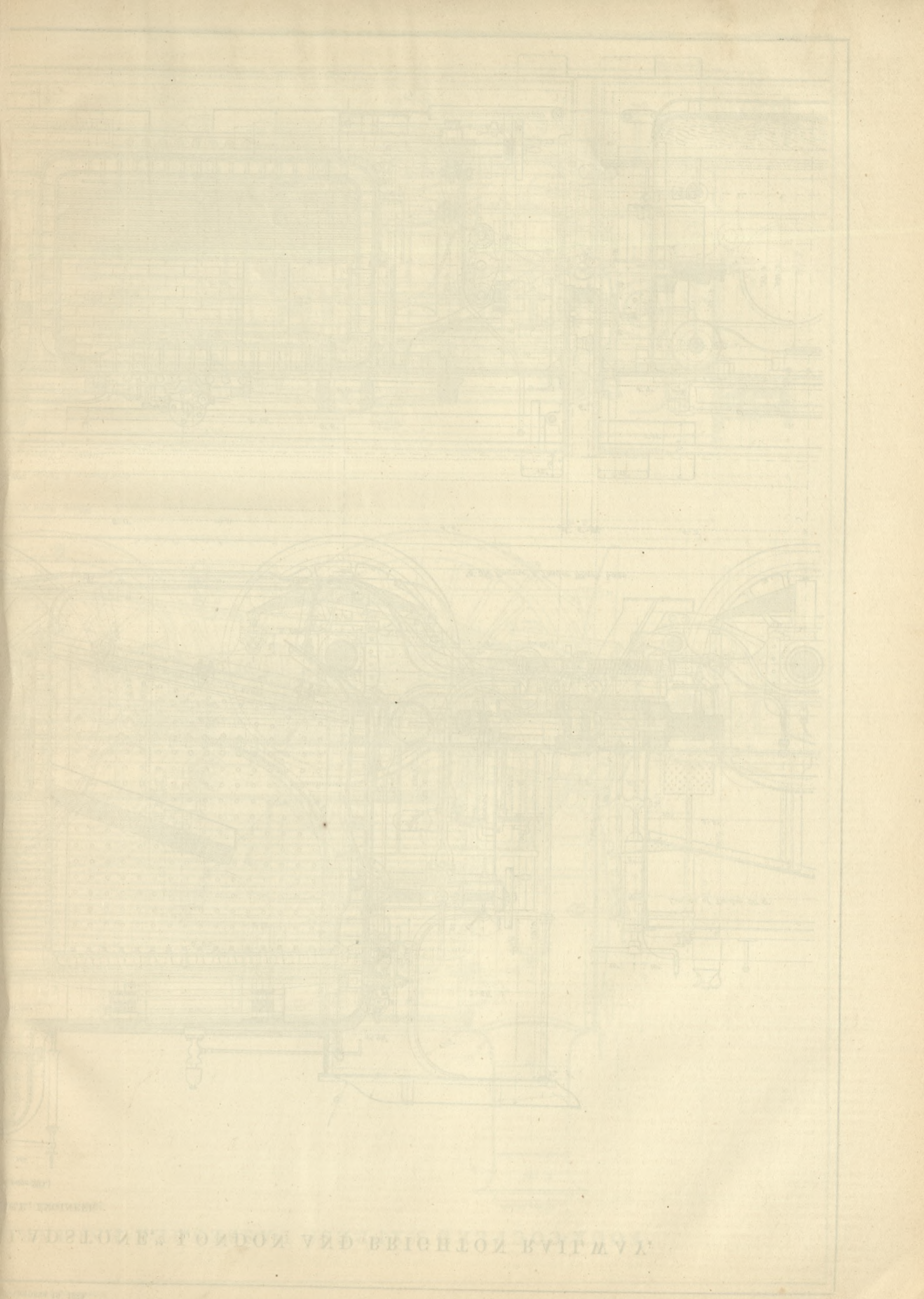
FOUR-COUPLED EXPRESS PASSENGER ENGINE.

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

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

(*For description see page 295.*)





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*** *With this week's number is issued as a Supplement a Two-page Engraving of a Four-coupled Express Passenger Engine, "Gladstone," London and Brighton Railway. Every copy as issued by the Publisher contains this Supplement, and subscribers are requested to notify the fact should they not receive it.*

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.*

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J. R. (Barcelona).—*A letter lies at our office for this correspondent.*

Darlington.—*What kind of book do you want?—one on strains, or one on practical construction?*

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C. V.—"Roller Mill" *is an American paper, which you can probably get through Messrs. Trübner and Co., Ludgate-hill, or Messrs. E. and F. N. Spon, Charing-cross.*

Enquirer.—*We regret that we are unable to assist you. If you advertise, you may perhaps meet with the assistance you require in working out your numerous inventions.*

Vietas.—*We see no reason to alter the opinion we expressed last week, namely, that about* £50 *would be a fair charge to make. We allow in this* £15 *for the drawings. We cannot ascertain with any accuracy what work you did in carrying out the drainage.*

Mine Agent.—*We consider the processes you require to make yourself acquainted with will be best met with in the "Select Methods in Chemical Analysis, chiefly Inorganic," by Wm. Crookes, F.R.S., &c., published in* 1871, *by Longmans, Green, and Co. It is the most recent book in the English language, and is quite trustworthy. It contains a good deal more than you require, but we know of no smaller work.*

J. C.—*Coal gas is, speaking in general terms, a compound of carbon and hydrogen. When an explosion takes place in the cylinder of a gas engine, the hydrogen unites with oxygen, producing water, which is immediately converted into steam by the heat. The carbon unites with oxygen also and produces carbonic acid and carbonic oxide, the nitrogen of the air is left free. Consequently what is driven out of a gas engine cylinder on the return stroke of the piston is steam, carbonic acid and oxide, nitrogen, and atmospheric air.*

THE STRENGTH OF CHAINS.

(To the Editor of The Engineer.)

Sir,—Can any reader give me a rule for calculating the strength of chains with circular rings?

F. E. S.

Wigan, October 16th.

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

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

THE ENGINEER.

OCTOBER 19, 1883.

THE DEFECTS OF OUR TELEPHONE SYSTEM.

It has often been said that the Post-office authorities are slow to adopt improvements. We do not think that this is true. The history of progress in certain directions is that of a series of accidents, and when inventions have been put on one side for a time it will usually be found that the world was not quite ready for them, and does not deserve to be called hard names. The world is always ready to receive and use improvements, provided they are brought forward in the proper way; but the way is peculiar. There are men who have been duly apprenticed and have become masters in the art of appealing to influence and cupidity in order that the world may go forward. Those who heard Mr. Preece's paper at the late meeting of the British Association, and the discussion thereon, know that some light was thrown on the action of the Post-office authorities. As we have hitherto been unable to find space for this paper, the gist may be given here. Mr. Preece contended that the defects of telephony arising from electric induction could be completely overcome; in fact, he had shown this last year at Southampton. He maintained that telephonic conversation could be carried on clearly, secretly, silently—so far as regarded extraneous noise—and with great facility by the use of apparatus similar to that adopted by the post-office at Newcastle. The arguments advanced were so clear, and the logic so sound, that no one ventured to dispute the correctness of the conclusions. The discussion was almost entirely directed to the adverse criticism of the telephonic system as known in London. The fact is rather startling to find no one ready to speak favourably of the system adopted, and therefore demands attention. The experience of the speakers in the discussion pointed to a great loss of time in not being able to obtain communication as desired, and to the annoyance, at times rendering it impossible to hear a word distinctly, of the inductive action.

Sir F. Bramwell tried to throw oil upon the troubled waters, and asked how it was possible to expect perfection in so short a time, that is, after two or three years' work. The telephone introduced a new application of science; many difficulties had to be encountered and overcome, but he tacitly admitted that the companies had not realised the necessities of the case, and that so far as trunk lines were concerned, the provision had been too meagre. We may be allowed to formulate a sharper criticism than was heard at Southport, to say that all the arrangements are defective; that from the first there has never been the slightest sign of the companies being able to organise a proper telephone system, and that time and extensions only tend to make matters worse. Ignorant and inefficient administration is sufficient to account for all shortcomings. Nevertheless it must be assumed that the children of mammon are still wise in their generation, and it will then be seen how such a weak-kneed system has arisen. It is no secret that the inmost idea of the company promoters—the always present expectation—is that very soon the Government will see the necessity of taking over the telephone system as it did the telegraphs. It is just as well known that the officials realise the fact that sooner or later the question of taking over the system must arise. Hence we find telephony in the anomalous position of being worked by men who think little of perfection of system, who apparently know little of the principles of telephony, but desire to get the whole affair taken up by Government as soon as possible. The tax-payer may also realise this fact, and recollecting the purchase of the telegraphs, may kick against another such arrangement. The result of this condition of affairs is that business men have become acquainted with telephony, have begun to learn its value even in the defective state in which it is put before them, and are ready to agitate for a better state of things. A careful examination of the telegraph system of this country shows that in the hands of the Government it has caught up to and far surpassed in excellence that of any other country. We have never failed to point out the weaknesses of a monopoly; how it prevents to a certain extent the introduction of new inventions; but it will be found that the telegraph authorities have not followed in the footsteps of ordinary monopolists. They have introduced improvement after improvement till the apparatus they employ is admitted to be unequalled by that of any other administration. The cry for cheap telegrams was not resisted by the Post-office because the organisation was wanting, but because the loss, if any, accruing would fall upon the tax-payers, so that the merchants and others using the telegraph would benefit at the expense of those not using it, and presumably not so well able to pay. Just as the Post-office has the best telegraphic apparatus, so it is now admitted it has the best telephonic apparatus. The annoying inductive action is neutralised by the twisting of the wires. The Post-office adopts the necessary arrangement both with overhead and underground wires; the telephone companies do not use the plan. The switch-board of the Post-office shows the operator in the switch-room the subscriber intending to call even before the call is made, so saving time; it shows whether a subscriber is in his office or out, again saving time; it shows whether a wire is engaged or not, another saving of time. This switch-board is but slightly more expensive, nor is the arrangement of wires more complicated than the board or the arrangement of the companies; and when the pertinent question was asked, Why do not the companies adopt the plan described? the answer was forthcoming. The board is not patented; it is not the interest of any one to introduce it. The companies do not care about such articles; the interest of promoters lies in patented articles, and hence the latter is handed over the former as the better.

We can find only one reason why some special attempt has not been made to overcome the evils of induction. Given two wires nearer to each other than any other conductor—if a current is sent through one wire it induces a current in the other wire. Now, introduce a third wire; the three wires may be so arranged that a current can be sent through two of them without any current being noticeable in the third—the actions must be made equal and opposite in direction, the one action neutralising that of the other. Given a hundred or a thousand wires, it may have been thought by those who are hiding the clouds from our streets, that by the law of averages equal currents would be going at equal distances in every case in opposite directions, and so the bad effects of induction would be avoided. The wires could be arranged so that their counteractions might come into play, but the arrangement would differ considerably from that now used. However, the simpler and more effective plan is the twisting of the wires around each other, as described by Mr. Preece at Southampton and Southport. Another fixed idea of the London telephone companies seems to be that only one particular kind of wire can be used for telephonic purposes, and this wire of comparatively large section, almost hiding the light of the sun from some streets where the wires are very numerous. At Vienna, both in the Exhibition and in the town, phosphor bronze wire is largely used for telephone lines. The wire used is so fine that it is in many cases unnoticed, and in no case does it obtrude itself like the wires of London. Those who have had experience with phosphor bronze wire state that it is better suited in every respect for telephonic use than the ordinary wire. The shortcomings of the telephone companies may thus be summed up—employing apparatus that is wasteful of time, that does not allow of secrecy, that tends to increase outside sounds, wires obtrusive to the sight—in some cases obstructive to traffic—and the whole without systematic arrangement, while the charges made are greatly in excess of what they ought to be or would be if the system was properly designed.

PROFESSIONAL ETIQUETTE.

The relations which should subsist between the fellow members of any profession must always be matters of delicacy exceedingly difficult to treat of in writing, because so much must be left to those niceties of personal feeling which will of necessity vary considerably among the members. But there are in nearly all professions certain broad rules of conduct which cannot be departed from without injury to the general body, or without entailing certain social disqualifications lowering to the position of any particular calling which neglects them. The legal and medical professions have a high and recognised standard, to depart from which is likely, and, indeed, almost certain to bring the conduct of defaulters under the active notice of the societies by which certificates or diplomas are granted; and to the fact that this is so, independently of the feeling which should govern all members of a gentleman's profession in their dealings with one another, is undoubtedly due the rarity with which we hear of any breach of etiquette in these professions.

It has been recently, and to our great regret, brought to our notice that in several instances engineers have shown an entire disregard of that unwritten law which should regulate their action in their relations with their fellows. Now we rejoice to think that, taking the profession all round, there is no other that can boast of a larger proportion of highly educated men than belongs to that of the civil engineer. Not only is the course of study necessarily one of the most elevating character, but the profession demands for its practice habits of self-command, as well as those necessary for the ruling of others. Hence there is good cause why it should and does attract into its fellowship men who are emphatically gentlemen. Its prizes are high; its pursuit one especially suited to the enjoyment of that out-of-door exercise and of sport which are emphatically characteristic of the well-bred Englishman, and there is therefore every reason why it should draw to it men who, from their early training and position in social life, are accustomed to the amenities which govern their relations in such circumstances. That it succeeds in doing so to a very large extent we have evidence every day, and the fact makes it more regrettable when we hear of exceptions to what is a general rule, exceptions which prove that we have associated with us some who are forgetful of the obligations the position they claim to hold imposes on them. The Institution of Civil Engineers holds towards the great body of the profession a relation which unfortunately cannot at present be said to assimilate in many important characteristics with the societies which control the sister callings of law and medicine. True, no higher distinction can be hoped for or desired than that of being honourably enrolled among its leading grades; but there are many men worthily following the pursuit of a civil engineer who, from circumstances, are not so enrolled; nor is its diploma a necessity. Hence it is that the council of the Institution cannot exercise over the profession at large that influence on its etiquette practised by the other societies referred to. But we hold that it may and should do much by marking in some distinctive manner its disapprobation when the unprofessional conduct of any of the members of the Institute comes under its notice. Its awards under such circumstances could not fail to greatly affect for good the action of the large number of civil engineers who practice outside the pale of the Institution.

We can find no excuse for the cases recently brought to our notice, and which, unfortunately, impugn the good feeling of some men holding the high position of members of our representative institution, in the plea of the excessive competition which the needs of present day life creates. A civil engineer cannot be held to stand in the same relation towards his brethren that the advertising shopkeeper does towards his rival in the same town. A profession which claims, and justly, to occupy a higher social rank than the class last referred to, must accept as a condition of such a claim a higher social standard governing its inner relations; and we hold it well worthy of the consideration of the council of the Institution of Civil Engineers as to whether it may not be in its power to enforce, or at all events effectively promote, the maintenance of that higher standard. Since the first establishment there have been occasions on which the council has not hesitated to pronounce very decidedly the view taken by it of questionable transactions by members, and when doing so it has not spared. But such instances have been extremely rare, and they might, we hold, be perhaps added to with good effect. In the cases which have called for these remarks, certain municipalities have sought the advice of some of our leading experts, have availed themselves of it not only to the fullest extent, but have also made use of the high position of their advisers, their influence, and their talents, to obtain parliamentary sanction to the plans laboriously prepared for them; and then, having obtained by such aid everything that to them seemed necessary, they have thrown over their trusted and trusting advisers, and offered the execution of the work designed to some local engineer, who has seen fit to take over the brain labour of a brother engineer and to become the agent of a body which has been capable of an apparent breach of implied faith. We need scarcely point out that such a course is likely in very many instances to recoil seriously upon the offending municipalities; but, unfortunately, the members of many corporations are but too ready to apply to the public affairs of which they have the control those principles which are currently accepted as forming the

standard of a large proportion of the class of which corporations are mainly composed. While regretting that this should be so, our experience of such bodies forbids us to feel surprise; but we do feel both surprise and regret that any members of our profession can consider it proper to occupy the, to say the least, doubtful position offered them.

It is a cruel injustice—neglecting the consideration of lost remuneration—to make the reputation of a leading engineer dependent upon the uncontrolled carrying out of his designs by a person perhaps wholly unpractised in the branch to which the former may have devoted a lifelong experience. The brain that conceived should also carry out, if justice is to be done to all parties, and it must prove in most cases as false economy to withdraw such carrying out from the control of the designer, as it would be to place a valuable chronometer in the hands of some little village watchmaker for repairs to its delicate mechanism. We think that the Council of the Institution of Civil Engineers should be empowered to deal with such cases as those which we have indicated, as affecting the reputation of all men composing the various classes of the Institute. The honour of the profession, which stands so deservedly high, it will be the wish of the whole body corporate to maintain as high as possible, and it would surely not be difficult to mark in some way the feelings of displeasure with which all members must regard any conduct seriously affecting that honour.

RECENT RAILWAY ACCIDENTS.

Another batch of reports to the Board of Trade on recent railway accidents, which has just been issued, serves to illustrate several points in connection with the subject of brakes which should be interesting both to the public and the railway companies. Of six accidents reported upon by various inspectors, two show the want of brakes, two the want of uniformity in brakes necessitated by the constant interchange of stock, and two the uselessness and dangerous character of certain forms of what some people claim to be safety appliances. In the first category are the accident at Raith sidings on the North British Railway on 17th August last, and that on the South-Eastern Railway at Grove Park station on the 19th of the same month. These two collisions caused injury to eighteen people, and were both cases of sudden emergency, which were no doubt quite unexpected by the officials, and, therefore, not provided against. In the second category come two more collisions, one at Mexbro' station on the Manchester, Sheffield, and Lincolnshire Railway, on the 7th August, and the other at Carlisle on the 13th August. In the former case the engine and train were fitted with the Smith vacuum brake, which, however, was not available, since the brake van between the tender and the coaches was not so fitted. In the Carlisle case, a return North-Eastern excursion train from Keswick to Sunderland, fitted with the Westinghouse brake, was being drawn by a London and North-Western engine without the necessary appliances. These two cases are credited with injury to thirty-three persons. Like most sensible men, Major Marindin has views on the absurdity of such a system, or want of system, and he also has the courage to speak very plainly on the subject. Referring to the Carlisle accident, he says:—"The accident might easily have been prevented if the driver of the excursion train had had a continuous brake at his command; but, as is too frequently the case, owing to the various classes of brakes in use upon different lines, the Westinghouse brake with which the train was fitted was useless so long as the train was drawn by a London and North-Western engine. It will sooner or later become a question for very serious consideration whether stock should be allowed to be transferred from one line to another, unless means are provided for utilising the brakes with which it is fitted, and which are necessary for the safety of the passengers."

Under our third heading come two more collisions, killing one and injuring thirty people, viz., that at Perth, on the Caledonian Railway, on July 28th, and another at Lofthouse station, on the Great Northern Railway, on the 15th of September. The Perth case gives Major Marindin another opportunity of speaking his mind. It seems that an East Coast train from Edinburgh, when standing at Perth ticket platform, was run violently into by a West Coast train from Euston, consisting of ten vehicles. The driver was supposed to have control over the Clark-Webb brake, with which the four vehicles in front of the rear van were fitted, but this, as on many previous occasions, was found to be a delusion. From the driver's evidence we may learn the method of operating the chain brake. He says, "I pulled my patent brake cord before getting to Edinburgh-road, and directly after I asked my fireman to help me, because I thought the train was not pulling up quick enough." Then, seeing the East Coast engine at the ticket platform, he "then gave the cord another pull, helped by my fireman, but could get nothing out of it. When I saw the engine I was running perhaps twenty miles an hour. My steam was off, my tender brake hard on, and my cord was pulled as hard as I could get it." Yet the brakes would not go on. Major Marindin having made several experiments with a train made up exactly like the one in question, with the identical brake van, says the result "shows that it is an absurdity to talk of a patent chain brake at the rear section of a train of ten vehicles being under the control of the driver by means of the connecting cord, if by 'control" is meant the power of applying the brake. . . I believe that to a driver accustomed to drive with a train fitted with a proper continuous brake under his control—he had often used the Westinghouse—such a machine is nothing but a trap, . . and it is to be hoped that this fatal accident, following so soon after the terrible disaster at Lockerbie, will cause the Caledonian Railway Company to insist upon having the West Coast stock fitted with the brake which they have adopted for their line, and with which all their own engines are being fitted." It is gratifying to learn that the Caledonian Company has carried out Major Marindin's suggestion in the Lockerbie report, and that it has insisted upon the West Coast joint stock, owned by it and the North-Western Company, being fitted with the Westinghouse brake, and the work is now being rapidly proceeded with at Wolverton. The Great North of Scotland Railway having also now adopted the Westinghouse brake, as well as the Caledonian, North British, and Glasgow and South-Western Railways, the Scotch railway companies are entitled to the credit of having done what they can to further the question of uniformity in brakes; and this can hardly be said for certain companies south of the Tweed.

The last case we have to comment upon was, there can be little doubt, due to the slow action of the Smith vacuum brake. The 9 a.m. express from King's-cross to Leeds ran into a coal train standing at Lofthouse station, on the Great Northern Railway. The signals were off, but the coal train could be seen for a distance of 180 yards, and the speed was only twenty or twenty-five miles an hour, on a rising gradient of 1 in 100. The driver asserts that he never saw the obstruction until within 40 or 50 yards of it—a statement which scarcely harmonises with other points of his evidence, for it seems there was time to shut off steam, reverse the engine, apply the vacuum brake, and to reduce the speed to fifteen miles per hour by the time his engine struck the coal train. Now at twenty-five miles per hour about twelve yards are passed over in one second; so that the above operations and reduction of speed must have been performed in four seconds or less; and numerous experiments with the vacuum brake have shown this to be impossible. It was, moreover, in the middle of the day, and in clear weather, and the inference is that there was a considerably longer distance—sufficient with a quick acting brake to have stopped the train at the speed mentioned. This, however, is not all. A brake constructed upon proper principles should not only go on quickly, but should stay on; and the slacking off of the vacuum brakes in this case made a double collision. The driver states: "My engine mounted the brake van, and broke off the vacuum pipes, and then I felt the train press the engine forward. My engine appeared to carry forward the upper part of the brake van, crushed up the wagon of drain-pipes next to it, and came to rest on the second wagon, which was loaded with coal. All the wheels of my engine were lifted from the rails." Col. Rich, in reporting, says: "The brakes no doubt prevented the recoil of the carriages," which from the evidence quoted, and from the principle of all non-automatic brakes, they could not have done. So soon as the vacuum pipes on the front end of the engine were broken, the brakes, if already applied, would at once come off, and the train would then be free to overrun the engine. Indeed, from the reports of passengers in the local papers, it would seem that it was the second collision which caused the most injury.

The six accidents, resulting in a list of one killed and eighty-one injured, all point to the necessity for insisting on the Board of Trade requirements in brakes, and the justice of the demand for uniformity. They illustrate the emergencies which will continue to arise so long as railways exist, and the necessity for a powerful appliance, instantaneous and certain in action; or, in other words, an automatic brake.

"NEST GEARING" AND ROLLER FRICTION.

Under this title Professor Fleeming Jenkin described at great length to the mechanical section of the British Association at Southport, a form of frictional gearing which he called nest gearing, in virtue of one form of its arrangement. The gearing is really frictional gearing, as it consists simply of wheels or rollers which transmit motion by reason of frictional adhesion between them and the wheels to which motion is transferred. A nest, as exemplified in a large winch exhibited by Professor Jenkin, consists of a central or nearly central wheel, to which motion is given by these rollers, which are kept in contact with it by means of an encircling annular ring. The arrangement is a slight modification of that adopted by Mechwart in the roller mill exhibited at Carlisle in 1881 by Messrs. Bucholz and Co., as illustrated in The Engineer of the 30th July, 1880. The modification is, however, an important one, as whilst the nest is in proper adjustment, the journal of the shaft to which motion is transmitted is held in equilibrium, and the friction in its bearing is thus reduced to a minimum. This, of course, removes one of the chief objections to the ordinary frictional gearing, in which one smooth wheel transmitted motion to another by means of the pressure brought to bear between their surfaces, that pressure being borne by the bearings of the shaft carrying the two wheels. Gearing of this sort has long been in use, one of the two wheels usually being provided with a wood or a paper periphery, as providing greater frictional adhesion with less wear; and an adaptation of this gear was exhibited at Southport by Messrs. Siemens Brothers, who showed two of their dynamo-electric machines driven by engines geared in this way, the machines being employed in generating a current for lighting the winter gardens during the evenings of the *conversazione*. The "nest" above described, possesses the advantage referred to of relieving the journal of the driven shaft, of the pressure which is necessary to produce frictional adhesion; but several of the modifications described by Professor Jenkin offered no such advantage—one of these being a belt held in frictional contact by a roller pressing upon the driven wheel, an arrangement calculated to roll out or elongate the belt in the most efficient manner. Professor Jenkin seems to have had his attention directed to gearing of this kind by a consideration of the necessities of the "telpher" locomotive, or electric locomotive for use on a wire or rod tramway. In this an electro motor, running at a high speed, has to transmit motion to the car of the locomotive, running at a much smaller velocity, and frictional gear, no doubt, offers the advantage of simplicity and quietness; but the question of interest which presents itself is the durability of the surfaces in contact, and also, we may be permitted to say, the power which gearing of this kind will consume after it has been running some time. In the illustrations of the gearing exhibited in the electric locomotives at Southport the surfaces in contact were small. For high speed gear, or gear transmitting but a small quantity of power per revolution, the pressure between the surfaces in contact may be small, and the destruction of the surfaces in contact may be very slow, but when two wheels, which have their contact peripheries between their centres, are running together as an ordinary pair of rolls, the surface in contact is so small that the pressures per unit of area may be very large, and in this case the destruction of the surface must be more or less rapid. When the centre of one of the wheels is within the diameter of the other of a pair, as with a pinion running within a crown wheel, then the surfaces in contact may be considerable, and the destructive effect of the transmission of motion by frictional adhesion may be very small. This arrangement is, however, of very limited application. The question then arises, what is to be gained by the gearing described by Professor Fleeming Jenkin which shall make it better than the frictional gearing of one sort or another which has been long in use? The answer seems to be that the advantage is confined to that form which is strictly described as the nest gear, namely, that in which the several rollers and the driver wheel are contained within a ring, as in the case of the winch referred to.

The question may, however, be looked upon from another point of view. The wear of this form of gearing may be supposed to bear some relation to the intensity of its rolling friction. Professor Osborne Reynolds has shown that with a wheel of elastic materials the rolling friction will be greatest when the path in which the wheel rolls has a curvature which is as nearly as possible the same as that of the wheel, in which case the centre of the curved path will be very near that of the wheel. The rolling friction will therefore be less with a similar wheel running upon a plane, and will be least with a pair of wheels running with their surfaces in contact between their centres, as in the case of a pair of, say, sheet rolls. This, of course, assumes that the materials of the wheel and the surface it rolls upon, or the two wheels, are perfectly elastic; but we have to deal with materials to the elasticity of which there is a limit, and with very small surfaces in contact it is easily conceivable that this limit may be quickly reached. This being the case, rolling friction would be greatest with wheels whose contact peripheries were between their centres, or exactly the reverse of the case with wheels of extremely elastic materials, such as glass. With wheels of perfectly homogeneous materials it is possible to conceive that a pressure somewhat greater than the elastic resistance of the material would be productive of uniform wear of the surfaces in contact, but in practice it is difficult or impossible to realise this perfection, and any imperfection must result in variable wear or variable destruction of surface, and once irregularity of surface is set up by destructive compression, the smooth running of the frictional gear is lost, or at least it rapidly decreases, and with it the economy of power consumed as compared with tooth gearing. Practical experience affords very little guidance in the matter. The wear of railway tires and rails affords none, as rubbing friction is so considerable. The harder the surfaces the less, of course, will be the rolling friction; but experience with chilled railway wheels on steel rails indicates that crumbling of the wheel surface would take place with even very hard surface under any considerable pressure, though the conditions of working on such railway wheels are in their favour, as compared with wheels used in frictional gear. It certainly does not seem apparent that nest gearing in most of its forms is clear of the disadvantages which have hitherto attended gear of the frictional adhesion class, but it may be admitted that as Professor Fleeming Jenkin gave a blackboard lecture and did not read a paper on the subject, he may have something more to say about it.

THE AMMONIA OBTAINED BY THE DISTILLATION OF COAL.

In a recent number of The Engineer—July 13th, 1883—we drew attention to a paper by Mr. Foster, lecturer on chemistry at the Middlesex Hospital, on the behaviour of the nitrogen of coal during destructive distillation. He had found that of this nitrogen only 14·5 per cent. left as ammonia, 1·56 per cent. as cyanogen, 35·26 per cent. is present in the coal gas in the elementary condition, and 48·68 per cent., or nearly half the total amount present, remains behind in the coke. The amount retained by the tar is very small, it is believed. One of the few papers of popular interest which has been communicated recently to the Chemical Section of the British Association bears on the recovery of this ammonia. The system described is the more interesting on the present occasion from the fact that it had been in use in the borough of Southport during the whole time of the meetings of the British Association. In the gas manufacture, as usually carried on, very little of all the nitrogen contained in the coal is recovered in the form of ammonia, and whilst there is nitrogen to furnish 25 lb. to 30 lb. of ammonia per ton, the average quantity recovered is only 5 lb. to 6 lb. per ton. The idea that has led to the system in question was that by the use of lime the yield of ammonia might be greatly increased with very little disturbance of the ordinary process of gas production. The first practical operations were tried at the Vauxhall Gasworks, and at the outset were of a very primitive description. The slaked lime was carried into the retort house in sacks, and then spread over the heap of coals. In charging the retorts, the coal with the lime resting on its surface was partly scraped and partly allowed to fall into the scoop charging the retorts, and this with the smallest amount of extra labour, and a cost of less than a halfpenny per ton of coal carbonised. The work was performed with striking advantage, both in the quality of the gas and in the bye-products realised. The process has been since advanced in all its details, and half a hundred of lime is now used to the ton of coal. Thirty thousand tons of coal have been already carbonised on this system, yielding 20,000 tons of coke, which has been partly employed in the gasworks and partly sold for all kinds of duties. The results of experiments carried out at the Beckton Gasworks, at the Commercial Gasworks, and at the gasworks at Cheltenham, were quoted to show the gain in ammonia respectively as 36 per cent., 28 per cent., and 20 per cent. In larger makings a gain of 35 per cent. of ammoniacal liquor was obtained from the limed coals over the percentage of liquor obtained by the same coals not limed. The gas, instead of being purified after issuing from the retort, is evolved without sulphur impurities through the addition to the coal of lime in moderate quantities previous to distillation. The coke by this system, known as Cooper's process, is freed from sulphurous acid, the ammonia and tar products are increased in quantity, and the gas itself is fragrant instead of fœtid. Appreciation of the process

was expressed by several persons, including Dr. Wright, of St. Mary's Hospital, London, and Mr. Fletcher, H.M. Inspector under the Alkali Acts, at Warrington. It should be stated here that the liquids deposited in the condenser during the manufacture of coal gas, are those which are devoted to the production of sulphate and chloride of ammonium. They are usually removed from the gasworks in flats or canal boats of known capacity, under contracts commonly taken out at so much per 10,000 gallons. The manufacture of chloride of ammonium direct from the liquors is conducted on a large scale in Liverpool, and consists essentially in saturating with hydrochloric acid, concentrating the liquor, crystallising and subsequently subliming the crystals. A far larger proportion, however, of the crude gas-liquid is consumed in the production of sulphate of ammonium, by processes which consist essentially of distillation, with addition of lime, to decompose ammoniacal salts, and condensation of the vapour in sulphuric acid, concentration and crystallisation of the solution after saturation has been effected. Sulphate of ammonium is employed in large quantities in the composition of artificial manures. Moreover, the above process is based on a method in common use for the detection of nitrogen in an organic body. If such a body is heated with lime, or still better, soda-lime, to a red heat, the nitrogen is evolved in combination with hydrogen as ammonia, and the presence of this compound can at once be recognised by the characteristic smell of the ammonia. It will be seen above that, according to Mr. Foster's experiments, nearly one-half the nitrogen remains in the coke when coal is ordinarily distilled without an alkaline body.

SHIPBUILDING AT SUNDERLAND.

The effect that can be produced by the action of men in one industry on another to which their work contributes may be easily ascertained by a glance at the condition of the shipbuilding industry in Sunderland. During the early part of the present year there were from sixty to sixty-five vessels usually on the ways of the shipyards on the Wear; but there are now barely thirty. Since the end of June last a large number of engineers have been on strike, and though work has been carried on at the engine works, it has been with a staff that was very limited, and for a time largely composed of apprentices. Work naturally fell behind; engines that had been contracted to be delivered in August were not delivered two months later; and though now the employers are beginning to fill their workshops, the result of about three months' idleness of the men who are on strike is felt keenly by the associated trades. Vessels that were launched and in the river were delayed for want of engine power; others that were ready to be launched were delayed on the stocks as long as possible, so that they might not have to encounter river risks; and thus the work of the shipbuilders, the boilermakers, and others, has been lessened, and will be lessened until the work of the engineers is brought abreast of that of other trades that waits now for it. Last year Sunderland took the leading position amongst northern shipbuilding ports; this year it must expect to lose it. The injury done will be far greater than anything that could be hoped to result in the shape of good to the workmen, and the folly of the strike is now manifested.

A RESULT OF THE DAPHNE DISASTER.

In various ways carefulness and method are now manifested in Clyde shipyards in connection with shipbuilding and launching, which can directly be traced to the lessons taught by the disaster which attended the launching of the Daphne on the Clyde. A strict surveillance is being exercised in connection with the number of workmen allowed on board vessels about to be launched, the number, indeed, being, as a rule, minimised simply to what is necessary for the purpose of managing the vessels after launching. Loose weights are more carefully looked after, being mostly collected and made fast about the mid line of the vessel's decks, and in some cases these weights are placed lower down than the place where they are ultimately to be fixed, with the special object of ballasting. Approximations to the stability of vessels, at the estimated launching draughts, are now more generally entered into, and in yards where such calculations are not entirely new, greater accuracy is aimed at than was formerly thought necessary. The steamer Daphne—now named the Rose—has had her character as to stability in the loaded seagoing condition thoroughly approved by exhaustive inclining experiments, and she is now busily engaged in the service for which she was intended. The company who own her have lately lost one of their vessels—the Iris—and printed specifications have recently been issued to several builders for a new vessel to take her place. The new specification, we understand, evinces careful regard for the question of stability, and makes clear where the responsibility of such matters will rest. It is stated that as the vessel must have a high range of initial and progressive stability, with outfit complete, boilers and fresh water tanks full, but with no coal, ballast, or cargo of any kind, the builders must satisfy themselves that, consistently with the requirements of the specification, the designs they will supply for the vessel will accomplish this end, they being held responsible that the conditions will be fulfilled. The specification further stipulates that the builders have to incline the vessel when finished, and to supply the owners with her curve of stability, and the calculations of the same, with formula; also inclined body plans showing centres of gravity and buoyancy, and metacentre. The adoption of this plan of stipulating for accurate data and curves of stability, we hope will become more general, as it will doubtless have the effect of improving the designs of new vessels, and of creating that regard for scientific method in shipbuilding which even at present is not over plentiful.

COUNTERFEITING THE LOWMOOR BRAND.

In another column we report the trial at the Staffordshire Quarter Sessions of a rivet manufacturer in that shire, who had been committed for trial for counterfeiting the Lowmoor brand upon some rivets which it had been specified should be made of the iron of that well-known Yorkshire firm, and stamped "Lowmoor" upon the head. The order was let out by the prisoner to another rivet maker, the prisoner promising to find the iron, and also the stamp for the heads. Lowmoor rivet iron of the section used is sold by the Lowmoor Company at 19s. per cwt., and they also make rivets themselves, and stamp them "Lowmoor." Through a second party, who gave 12s. 6d. a cwt. for it, the prisoner got for 14s. a cwt. the requisite iron, which it was at one time claimed had been rolled from Lowmoor tires, and he had a die made, with which the heads of the rivets were stamped "Low Moor." But before this stamp was ready, the rivet maker seems to have had no difficulty in getting on with the order, for he borrowed a stamp with "Low Moor" upon it "from a friend." The defence was that as the prisoner believed that he was using Lowmoor iron, he considered himself justified in using the stamp on the completed rivets. And a technical defence was set up that "Low Moor" in two words was no infringement of "Lowmoor" in one word, even if it should be held that the prosecutors had a right to use the name of a town as a trade mark. The jury found the prisoner guilty, but strongly recommended him to mercy, for a good character had been given him; and the prosecutors did not seek a heavy punishment. Sir Rupert Kettle pointed out that "Lowmoor" had been a trade mark for ninety-four years in the possession of the firm who now held it, and their predecessors. Though it was of great importance for the safety of life that rivets of an indifferent quality should not be put into boilers, and rivet makers must learn that they must not make rivets which purported to be made by the well-known Bradford firm, yet, as he believed that the defendant did not know that he was acting illegally, he should order him to pay the cost of the prosecution, and to find recognisances. This case is notable as the first with which we are familiar in which the infringement of the brand in question by rivet makers has been attended by committal for trial. There have been somewhat similar charges in the same district, but previously the offenders have been let off with a fine. Henceforth Messrs. Hird, Dawson, and Hardy should have less cause for complaint touching the fraudulent use of their brand.

LITERATURE.

Development of Armour for Naval Use. By Lieutenant Very, U.S.N. 1883.

Public attention in America is being directed specially to the questions of guns and armour at the present time, and the volume of the "Proceedings" of the U.S. Naval Institute, brought out under the above title, has attracted considerable notice, and deserves our attention.

The author first takes up the question of energy. Dealing generally with the matter, he observes that the striking power of a given gun depends on the muzzle energy of the shot, less the energy expended in counteracting the resistance of the air and the energy represented by breaking up or deformation of the projectile before it has pierced the armour. He points out the extent of the advance that has been achieved in the development of modern armour-piercing rifled projectiles, compared with those of smooth-bored guns, instancing, for one example among others, the fact that the 68-pounder smooth bore, having a muzzle energy of 1145 foot-tons, loses 68·4 per cent. of it at a range of 1200 yards; while the 100-ton gun, with an energy of 35,094 foot-tons, loses only 14 per cent. in the same distance. The utilised force of the projectile, indeed, has been increased from about 30 to 83 per cent.; in the case of the 68 and 120-pounders at even 600 yards range, that is to say, whilst in the old guns about half the total work of which a shot was capable of doing was wasted at 600 yards range, only about 17 per cent. is lost now.

The question of loss of energy in flight owing to the resistance of the air is, we think, best dealt with on the system of comparing what is called the "sectional densities" of the projectiles; that is to say, the weight in proportion to the cross section. The mention of what is lost by a trumpery little projectile like that of the 32-pounder smooth bore in comparison to that of the 100-ton gun is very well in its way; but it is more a curious popular statistic as to the development of modern artillery than one of any present scientific bearing. The comparison of the loss of two projectiles of nearly equal weight shows more truly the advantage of rifled guns discharging elongated projectiles over smooth bores. On this account we are surprised not to see the loss of the Rodman smooth bore shot shown in the table.

The statistics as to the loss of 66 per cent. of energy in cast iron breaking up, and of 14 per cent. of energy of wrought iron in becoming deformed, are much more interesting; but Fairbairn's experiments were not made with the metal now in use, and only apply in a very limited measure to present questions. Punching and racking bring us face to face with the problems of the day. Racking originally referred to the bending and distortion of a structure, such as took place on tearing laminated armour open, and such as was attempted when the Glatton turret was distorted with the object of jamming it in the Portland experiment of 1872. Latterly we have applied the word racking to all forms of smashing and cracking up armour when the destruction of the front armour is effected, in contrast to punching when the projectile passes through the armour with a minimum of loss of energy and injury to the armour, and works mischief on whatever is behind it. We are glad to find that the term "racking," which was originated in America when soft armour was used, is there also applied to the smashing of hard armour in the way we have employed it. Mr. Very says on this question: "Punching is produced by concentrating the striking energy on the smallest possible space of the armour, and racking is produced by spreading it effectively over the largest space. Whatever work is expended in producing one effect is, as a matter of course, so much lost from the production of the other. Therefore, in dealing with the subject, the mind must never lose sight of the fact that the whole question is resolved into the one of the most effective distribution of energy." Again: "Of all descriptions of projectiles striking armour with a given energy, that one will be more certain to reach the objects protected which concentrates its energy on the smallest space of the armour. The shape of the elongated one gives the particles of metal of which it is composed the best possible support in overcoming resistance, thus permitting the use of shells, and the artillerist takes advantage of this quality in utilising the shell charge to increase the distribution of the surplus energy, as well as to give new energy to the broken pieces, thus really attaining the object sought." . . . "When a certain projectile strikes a certain plate and smashes it like glass, it is not an evidence of the excellent system of the artillery, but of the poor quality of the armour. It is in this particular that the advocates of the extreme racking theory have fallen into error." Speaking of the Spezia experiments of 1876, when steel plates first attracted general notice from their powers of resistance, Mr. Very says: "The true theory in the development of artillery is now, as it has always been, that of punching. Conversely, the true theory of armour development is now, as it has been, that of racking; that is, of offering increased resistance to punching. Wrought iron was developed on the other theory as a matter of necessity, and to meet existing exigences; but when the development of steel had progressed to a certain point, a complete and sudden revolution took place. But this revolution was no surprise to those who had carefully studied the subject; it was, in fact, forced by them, and the only resistance to the change is in the ideas of those who, in discussing the punching and racking theories, lose sight of the fact that since artillery and armour are directly opposed to each other, the theory which is true for one must be false for the other."

We have quoted these paragraphs at some length because there is much that is well expressed in them. Unquestionably the artilleryman attacking armour might prefer to fire at soft material such as he could punch with well-made rigid projectiles, which should perform a minimum of work on the front plates and pass through without deformation into the interior of the ship. Such projectiles might be made to contain bursting charges, so as to carry fire and deal destruction in the ship in its most terrible form. Such a measure of success would, however, as we have before now pointed out, be self-destructive to that form of attack, for it is clearly better to suffer even wholesale stripping off of front plates to allowing the entrance of live shell into a ship. Hence it is certain that vessels will carry plates sufficiently hard to keep shell out, and we hold that, consequently, the destruction of ships for the future will chiefly take the shape of racking. Now will follow a modification of what seems to be implied by Mr. Very's line of reasoning, that is to say, the development of guns will not be absolutely the same for this racking work as would have been the case had punching held its own. Speaking generally, a shot punches directly in proportion to its energy and inversely to the size of the hole it has to make, but it racks simply in proportion to its energy. The size of a hole which it would make if it could, but never can make, clearly does not enter into the question. Hence, guns will not be developed simply according to the punching powers, but in a modified form. It is true that the same qualities that give punching give good shooting; for cutting through the air is, as we have before said, a question of sectional density, and is of the same general nature as punching; but long small bore guns will only be good for racking in the measure in which they possess stored-up work—thus they gain little or nothing by their small diameter except in flight. Hence we may expect to see monster guns, for which the long small-bored pieces can only be a temporary substitute. For example, the 43-ton gun appears as if it were equal to the perforation of 26in. of wrought iron, while the 100-ton muzzle-loading gun can only master 28in.; but against hard armour the latter gun has probably nearly double the power, for its energy is 41,333, while that of the 43-ton gun shot is only 23,320. The heavier shot has indeed a further advantage in the fact that, striking at a lower velocity, it probably breaks up less.

On the subject of energy Mr. Very does not seem to be clear. He finds fault with the expression that steel plates absorb the shock of the projectile in the act of going to pieces. This, he says, is contrary to the laws of cause and effect. We think he does not clearly understand what is meant. The energy of the projectile has to be accounted for. A soft iron plate absorbs a part of the energy of a shot that outmatches it locally at the point of impact; but the shot, having punched it, passes on with the remaining energy left in it. A corresponding steel plate, though outmatched, absorbs the whole work stopping the shot. The shape the work takes is that the plate is broken to pieces. The actual work of fracture represents the energy. One or two slight mistakes occur here. For example: On page 542 chilled iron is said to be used for inland forts. Now even France has condemned it as unsuitable for this purpose, and it is likely only to be employed on coasts, with few exceptions. The definitions and explanations on page 547 seem to argue a state of knowledge in a reader almost too crude to follow a great deal that is in the work. We would here call attention to the cuts and information on experiments, especially those conducted at Gâvre, which we have not met with elsewhere. By the way, we notice a good many cuts—about forty, we think—copied from The Engineer, to which Lieut. Very is welcome; but he would have been still more so had he acknowledged the source from which he obtained them. The same remark applies to matter extracted verbatim from Captain Mackinlay's excellent text-book for the Royal Military Academy.

Passing on to the question of gun construction, Mr. Very remarks that the system of conversion had been pushed too far in America, so that, for the sake of utilising the guns existing, the opportunity had been sacrificed of making any really powerful weapons. Thus "no eggs had been broken, but, in consequence, no omelette had been obtained." The opinions expressed on the line taken by different Powers as to guns are, we think, very good. According to Mr. Very, England made a mistake in taking to muzzle-loading, and France and America sacrificed too much to conversion. Germany seems to have a specially good system of using up her guns, so that few become obsolete before they are worn out.

The American preference for cast iron meets with no more favour in this paper than that for smooth bores. General Roset's attempt to make a 100-ton cast iron gun in Italy is instanced as a proof of the hopelessness of looking to cast iron as a fit material for powerful ordnance. Here we thoroughly agree with Mr. Very, though in justice to the General, we would observe that we believe that his gun fulfilled what he promised, though, of course, it is lamentably weak in comparison with the Elswick ordnance of the same weight. We may observe the curious fact quoted that experiments as to the protection afforded by coal against artillery fire were made at Gâvre in 1844. Space fails us to follow the remarks on construction of ships, but we may say briefly that as a type the Monitor is declared superb, though the individual ships made in America were not successful as permanent designs. The Inflexible and Duilio are looked upon as the development of this type, the steel plate of the latter being preferred to the wrought iron sandwich armour of the former. Altogether we commend this work as valuable and concise on a subject on which most often existing literature is obsolete.

A NEW FORM OF FLEXIBLE BAND DYNAMOMETER.*

By Professor W. C. Unwin.

In the ordinary strap dynamometer a flexible band, sometimes carrying segments of wood blocks, is hung over a pulley rotated by the motor, the power of which is to be measured. If the pulley turns with left-handed rotation, the friction would carry the strap towards the left, unless the weight Q were greater than P. If the belt does not slip in either direction when the pulley rotates under it, then Q−P exactly measures the friction on the surface of the pulley; and V being the surface velocity of the pulley (Q − P) V, is exactly the work consumed by the dynamometer. But the work consumed in friction can be expressed in another way. Putting θ for the arc embraced by the belt, and μ for the coefficient of friction, $\frac{Q}{P} = \epsilon^{\mu\theta}$, or for a given arc of contact $Q = k P$, where k depends only on the coefficient of friction, increasing as μ increases, and *vice versâ*. Hence, for the belt to remain at rest with two fixed weights, Q and P, it is necessary that the coefficient of friction should be exactly constant. But this constancy cannot be obtained. The coefficient of friction varies with the condition of lubrication of the surface of the pulley, which alters during the running and with every change in the velocity and temperature of the rubbing surfaces. Consequently, in a dynamometer in this simple form more or less violent oscillations of the weights are set up, which cannot be directly controlled without impairing the accuracy of the dynamometer. Professors Ayrton and Perry have recently used a modification of this dynamometer, in which the part of the cord nearest to P is larger and rougher than the part nearest to Q. The effect of this is that when the coefficients of friction increase, Q rises a little, and diminishes the amount of the rougher cord in contact, and *vice versâ*. Thus reducing again the friction, notwithstanding the increase of the coefficient. This is very ingenious, and the only objection to it, if it is an objection, is that only a purely empirical adjustment of the friction can be obtained, and that the range of the adjustment cannot be very great. If in place of one of the weights we use a spring balance, as in Figs. 2 and 3, we get a dynamometer which automatically adjusts itself to changes in the coefficient of friction. For any increase in the coefficient, the spring in Fig. 2 lengthens, Q increases, and the frictional resistance on the surface of the pulley increases, both in consequence of the increase of Q which increases the pressure on the pulley and of the increase of the coefficient of friction. Similarly for any increase of the coefficient of friction, the spring in Fig. 3 shortens, P diminishes, and the friction on the surface of the pulley diminishes so far as the diminution of P diminishes the normal pressure, but on the whole increases in consequence of the increase of the coefficient of friction. The value of the friction on the surface of the pulley, however, is more constant for a given variation of the frictional coefficient in Fig. 3 than in Fig. 2, and the variation of the difference of tensions to be measured is less. Fig. 3, therefore, is the better form. A numerical calculation here may be useful. Supposing the break set to a given difference of tension, Q − P, and that in consequence of any cause the coefficient of friction increases 20 per cent. the difference of tensions for an ordinary value of the coefficient of friction would increase from 1·5 P to 2 P in Fig. 2, and from 1·5 P to 1·67 P in Fig. 3. That is the vibration of the spring, and the possible error of measurement of the difference of tensions would be much greater in Fig. 2 than in Fig. 3. It has recently occurred to the author that a further change in the dynamometer would make the friction on the pulley still more independent of changes in the coefficient of friction, and consequently the measurement of the work absorbed still more accurate. Suppose the cord taken twice over a pulley fixed on the shaft driven by the motor and round a fixed pulley, C. For clearness, the pulleys A B are shown of different sizes, but they are more conveniently of the same size. Further, let the spring balance be at the free end of the cord towards which the pulley runs. Then it will be found that a variation of 20 per cent. in the friction produces a somewhat greater variation of P than in Fig. 3. But P is now so much smaller than before that Q − P is much less affected by any error in the estimate of P. An alteration of 20 per cent. in the friction will only alter the quantity Q − P from 5·25 P to 5·55 P, or an alteration of less than 6 per cent. To put it in another way, the errors in the use of the dynamometer are due to the vibration of the spring which measures P, and are caused by variations of the coefficient of friction of the dynamometer. By making P very much smaller than in the usual form of the dynamometer, any errors in determining it have much less influence on the measurement of the work absorbed. We may go further. The cord may be taken over four pulleys; in that case a variation of 20 per cent. in the frictional coefficient only alters the total friction on the pulleys 1¼ per cent. P is now so insignificant compared with Q that an error in determining it is of comparatively little consequence. The dynamometer is now more powerful in absorbing work than in the form Fig. 3. As to the practical construction of the brake, the author thinks that simple wires for the flexible bands, lying in V grooves in the pulleys, of no great acuteness, would give the greatest resistance with the least variation of the coefficient of friction; the heat developed being in that case neutralised by a jet of water on the pulley. It would be quite possible with a pulley of say 3ft. diameter, and running at 50ft. of surface velocity per second, to have a sufficiently flexible wire, capable of carrying 100 lb. as the greater load, Q. Now with these proportions a brake of the form in Fig. 3 would, with a probable value of the coefficient of friction, absorb 6-horse power. With a brake in the form Fig. 4, 8·2-horse power would be absorbed; and with a brake in the form Fig. 5, 8·8-horse power would be absorbed. But since it would be easy to have two, three, or more wires side by side, each carrying its load of 100 lb., large amounts of horse-power could be conveniently absorbed and measured.

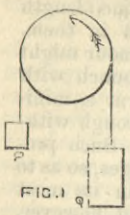


FIG. 1

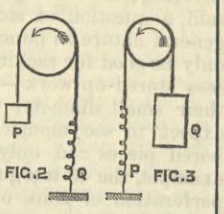


FIG. 2 FIG. 3

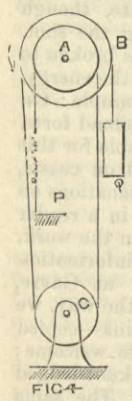


FIG. 4

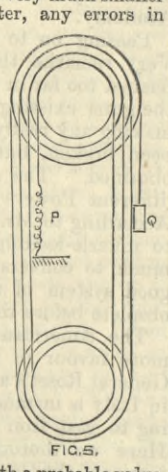


FIG. 5

THE PREVENTION OF BLOWHOLES IN THE MANUFACTURE OF STEEL.

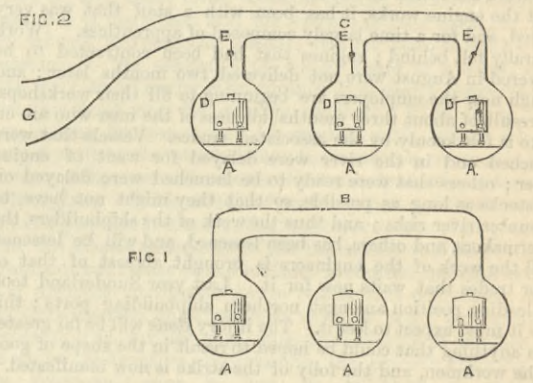
The winter session in connection with the Manchester Association of Employers, Foremen, and Draughtsmen, was opened on Saturday, when a well-attended meeting was held in the Mechanics' Institution, Mr. Thomas Ashbury, C.E., occupying the chair. An interesting paper on "The Manufacture of Steel" was read by Mr. W. Annable, of Govan, Glasgow. The paper was mainly devoted to a discussion of the best methods to be adopted in overcoming one of the serious difficulties—the existence of blowholes—in the manufacture of steel. Mr. Annable having quoted several authorities to prove that gases were occluded as well as mechanically mixed with the metal, said they were told that the mechanically mixed gases tried to escape during the time the metal was passing from the fluid to the solid state, but as steel set so rapidly a goodly portion of this gas was entrapped and formed blowholes. This theory appeared very feasible, as cavities were more numerous near the top end of ingots than at any other part, and this seemed to demonstrate that if the metal had remained fluid a little longer these gases would have escaped. In practice, however, this was not the case, for metal that was not "dead melted" and contained these gases was always the longest in setting, and instead of going down in the mould as contraction took place, did the reverse, began to come up, and unless force were applied would come over the top of the mould. As it seemed to be the mechanically mixed gases that gave us the blowholes, these were the gases that makers and users of steel were interested in, and to overcome the effects of which many methods had been adopted. Having described several of the best known of these methods, Mr. Annable said his own experience told him that if the steel were well saturated with any of the five following elements—carbon, manganese, silicon, phosphorus, and sulphur—which were always associated with iron and steel more or less, the metal would sink down in the mould and would be found quite free from blowholes. He believed that ironfounders found the same thing; that common iron was easier to deal with in casting than the better brands were. But this metal, although free from "blows," would not be suitable for our everyday requirements, as we must have a definite composition for each and every purpose. Consequently the important question arose as to how they were to obtain these definite tempers without blowholes. What was needed was a simple practical method whereby they could produce all classes of steel free from blowholes or cavities. He had tried several methods with success. One was "dead melting," but this did not always give the desired results when dealing with large masses of metal, as they could not get rid of the metal before the temperature became reduced, and this gave rise to some changes. With small quantities, however, as pot metal, "dead melting" was all that was required; it answered admirably, and could be depended upon. One method he had tried, and which he would recommend, was to cast the ingots in closed top moulds. These were run from the bottom, and inside each mould a small quantity of combustible material was placed, which was fired by the incoming metal. This at once expanded the air in the mould and created a pressure, as it could not readily escape by the holes in the top of the mould, which were only two, each ⅜in., whilst the head of metal they had in the runner counterbalanced the pressure, and the gases rushed out of the two small openings with a loud roar. It was not, however, pressure to which he wished to draw their attention, but to one fact, that the metal was being cast free from atmospheric air, to which Dr. Müller and others assigned the cause of blowholes. The metal was being cast in an atmosphere of carbonic acid, brought about by the combustion of the shavings which were placed in the moulds before casting began. Besides they had all the ingot cast at one temperature and one density, and it would be found perfectly homogeneous, which could not be said of those cast from the top, whilst it would be also free from blowholes. In addition the "pipe" in the top of the ingot would be found much reduced, according to the length of the runner, as the ingots received a supply of metal from it during the time they passed from the fluid to the solid state. Another method was to place the ladle on to the centre runner, and then they excluded all air besides using the weight of metal in the ladle to force the metal home against the pressure of gas set up in the mould. The open-topped mould, so much used for Bessemer and Siemens' ingots, was objectionable in more than one sense. When the metal fell from the ladle to the bottom of the mould, sometimes 8ft. or 9ft., it not only took down with it a stream of air, but in falling on the bottom of the mould the first 20 lb. or 30 lb. of metal were splashed in all directions, and if they were to examine these splashes they would find them to be covered with a blue scale, which was oxide of iron. As they went on pouring the hot fluid metal it re-melted the splashes and quite a reaction took place in the steel at the lower end of the ingot; the oxide of iron gave up its oxygen and attacked the carbon and manganese of the steel, just the same as when ore was thrown into the furnace, and they could at any time see the brownish red fumes leave an open-topped ingot mould when casting. These fumes which were the result of the chemical action below, became less and less as the metal got nearer the top. He had stated that open-topped ingots were not homogeneous. To prove that this theory was correct he had several ingots analysed, and the result showed that at any rate carbon was eliminated by the reaction of which he had spoken caused by the interference of the atmospheric air. Some might think he had exaggerated the effects of oxygen on molten or heated metals, but what he had said would be confirmed by the practical experience of any smith, as a small bar of iron or steel at a red heat under the hammer would yield a thin film of scale at every blow. This scale was oxide of iron, and showed with what avidity oxygen attacked metals even at a red heat. They might, therefore, assume that with fluid metal broken up or disintegrated as it was when falling some feet to the bottom of the mould, that oxidation would take place at a greater ratio than when metal was only just red hot. He had seen ingots cast in the manner just described, that when brought under the hammer the bottom end had dropped off at the first blow, after which the remainder of the ingot had hammered all right and given good blooms and billets. This he attributed to the manner in which the ingot was cast. What they wanted was some simple method of treatment which would give them all tempers of steel free from cavities. Pot metal, which gave them all kinds of tools they could get free. Castings also might be made free by conforming to certain treatment and chemical mixture by skill and care in preparing the moulds, and by judgment in allowing for fluid contraction by giving the metal plenty of head large enough in diameter. As the bulk contracted in cooling it would get its feed or supply from the centre of this head or column of metal put there for the purpose, and by making provision in cores for that large amount of contraction in steel this would take place without tearing the casting assunder. The ordinary Bessemer metal was very frothy and lively when cast below carbon ·30, mild steel temper, and it was with difficulty that it was kept in the mould; but even should it be prevented coming over the top, it was not free from blow-holes, which would be found to penetrate to half the depth of the ingot. Solid castings were being produced in steel, but the great difficulty arose where they had to make ordinary soft steel free from blowholes, and this was a difficulty which led to enormous waste in manufacturing operations. The subject was, however, receiving the fullest attention, and he had not the least doubt but that the difficulty would shortly be overcome, and that they would be enabled to produce ingots and castings that would be as sound and free from cavities as though they had been forged under the hammer. A discussion followed the reading of the paper, and Mr. Annable, replying to a few questions, said a good trustworthy cylinder could not be made without putting a large head upon it; if it were made in any other way it was sure to be a failure on account of the contraction which took place all the way down. In his opinion the steel made by compression was really no stronger than steel made in the ordinary way, provided, of course, that it received proper treatment afterwards. He believed the report with reference to the large output of steel in America was perfectly true; but speaking for himself, he would only say that he had never gone in for quantity, but for quality. He did not think they could get a reliable tool steel from the Bessemer process, because the proportion of manganese was too great, and they could not get the amount of carbon which was required. Tool steel must have its chemical elements mixed to a nicety, because if this were not secured it would be unsuitable for the purpose. The chairman, in closing the discussion, observed that the difficulties connected with the manufacture of steel were being grappled with in a manner which gave them confidence in ultimate success. Good sound ingots and sound castings were the great desideratum in the use of steel, and he had no doubt the time would soon come when solid steel would be relied upon quite as much as any other metal. The varieties of steel were so great that it was sometimes difficult to discover where steel began and where iron ended. One great mistake that was made was that the user of steel did not always specify the purpose for which the steel was required, and if engineers or other persons designing anything where steel was required would be frank and tell the maker what the steel was required to do when it was in position, they would frequently get more satisfactory results. With the tools of such immense power as were now being produced, many of the difficulties which had hitherto stood in the way of the manipulation of steel would disappear. The usual vote of thanks to the reader of the paper closed the proceedings.

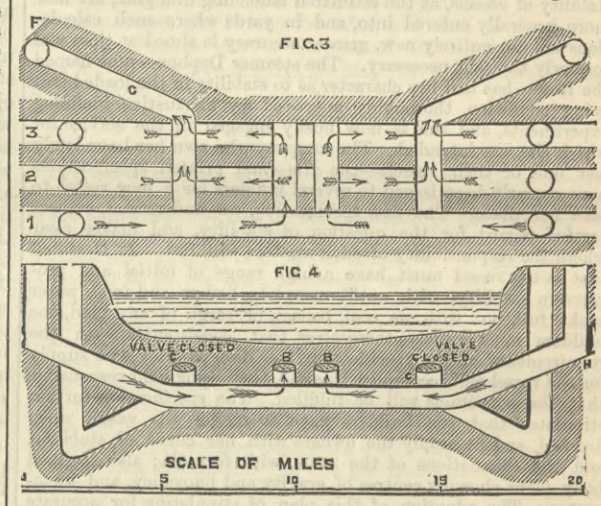
* Read before Section G of British Association.

ON THE ADVANTAGES OF CONSTRUCTING, VENTILATING, AND WORKING LONG RAILWAY TUNNELS, WITH THREE SEPARATE OPENINGS.*

By Mr. T. R. Crampton.

My purpose is to endeavour to show that by the construction of three tunnels of equal size, say 17ft. diameter, with one set of rails laid in each, not only that they can be constructed cheaper than one of 30ft. with two sets of rails, but at the same time will secure the maximum of advantages with a minimum of disadvantages. It is assumed that the well-known coal or coke-burning locomotives would be employed, involving artificial ventilation, as, up to the present time, no other system has been worked out practically for long tunnels, so as to justify the ordinary system being dispensed with. The tunnels should be so constructed that other motors than ordinary locomotives may be employed, and it is not too much to hope that such will be brought into practical operation, evolving no deleterious gases, and requiring little artificial ventilation, in which event all the three tunnels could be used for traffic—in fact, give a third set of rails, without extra outlay. It may be remarked that double tunnels, of the length mentioned, where the men repairing have to be on the watch for passing trains should be somewhat wider than usual. Mr. J. Clarke Hawkshaw, in his paper on a long tunnel, read at the meeting of the Association held at Southampton last year, proposed 30ft. tunnels, and so far as I am aware, is the only paper that deals with this question practically. I will endeavour to describe it. He proposes to construct between two vertical shafts twenty miles apart a 30ft. tunnel, having 470ft. of area for the trains. About half the air required for ventilation passes through a large chamber, of 106ft. area, constructed on the bottom of the tunnel. The air entering it at each end, on meeting at the centre, it passes into the working tunnel at that point. The other half, entering the working tunnel at their ends, travelling to a point between the centre and the ends, where it and that coming from the centre meet half way, both passing into a separate ventilating tunnel, through which the air and gases are drawn to a convenient outlet. A similar ventilating tunnel is employed for each half, thereby splitting up the air, thus giving advantages as compared with end to end ventilation. The system I propose to adopt may be described as follows:—Side by side three separate tunnels A A A are formed, each of sufficient dimensions to allow of a train passing through, say, 17ft. in diameter, or 227ft. area, the area of two together in which trains run being about 454ft. About midway of their length they are connected together by large passages B B without valves, so that air may have free access from one to the other; and about midway between the centre of the tunnels and each of their ends is formed a branch C C at right angles, either above or below, and separate openings D D D from this branch, into each of the other tunnels are formed, these openings being provided with doors or valves E E E, quite clear of the main tunnel, any two of which may be closed, and separating at this point the corresponding tunnels from the third. The branch C C to be led to any convenient position at which an exhausting apparatus may be erected for withdrawing air and gases from the branch. If two of the tunnels are left open to this branch, and the third one shut off from it by closing the doors or valves E E, the vitiated air will be drawn from the two working tunnels, through the connecting branch, while fresh air will be partly sucked down the vertical shaft through their open ends F F and partly at the centre B, which is supplied by forcing air down the vertical shaft G in communication with it, a stop or door H being placed just outside of the bottom of the shaft so as to compel the air to flow to the centre of the tunnel. It will be observed that no trains are running in this air tunnel so long as it is so used; there are similar doors for the working tunnel, but they are kept open, unless either of them is required to be made into an air tunnel, so that the passing trains run no risk of running into the doors. By means of the doors or valves E E E above mentioned, any one of the three tunnels can be used as a fresh-air tunnel, in which the men doing the repairs to the road would be clear of the traffic, whilst the other two are used for the traffic, as well as outlets for





* Read before Section G of British Association.

the mixed impure gas and air. If a breakdown of a train occurs in any one tunnel it can at once be converted into a fresh-air one, whilst its traffic is transferred to the one previously used for air, thereby avoiding delay. The system described for splitting the air and drawing off the noxious gases is, it will be seen, very similar to that described by Mr. Hawkshaw in his previously alluded to paper. The valves and other details being added, to make the system applicable to three tunnels, it will be obvious that other modes of ventilation may be adopted. In order to reduce the number of men working in the tunnel it is proposed, if found practicable, not to adopt the ordinary ballast and cross sleepers, but to substitute the longitudinal timber system, the timbers to be secured to brickwork or concrete H, forming a part of the tunnel lining, placing efficient elastic material between the foundation and longitudinals for their whole area, also between the rails and sleepers. An open drain I is formed between the rails; by this plan any water accumulating flows over smooth surfaces through small channels into the drain, the tunnel on each side being dry. The saving of labour in repairs, if this system can be employed, is so evident that a large amount of money might be expended in endeavouring to discover a suitable elastic material for the purpose. There is data on many long viaducts sufficient to justify experiments being made on the subject, and it is not unreasonable to expect that suitable material may be met with. In very long tunnels, nothing should be omitted tending to reduce the number of men working in them. My impression is that tunnels passing through solid materials, and proper foundations being made for the longitudinals to rest upon, with good elastic material placed between the rails and sleepers and foundations, one half of the men employed on the ordinary cross sleeper road resting on ballast would be saved, more particularly where the repairs are effected in pure air free from the traffic as explained. In order to compare the system of constructing three tunnels with one, I have taken the dimensions given by Mr. Hawkshaw as a base for calculation, particularly as it is proposed to ventilate the three tunnels substantially on his plan. The quantity of excavation and brickwork or concrete in each case will be as follows:—Single tunnel: 30ft. dia. lining, 3ft. thick, with the brickwork forming the air passage = to 39·5 cube yards per yard forward. Excavation to outside of brickwork 36ft. dia. = to 113 cube yards per yard forward. Three tunnels 17ft. dia. and 18in. brickwork. Brickwork lining for three tunnels = 24·5 cube yards per yard forward. Excavation to outside brickwork for the same 105 cube yards per yard forward. It is assumed that three 17ft. tunnels are stronger, more conveniently formed, and involve less risks in construction than one of 30ft. dia., at the same time there is no difficulty in making the latter. The above shows a saving in the three tunnels of 23 per cent. in brickwork, and about 7 per cent. of earthwork, compared with one of 30ft. With regard to ventilation, it is well known that the power required to force air along passages is practically as the cube of the velocity; and as the area of the air passages in the single tunnel is 106ft. with speed ten miles per hour, and that of one of the 17ft. diameter is 227ft. or rather more than double, giving only five miles per hour velocity, it follows that the power for this portion would be eight times less. That for the working tunnels would be practically the same, the velocities being nearly alike in both cases, which would be about 2½ miles per hour—the 30ft. having an area of 470ft., the two single ones together about 450ft. It is not necessary here to enter into any great detail, suffice it to say, by simply increasing the inlet for the air as described, using the ordinary formulæ, the 480-horse power required for the one tunnel is reduced to 170 for the three tunnels, or a saving of nearly two-thirds. I believe it has been suggested to ventilate two tunnels of the length proposed by passing the air through the whole length of them for the purpose of ventilation, doors being placed across the one end of each tunnel, which have to be removed for the passage of each train. Such a device I can hardly conceive would be adopted, particularly if it could be avoided; besides which, the power required to force sufficient air for ventilation for, say, forty-eight trains per twenty-four hours—as was assumed for the three tunnels—would be much larger, and the velocity of current more than ten miles per hour, or four times greater, than in the other cases, which is only two and a-half miles per hour.

In concluding this paper, Mr. Crampton referred to the hydraulic system of cutting tunnels and carrying away the *débris* which he described last year at Southampton, as reported in our columns. The discussion on the above paper elicited opinion in favour of the three tunnel system, but Mr. John Clarke Hawkshaw pointed out that the brick lining would have to be thicker than Mr. Crampton had assumed.

INFRINGEMENT OF THE LOWMOOR BRAND IN RIVET-MAKING.

At the Staffordshire Quarter Sessions on Monday last, Thomas Williams, rivet and chain maker, of Hales Owen, was arraigned before Sir Rupert Kettle, assistant chairman, charged with "unlawfully causing to be applied to certain chattels, to wit, iron rivets, on the 11th May last, at Rowley Regis, a counterfeit mark 'Lowmoor,' being the trade-mark of Hird, Dawson, and Hardy." The prisoner had been committed to the sessions by the Hales Owen magistrates, but had been admitted to bail, upon which he now surrendered.

Mr. Alfred Young, with whom was Mr. Neville, were the counsel for the prosecution, and Mr. Harris—of the Midland Circuit—with whom was Mr. R. C. E. Kettle, were for the defence.

In opening the case for the prosecution Mr. Young said that the charge was a misdemeanour which came under the provision of the Trade Marks Act of 1862. The sum and substance of the charge was that the prisoner, with intent to defraud, had caused and procured another person to apply the trade mark of the prosecutors to certain iron rivets. The facts were that on May 9th last the prisoner called upon Messrs. Mordy, Carney, and Co., who carry on business at Newport, Mon., apparently for orders, and succeeded in obtaining an order for 26 cwt. of rivets, which were specified to be Lowmoor rivets for boilermaking. In order to carry out the work the prisoner, on May 11th, put himself into communication with a rivetmaker of Blackheath, Staffordshire, named Potter, whom he asked if he could make the rivets, and stamp them "Lowmoor," since the rivets were of no value for use in boilermaking unless they were made of the peculiar quality and calibre of Lowmoor iron. Potter said he could, and prisoner promised to supply him with the iron and with the stamp. The prisoner, for the time being, had some difficulty in sending the stamp with "Lowmoor" upon it; but Potter appeared to have had no difficulty, for he borrowed one and went on making the rivets until the prisoner succeeded in having one designed. The order was completed, and the rivets were sent to Messrs. Mordy, Carney, and Co., and as they were stamped with the Lowmoor mark, would pass as genuine articles made by the prosecutors, whose trade-mark was well-known in the market. A very singular part of the transaction, however, was that after the prisoner had been committed for trial at Hales Owen, he went to Newport with the original order in his possession, and induced one of Messrs Mordy's clerks to introduce the words "to be made from Lowmoor iron and stamped Lowmoor on the head."

Thomas Jones, secretary to Messrs. Mordy, Carney, and Co., deposed that the firm began to trade with the prisoner in January last. In reply to a letter, they gave prisoner's son an order for 30 cwt. of Lowmoor rivets at certain prices, which were mentioned in the written order—the document was put in and read. It showed that the goods were to be of 3in., 2½in., and ⅞in. countersunk, and to be made of Lowmoor iron. The order was duly carried out, rivets being received with the word "Lowmoor" stamped upon the head. Cross-examined by Mr. Harris, witness stated that he was unaware of any distinction between Lowmoor iron and Lowmoor rivets. The goods which were supplied by the prisoner had, as far as he knew, answered their order. He had told Mr. Williams that the rivets were to be made of Lowmoor iron, and to be stamped "Lowmoor" upon the head, and he had no idea that he was doing anything wrong since the firm did not care who made them. He knew that buyers had no guarantee that rivets were not spurious unless they had the Lowmoor mark upon them, and that merchants purchased the wares.

Frederick John R. Sutcliffe, chief engineer to Messrs. Hird, Dawson, and Hardy, stated that bar iron, stamped with the Lowmoor mark, of from ½in. upwards, was utilised for rivet purposes. The firm supplied iron thus marked to merchants. The price of that particular ½in. brand would be 19s. per cwt. at the works; manufactured rivets of ⅝in., 25s. per cwt.; and 11/16in., ¾in., and upwards, would be 24s. per cwt. In cross-examination witness said he was not prepared to say that a specimen rivet which he was shown was made from Lowmoor iron.

Thomas Potter stated that the prisoner had engaged him to manufacture the rivets, and mark them "Lowmoor." He had borrowed a stamp from "a friend" to mark the rivets, until the prisoner supplied him with one; but the friend's name he would not divulge. When the prosecutors charged him with making rivets with their stamp he had replied that the order protected him.

Mr. Harris denied that the trade-mark had been infringed or imitated by the prisoner. The stamped rivets bore, he pointed out, the impress of the two words "Low Moor" instead of Lowmoor; and it was not possible for any one manufacturer to patent the name of a place and have the exclusive right of using it, because if it could be done every town in England would be utilised as an exclusive trade-mark by speculators. The prisoner had not made the rivets with the intention of defrauding the company, since to his knowledge he did not know of a registered mark called "Low Moor." The learned counsel now called the prisoner's witnesses.

Mr. Geo. Stones, of Stones Bros., of Smethwick, stated that he had ordered 35 cwt. 2 qr. 22 lb. of Lowmoor iron for the prisoner at 14s. per cwt.; and Mr. Jabez Lones, of Lones, Vernon, and Lones, of Smethwick, stated that Mr. Stones had bought the iron from him. The weights and invoices of this iron corresponded with those of the iron from which the rivets were made. Naboth Priest, clerk to Mr. Williams, said he ordered the stamp from a button maker and die sinker, of Smethwick, named Groves. That tradesman now said that the stamp supplied to Mr. Williams had been made by one of his operatives, from, he believed, a printed sketch that was found about. Other witnesses were called, who deposed that the prisoner had borne a good character for many years past.

Mr. Harris, in addressing the jury for the defence, said that it was very dangerous in any way to use any mark, since it might be construed into a fraudulent act; and that the only inference was that the prisoner knew nothing of the trade-mark.

Mr. Young, replying for the prosecution, remarked that no wonder the prisoner occupied good positions when he sold rivets as Lowmoor rivets made from iron for which he only paid 14s. per cwt., whereas Lowmoor iron was 19s. per cwt.

His Honour, in summing up, said that the jury must divest their minds of sympathy for the prisoner because of his local position. If it were to become a general thing to have rivets of inferior iron put into boilers the results would be extremely disastrous; and again, if trade-marks were to be dealt with loosely, no man's property would be safe. The trade-mark had been in the possession of Messrs. Hird's firm for ninety-four years. It was for the jury to decide whether the name being spelt in two words instead of one only was intended to convey that they were made at Lowmoor and manufactured by Messrs. Hird. The defence was that the rivets had been made out of bar iron rolled from Lowmoor tires. But even if the rivets were made from Lowmoor iron, the jury had to decide whether it was lawful for the prisoner to put "Lowmoor" upon them. He was of the opinion that the prisoner was not aware of the magnitude of the offence.

The jury, after a short deliberation, returned a verdict of "Guilty," with a strong recommendation to mercy, on account of prisoner's good character.

Mr. Neville, on behalf of Messrs. Hird, said that they were not actuated by any vindictive motives. They merely sought to make an example of any offender who infringed their mark.

His Honour, in addressing the prisoner, said he believed that he would regret as much as any one that he had been led into the commission of this misdemeanour, and that what had happened would prevent him from again pirating the Lowmoor trade-mark. By virtue of a recent Act of Parliament he had power to order the payment of the cost of the prosecution, and he did not propose to inflict any further punishment; but at the same time, it was necessary that it should be known in the district, where small industries were carried on so extensively that they must not tamper with trade-marks. The sentence would be that the prisoner pay the costs of the prosecution, and enter into recognisances to come up for judgment when called upon.

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

(From our own Correspondent.)

Finished iron consumers mostly continue satisfied with individual transactions of no great extent; but the total is very considerable, as is evidenced by the activity at the works. The majority of the mills are running actively, and some sheet makers are booked fully forward up to Christmas. These people are looking for better prices before very long. At present, however, they still quote £8 5s. to £8 10s. for galvanising doubles, and £9 5s. to £9 10s. for lattens. Makers do not care to contract beyond the end of the year, since they believe that the tendency of the market at date is upwards, especially bearing in mind the possibilities of an early rise in coal.

Best—thin—sheet makers this week again speak of business as very good alike on home and export account. John Knight and Co. quote as follows:—No. 1 working-up sheets, singles, £11 10s.; stamping sheets, £14 10s.; and charcoal sheets, £19 10s. In tin-plates, too, they are busy, and in this department they quote:—Cookley K charcoals, 25s. I.C., with 6s. additional for each X; and cokes, 21s. per box, with 5s. additional for each X.

Bar makers have booked some good orders as the result of the quarterly meetings, and they do not express surprise that at the gathering on 'Change this—Thursday—afternoon in Birmingham, there should be a quietude in new business. This is not at all unusual at the gatherings immediately succeeding quarter-day. Marked bars remain at £7 10s. to £8 2s. 6d., and common bars are £6 10s. to £6 2s. 6d.

Instances were mentioned to-day in which foreign enquiries that are reaching the ironworks are for such small lots of bars, hoops, &c., of assorted sizes, that a year or two ago similar orders would have been at once placed with a merchant to satisfy out of his warehouse stock. But such is the rage for low prices that even small foreign buyers are bent upon taking every possible advantage of the present state of things.

The galvanised iron roofing makers are doing a large colonial and South American trade, and other branches of the galvanised trade are also fairly brisk. For corrugated sheets of 22 to 24 gauge makers are firm in their quotation of £13 5s. delivered Liverpool, and £13 10s. delivered London; and they are helped to get the figure by the rising tendency of the spelter market. The representatives here of the Birkenhead Galvanising Company state that that firm have this week secured orders at £13 10s. per ton.

A meeting of the makers of sheets of all descriptions and of hoops was held to-day in Birmingham to consider the Government standard wire gauge. Mr. B. Hingley presided. It was explained that the proposed gauge would be very inconvenient in the sheet and hoop trades, and it was resolved that a deputation should wait upon the Board of Trade to secure, if possible, a separate gauge. It was decided to reject the Government gauge.

Pig iron ruled quiet to-day, but the vendors of outside brand were nevertheless pretty strong in their prices. Derbyshire sorts were 47s. 6d., and Northamptons 46s. 3d. Ulverstone forge hematites were 60s. delivered, and Barrow ditto 61s. Native all-mine pigs were 62s. 6d., and here and there 60s. would have been accepted for a good order.

The number of furnaces now blowing is estimated at forty-two, but not all the output is going into current consumption. The largest outturn at any one individual plant is between 1000 and 1200 tons weekly at the Spring Vale Works. The proprietary—Messrs. A. Hickman and Son—are pressing forward with the erection of their two new large furnaces for the smelting of native ores out of which to manufacture steel by the Thomas-Gilchrist process; and they state that they hope to have the finished steel plant ready for commencing operations by February or March next. The Lilleshall Iron Company, Shropshire, are producing at the present time 1100 tons of pigs weekly, of which 800 tons are hot-blast and 300 tons cold-blast. To do this they are running, in all, five furnaces.

Consequent upon the recent ironstone miners' strike in North Staffordshire, pottery mine from that district is very scarce, and ironmasters who use it for blast furnace purposes and for fettling in the puddling furnaces are this week willing to give big prices if only they can secure supplies.

The colliers' wages question is every day assuming a graver aspect. The South Staffordshire masters are anticipating with some pardonable anxiety the meeting of the Coal Trade Wages' Board, which is summoned for Monday in Wolverhampton to consider, under the presidency of the umpire, the men's claim for an advance of 10 per cent. That the masters will have no alternative but to stoutly resist the claim is universally admitted, and it cannot be seen what good arguments the men have to support their application in the face of the present over-abundant supply of manufacturing coal and the low prices which are resulting.

The mineowners in certain of the districts in North Staffordshire, where ironstone is chiefly raised, have for the moment satisfied their men by promising to give them the old rate of wages—for which they struck five months ago—if they will for a fortnight first work at the 10 per cent. drop. Some 2000 men are affected by this arrangement, and they have consented to it. The main reason which has at last induced the masters to concede these terms is that in consequence of the strike stone has become very scarce and valuable. But it would not seem that all the masters are willing to allow the men to resume. Yet at pits where, rather than play for five months, the men accepted the 10 per cent. drop some time ago, notices are now to be handed in by the men for a return to the old rate. And more than this, the operative leaders are this week trying to incite the men to take part in the general agitation throughout the country for a 15 per cent. advance.

A new rotary steam engine which is comprised in the space of about 2ft. by 3ft., and will develope 25-horse power, is this week on view at the iron planing works, at Bridge-street, Broad-street, Birmingham, of Mr. W. H. Westwood. The inventors—who are also the patentees—are Messrs. Gore and Pearson, practical working engineers. They state that it was their intention to introduce this engine as a gas exhauster and blowing engine, but that as it was not convenient to try it in that form, they started it as a steam engine. The pistons expose a surface of 50in. to the action of the steam, and this surface never varies. The arrangements are such, that before one piston leaves the working part the other piston has entered. They therefore compare it to an engine with an endless stroke. It would be impossible to place it in any position in which it will not begin to work directly steam is admitted, for it will start at any point. By reversing steam and exhaust, a back as well as a forward action is obtained. Used as a gas exhauster, it will deliver, the patentees explain, the gas or air in one uniform stream without any variation or pulsation. The specimen now on view at Birmingham is not a perfect one, since it is very loud in working. I understand, however, that it was constructed before the patent was taken out, and that its various parts were made at four different engineering shops. Messrs. Gore and Pearson state that under proper construction this defect will no longer appear, but that there will be a smooth gliding motion throughout.

Merchants in the hardware trades report a lull in the Australian trade at the moment, with a disinclination by dealers to increase their stocks. The Mediterranean trade is gradually righting itself after the panic caused by the cholera in Egypt, and an improved demand may be anticipated before very long. India is buying better in several lines, and the fag end of the Canadian season shows up well. The European countries indicate clearly that more might be done if the tariffs were less hostile.

In consequence of the horse-nail manufacturers having refused to concede an advance of 3d. per 1000, the operatives at many of the factories are this week out on strike. The men state that they cannot get a living at present prices, and the employers, on their part, that they cannot give an advance through machine-made nails having been imported into the markets.

The series of lectures upon coal mining in all its aspects, which has been arranged for at the Mason's Science College, Birmingham, was inaugurated on Monday with a lecture by Mr. W. Y. Craig, M.P., who remarked that he had spent the greater part of his working life in the management of collieries. In the course of his address Mr. Craig sketched the training which, in his opinion, should be given to make the pupil an efficient colliery manager, and advocated a system of apprenticing managers and engineers from the age of seventeen or eighteen to twenty-one or twenty-two. Passing on to speak of colliers' wages, Mr. Craig said that what required to be considered at once was whether some substitute could not be found to do much of that work which was now done by the pick in the hand of the collier. Would science and practical training lead to the discovery of some force and machinery that could get coal at the face? They had had machines, but they had never come into general use. It was not the machine itself that was at fault, but they required some force which did not need to be conducted from the surface, but which was self-contained in the machine, and could be safely employed at the working face. They had arrived at considerable perfection as regarded machinery for haulage, but there was much yet to be done in this direction also.

NOTES FROM LANCASHIRE.

(From our own Correspondents.)

Manchester.—Occasional orders come forward which prevent the iron trade of this district relapsing into an actual condition of depression, but the market continues devoid of all buoyancy, with an indifference on the part of buyers about giving out any orders except such as are necessary to cover hand-to-mouth requirements. It is not that there is a high level of prices standing in the way of business, the present basis of value being really so low that there is practically little or no margin to work upon for any further reduction. It is the prevailing want of confidence in the future that is keeping back buyers. The recent activity in the shipbuilding trade is rapidly slipping away, and this, it is held, must materially affect the demand for iron. The shipping season is also drawing to a close, and with an evident tapering down in nearly all the iron-using branches of industry, consumers naturally come to the conclusion that if makers, in the midst of a fairly active trade, have not been able to bring prices up to a higher level than their present basis, it will be scarcely possible for them to be maintained when trade has dropped off. Consequently, where buyers can wait they are holding back.

During the past week or so there has been a moderate amount of buying in pig iron to renew expiring contracts with the close of the quarter, and in some cases this has filled up makers' order books for the present. Sellers consequently are in a rather better posi-

tion than they were a week or two back to the extent that there is lessened disposition to entertain low offers. If, however, the market were really tested by offers of any weight of iron, there is little doubt buyers would still be able to find out weak points.

At Manchester on Tuesday there was only a quiet market. Makers of pig iron, however, following the orders recently secured were not pressing sales, and quoted prices were generally firm at 45s. 3d. less 2½ for forge and foundry Lancashire, and 47s. 6d. to 44s. 10d. for forge and 45s. 6d. to 45s. 10d. less 2½ for foundry as the minimum for district brands represented by Lincolnshire iron delivered equal to Manchester. Only a very small inquiry was eported, and actual transactions at the above figures were very limited. n Scotch iron some very low sales were reported, and there is evidently a disposition to "bear" the market in this direction.

The condition of the finished iron trade remains practically unchanged. Makers are still kept going with present business, and for prompt specifications buyers have to pay full rates, which average £6 2s. 6d. to £6 5s. for bars, £6 12s. 6d. to £6 15s. for hoops, and £8 to £8 5s. for sheets, delivered equal to Manchester. There is, however, no pressure on the part of buyers, and for forward delivery very little is being done.

The engineering branches of trade are unquestionably getting quieter. Heavy tool-makers in this district are still getting a fair amount of work, and locomotive builders are kept very busy on old contracts, but these are not being replaced by any weight of new work. Small stationary engine builders are very quiet, and the same remark applies pretty generally to the machine trade.

Unemployed labour is getting thicker on the ground, but still the men generally are not as yet at all badly off for work. The reports for the past month from the various districts of the Trades' Union Societies connected with the engineering branches of industry show comparatively little change in the industrial condition of the country, but from the point of view indicating any recovery from the decreasing activity which has recently been recorded, they can scarcely be regarded as satisfactory, the general tenour of the reports being discouraging rather than otherwise as to any improvement in trade. The branch reports sent in to the Amalgamated Society of Engineers are much on the same lines as those of last month. With the exception of those districts affected by dispute, employment generally is reported to be fairly good, and the returns as to the number of men in receipt of out-of-work support are practically the same as last month. What little variation they do show is in the direction of a slight decrease in the numbers on donation. The secretary of the Steam Engine Makers' Society reports that no improvement has taken place during the past month, but that in some cases the returns sent in were of a more despondent nature. The number of unemployed had not increased to any great extent, but the list was far heavier than they cared to see. It was, however, well known that good work had been extensively carried out in the past, and it was to be hoped it would be repeated in the present time of need. The report, in referring to wages disputes at Leeds, Bolton, and Sunderland, states that although the struggle in the last-named town had continued more than three months, the signs of any settlement were more remote than at the outset. Up to the present time no men had broken away from the general body. Such conduct as this they would like to see exemplified at Leeds, where the men had made a claim for a minimum rate of wages of 28s. per week, and as an illustration of the different position of the two towns, the report points out that at Sunderland the present rate of wages averages 36s. to 38s. per week.

The members of the Manchester Association of Employers, Foremen, and Draughtsmen on Saturday evening made an inspection of the various departments in the new technical school, which has been established on a very complete basis in the premises of the old Manchester Mechanics' Institute, which is now practically merged into the new school. A course of instruction has been arranged, which includes most of the subjects in the Science and Art Department's syllabus, as well as the theory and practice of mechanical engineering, builders' work, weaving and designing, bleaching, dyeing, and printing, art and design, and the school is equipped with machine and other tools, appliances, and laboratories for the effective illustration of the various subjects of art and technology. The whole of the departments are now practically fitted up with the necessary appliances, with the exception of the section for spinning and weaving, for which the machinery is at present being made. The mechanical engineering section includes, on the ground floor, a thoroughly fitted-up mechanics' shop, and amongst the tools put down are a planing machine to take in work 3ft. long by 2ft. wide and 2ft. high, a slotting machine, with a 6in. stroke; a drilling machine, a screw-cutting lathe, sets of templets, and other requisite appliances, the whole of the machine tools being driven by a 3-horse Otto gas engine. In the basement are a complete moulders' shop, a smiths' forge, and an excellently fitted-up metallurgical laboratory, with nine wind furnaces, two muffle furnaces, and all the requisite apparatus for making assays and testing ores. There are also excellent mechanical drawing and lecture rooms. Other departments are also fitted up in a similarly efficient manner, and already upwards of 900 students for the day and evening classes have been entered on the books. The members of the association expressed their gratification at the completeness with which the school had been arranged; and there is no doubt it will form an important centre for thorough practical training in the various industries connected with the district.

In the coal trade, business has been quieting down considerably since the commencement of the month, and generally there is only a very moderate demand for any description of fuel. A few collieries are still filling up out of stock, but supplies in the market are plentiful, and there is an easier tendency in prices. Special sales are made at low figures, and to secure orders sellers, in a large number of cases, are willing to give way a little on their list rates. The average prices at the pit mouth are about 9s. up to 10s. for best coals, 7s. 6d. to 8s. for seconds, 5s. 6d. to 6s. for common, 4s. 6d. to 5s. for burgy, 3s. 6d. to 4s. for good slack, and about 3s. per ton for inferior sorts.

The miners have this week commenced their agitation for an advance of wages, but from what I hear the more sensible of the leaders are not disposed to push matters to extremes. In the present state of the market it can scarcely be expected that the coalowners will entertain any question of an upward movement in wages, and it is, I fancy, more with a view of keeping up appearances after the recent Manchester conference than of seriously pressing the application for an advance of 15 per cent. that the present action is being taken.

Barrow.—I notice that the demand for hematite pig iron still continues very quiet, and the orders coming to hands of makers both on home and foreign account are inextensive. Indeed, I may safely say that no change has taken place which leads one to hope that an early departure from the present quiet will be the result. The deliveries have not for some time been anything like the production, which has been well maintained up to the present, so that the stocks have been increasing and in most cases are now of great weight. The prices at present ruling are far below the actual cost of production, leaving no margin for the producer. A few orders have been offered at lower quotations than are now ruling, but they have been refused, makers preferring to stock metal in the hopes of a sudden change in the state of the market. Prices remain at No. 1 Bessemer, 49s. per ton net prompt delivery; No. 2, 48s.; and No. 3, 47s.; while No. 3 forge has been in limited request, at 47s. per ton at works. The steel trade is not very busy, but there is a little activity in the rail and merchant departments; but it is noticeable that orders are not near so plentiful as they have been. Rails are quoted at from £4 10s. to £5 per ton at works.

Shipbuilders are not well off for orders, and the business lately come to their hands has been inconsiderable.

Iron ore is in fair request at from 9s. to 11s. per ton at mines, while stocks all round remain very large.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

Sheffield is at present placarded with announcements requesting engineers and similar workmen to keep away from Sunderland during the strike, and to resist all inducements to accept situations in the North.

The colliery owners of South and West Yorkshire met the colliery owners of the Midland Counties at Derby on Tuesday, when it was unanimously resolved by the latter, "That this meeting is of opinion that neither the present state nor the immediate prospect of the coal trade warrants any advance in wages, and that any demand on the part of the workmen be strenuously resisted." Following this meeting, a further gathering took place at Sheffield on the following day, when the resolutions to give no advance were emphatically confirmed. The meeting further resolved that as the colliers had asked the coalowners to grant an interview to certain representatives they had appointed, the request should be complied with, and fixed Tuesday next for the purpose. The coalowners present on the 17th inst. represented the leading collieries in South Yorkshire, West Yorkshire, Derbyshire, Leicestershire, and Nottinghamshire.

Seventeen Sheffield firms have now forwarded examples of their goods to the Calcutta Exhibition.

Several foreign markets show a very serious falling off in hardware and cutlery. During September last the only markets which showed an improvement were Holland, Brazil, and Spain and Canaries, and the whole amount of that improvement was not £4000. On the other hand, Russia fell from £5526 to £3968; Germany from £16,033 to £15,295; France from £19,500 to £15,631; the United States from £50,109 to £30,479; Foreign West Indies from £9018 to £8009; Argentine Republic from £19,287 to £9717; British North America from £23,429 to £17,360; British Possessions in South Africa from £14,569 to £6570; British East Indies from £29,804 to £23,334; Australasia from £65,091 to £60,308. The total decline during September, 1883, as compared with September, 1882, is a little over £60,000, the relative figures being £305,509 and £365,600.

Steel rails, on the other hand, show an increase during September, 1883, as compared with September, 1882, of nearly £50,000; the benefit, however, has not been felt by Sheffield firms, as here the trade in rails is almost at a stand. Sweden and Norway show a vast increase—from £3038 to £21,087; British North America has advanced from £47,512 to £64,654; and Australasia, from £17,887 to £79,646. The decreasing markets are Spain, from £6363 to £5438; Italy, from £41,168 to £9155; United States, from £46,244 to £34,565; Brazil, from £23,338 to £13,147; Chili, from £5937 to £2939; British East Indies, from £26,076 to £22,362.

At the Manvers' Main Colliery the operation of the sliding scale for the regulation of wages can scarcely have been satisfactory, for a joint meeting has been held representing both the employers and the employed, at which the following resolution has been passed:—"On behalf of the underground workmen employed at the Manvers Main Collieries, we, the undersigned, hereby give six months' notice to terminate the existing sliding scale agreement; but at the expiration of such notice there shall be a meeting between the owners and the workmen, with a view, if possible, of re-arranging the scale for the future regulation of the wages to be paid to the underground workmen."

THE NORTH OF ENGLAND.

(From our own Correspondent.)

Contrary to expectation, the condition of the Cleveland pig iron trade has not improved during the last few days. Prices were, in fact, slightly weaker at the market held at Middlesbrough on Tuesday last. Some merchants accepted 38s. 10½d. per ton for prompt delivery of No. 3 g.m.b., and a majority of the makers were willing to take 39s. for that grade, only a few holding out for 3d. to 6d. per ton more. Not much business was done, however, as consumers believe they will be able to do better when the shipping season is ended. For forward delivery No. 3 is quoted at 38s. 6d. per ton. There is an abundant supply of grey forge iron, and large quantities have been sold at 37s. per ton for forward delivery.

Holders of warrants are more anxious to sell. In some cases they have accepted 38s. 6d. per ton, but 38s. 9d. is the more general price.

The stock of Cleveland pig iron in Messrs. Connal's Middlesbrough store on Monday last was 67,937 tons, being a reduction of 1273 tons during the week.

With the improved weather of the last few days the exports from the Tees have greatly increased. The quantity of pig iron shipped up to Monday night was 46,459 tons, against 49,808 tons in the corresponding period of September, and 46,932 tons in October last year.

Finished iron makers are still booking orders for prompt delivery at the old rates, which are as follows:—Ship-plates, £6 2s. 6d. to £6 5s.; angles, £5 12s. 6d.; and common bars, £5 17s. 6d. per ton, all free on trucks at makers' works less 2½ per cent. Consumers offer 2s. 6d. to 5s. per ton less for forward delivery, but makers as a rule do not entertain such offers. Steel rails are still to be had at £4 7s. 6d. to £4 12s. 6d. per ton, but few sales are made.

A satisfactory arrangement was come to last week with the men recently employed at the Darlington Steel and Ironworks, and who had been dismissed. On Monday morning the whole of the works were again in operation. The reductions in wages agreed to vary from 7½ to 15 per cent. The men employed in the steel department are said to have decided to join the Board of Arbitration.

The workmen employed at Messrs. Bolckow, Vaughan, and Co.'s Eston Steel Works have decided to become members of the Board of Arbitration. A deputation will wait upon the manager to try and induce the firm also to become members.

It is rumoured that active preparations are being made for restarting No. 1 plate mill and No. 1 forge at Messrs. Bolckow, Vaughan, and Co.'s Witton Park Ironworks. They have been idle for a considerable time.

The Sunderland engineers have been on strike since June 21st, and still show no signs of giving in. A good many apprentices are now on the side of the men, and the majority of those employed by Messrs. Dickenson and Messrs. Carr and Co. came out on strike on the 15th inst.

The whole of the plant belonging to the North of England Wagon Company, Limited, West Hartlepool, was sold by auction on Thursday last. The machinery, which has been idle for some years, was valued at £9000. The sale attracted a large number of buyers, and good prices were realised.

The accountants appointed by the Cumberland Coalowners' Association and the Miners' Association have issued their certificate for the quarter ending September 30th, which shows the net average selling price of coal to have been 5s. 3·57d. per ton.

The financial result of the recent visit of the members of the Iron and Steel Institute to Middlesbrough has been submitted to the subscribers to the guarantee fund by Mr. Walter Johnson, their honorary secretary. It appears that rather over £2000 was subscribed and between £1500 and £1600 was expended, leaving a balance on the right side of something like £500. Out of this residue a certain sum has been voted as a present to the Middlesbrough Volunteers for the use of their hall as a luncheon-room, and another sum to defray the cost of a piece of plate to be presented to Mr. Johnson, in recognition of his great services. A suitable contribution will also be made to Mrs. Rawdon, widow of the workman who unfortunately died of injuries received at the North-Eastern Steel Works during the visit. The balance will be returned *pro rata* to the subscribers.

The first council meeting of the Cleveland Institution of Engineers was held in the Exchange on Tuesday last, and was well attended. Mr. Edwin F. Jones was re-elected president for the ensuing session. The previous officers were also all re-elected. The result of the ballot for members of council showed no change, except the election of Mr. Edward Williams in place of Mr. J. W. Williams, who has left the district. The programme for the ensuing session seems likely to prove a very attractive one, including, as it does, some good names and papers on important subjects.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

The Glasgow pig iron market has been comparatively without animation during the past week. As the promised advance of miners' wages did not permanently affect the value of warrants, the damping-out of a considerable number of blast furnaces for a short time has failed to impart that strength to the market that might have been expected. The holders of warrants in some instances have been anxious to dispose of them, and as the inquiry has not been very pressing, prices naturally declined. In Messrs. Connal and Co.'s Glasgow warrant stores the increase in stocks has been arrested, there having, indeed, been a falling off in the course of the past week. The week's shipments of pig iron were 11,787 tons, as compared with 12,023 in the preceding week, and 14,199 in the corresponding week of 1882.

Business was done in the warrant market on Friday forenoon at 46s. 8d. to 46s. 7d. and again 46s. 8d. cash, the afternoon's quotations being 46s. 8½d. to 46s. 6d cash, and 46s. 9½d. to 46s. 7½d. one month. On Monday the quotations were 46s. 5½d. to 46s. 3½d. cash, and on Tuesday the price fell to 46s. 2½d. cash. Business was done on Wednesday down to 46s. 10½d. cash, while to-day—Thursday—a ½d. less was quoted, and the tone of the market was very flat.

There is not much change in the values of makers' iron, which are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 55s.; No. 3, 52s.; Coltness, 58s. and 52s.; Langloan, 57s. 6d. and 52s.; Summerlee, 56s. 6d. and 50s.; Chapelhall, 55s. and 52s.; Calder, 57s. and 49s.; Carnbroe, 54s. 6d. and 48s. 6d.; Clyde, 49s. 6d. and 47s. 6d.; Monkland, 48s. and 46s.; Quarter, 47s. 3d. and 45s.; Govan, at Broomielaw, 48s. and 46s.; Shotts, at Leith, 57s. 6d. and 53s.; Carron, at Grangemouth, 49s. (specially selected, 56s. 6d.) and 47s. 6d.; Kinneil, at Bo'ness, 48s. 6d. and 47s. 6d.; Glengarnock, at Ardrossan, 54s. and 47s.; Eglinton, 48s. 6d. and 45s. 3d.; Dalmellington, 48s. 6d. and 47s. 3d.

Last week's imports of minerals to the Clyde were smaller than usual, consisting of 2202 tons of ore from Bilbao, and 718 tons of copper pyrites from Huelva.

In the malleable iron department there is in most industries where the industry is prosecuted abundance of work, but at the same time, it is useless to disguise the fact that, owing to the paucity of fresh orders in the shipbuilding trade, the prospects are not regarded with satisfaction. The different branches of the iron-founding and engineering trades are likewise active at present, but are subject to a similar feeling of doubt as to the future.

The coal trade in the West of Scotland keeps fairly active, but it lacks the pressing demand that was experienced lately. The inquiry for shipment is not quite so good; and but for the three days' stoppage of work in the Hamilton district last week, some difficulty might possibly have been experienced in disposing of the current production. Among the principal shipments from Glasgow were 3500 tons to Odessa, 1385 tons to Martinique, 850 tons to Bordeaux, 700 tons to Barcelona, and 600 tons to Gothenburg. At Ayr 9059 tons of coal were dispatched in the course of the week, and 7322 tons at Troon. In the West prices are not materially altered, and it is regarded as quite uncertain whether the coal-masters will be able to secure an increase of prices on the 1st November, when they have promised to advance the miners' wages by 6d. a day. Business has scarcely been so brisk in Fife and the Lothians. The export of coal at Grangemouth during the week was 9212 tons. All over the country the inland consumption is good, and will doubtless improve as colder weather increases the household demand.

The agitation for increased wages so long carried on in Fifeshire appears as far as ever from being successful. A conference was lately asked for by the secretary of the men; but Mr. Connel, the mine-owners' secretary, has written that they cannot see their way to confer with the representatives of the men. They find that the current prices of coals do not warrant an advance of wages; but they suggest the adoption of a sliding scale for the regulation of wages.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

It is premature, perhaps, to state what the action of the associated coalowners will be in respect of wages for the next period; but it is expected that a small advance will be recorded. This certainly was the belief a short time ago. There are three sliding scales now in operation in the district—that of the associated owners, the Ocean, and the Ferndale. It has happened once or twice that the two last have declared advances when the sale prices of the associated owners did not justify one. Now the Ocean has signified that wages must remain unaltered, and Ferndale has declared a 2½ per cent. advance. It is most unfortunate in the interests of peaceful trade that the colliers cannot all be governed by one scale. The steam coal men are working tranquilly at present, and the tide of prosperity is still flowing in with unabated vigour. There is the fullest activity at all the ports, and a marked stiffness in price. Owners too are chary in accepting business, especially for future deliveries at distant dates. This condition does not extend to the sister trade.

The stagnation of the iron trade continues, and winter prospects are not encouraging. The only hopeful branch is that of tin-plate, which is moving up, and during last week has advanced 1s. per box and more for best samples. A large trade has been done in wasters, but this is declining, and the chief inquiry is for A 1 brands.

I hear rumours of a steel works to be started in Carmarthenshire, but have not much faith in anything far inland and out of the way of exports. A good venture, too, in the crucible steel line is projected for Glamorganshire by a capitalist, who has further the advantages of good technical knowledge and great energy of character. Names and places will be forthcoming in due time. In the present flourishing condition, capital is finding out various new channels of enterprise. I hear that an effort is making to convert the Glamorganshire Canal into a railway. This would run into the very heart of Cyfarthfa works, and command a series of collieries in Aberdare and Merthyr valleys.

A new line is projected too from Haverfordwest to St. David's. The country is sparsely peopled; agriculture not forward, but a small percentage might be realised on modern pilgrims, black cattle, lime phosphates, and farm produce. The trade done now is primitive. Sloops run into the little bays at high tide, open the hatchways, and drop the cargo in a heap in the sea, and at low tide this is taken away in small carts. I should like to see a railway let the light of civilisation into the country.

Pitwood is in good demand, but with acres of waste around the coal fields there is no growth. Last week prices advanced 1s.

The leading price at Welsh ports of best steam coal is 11s. per ton.

The strike of the ironworkers at Tondu is ending as strikes generally do. The joiners have resumed work at 5 per cent. reduction; the forgemen have had a slight concession, and will resume work forthwith, and the artisans are expected to follow.

Mr. Walker, the able contractor of the Severn Tunnel, has had another mishap in the form of an irruption of water in a prodigious volume, but at my last advices the pumps were getting the mastery.

An inquest on the sufferers of the Gelli, Rhondda, was held last week, and a verdict returned in accordance with the evidence, which showed a very bad condition in ventilating arrangements.

The North Wales colliers are agitating for an advance, but it is questionable if masters can give it.

Some degree of sympathy is being expressed in Wales by the colliers for the colliers of Staffordshire, though, as yet, I do not hear of any fund being started.

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.

9th October, 1883.

4777. Combing Machines, C. Hoyle, and I. and J. Ickringill, Keighley.
4778. Preventing or Neutralising Earth, &c., in Electric Telegraph Wires, J. Fletcher, Stockport.
4779. Furnaces, J. T. King.—(*S. Bissell, U.S.*)
4780. Electric Generators, H. B. Ford, London.
4781. Electric Conductors, J. G. Parker, London.
4782. Transmission of Loads, C. Hodgson, London.
4783. Cleaning Coal, &c., A. Sottiaux, Belgium.
4784. Coating Iron or other Metal with Metallic Copper, &c., A. Gutensohn, London.
4785. Calico Printing Machines, J. Millar and T. M'Killop, Glasgow.
4786. Frog Pad for Horses, C. C. Baird, Edinburgh.
4787. Electrical Synchronous Telegraphic and other Systems, S. Pitt.—(*P. B. Delany, New York, U.S.*)
4788. Telegraphy, S. Pitt.—(*P. B. Delany, U.S.*)
4789. Work-boxes, &c., W. Tween and E. Renaudin, London.
4790. Tickets or Labels, E. K. Dutton.—(*Z. T. Hall, Philadelphia, U.S.*)
4791. Permanent Way, J. Kenyon, Blackburn.
4792. Bleaching, &c., Hanks of Yarn, P. Thomas and J. Zweifel, Manchester.
4793. Railway Safety and Signal Systems, P. M. Justice.—(*C. Catala, Belgium.*)
4794. Rotary Stands, A. M. Clark.—(*C. A. Schmidt, New York, U.S.*)
4795. Fire-escapes, A. M. Clark.—(*J. Zerr, U.S.*)
4796. Bottle-washing Machines, A. M. Clark.—(*W. Cowles, New York, U.S.*)
4797. Air-compressors, &c., C. W. Potter, London.
4798. Sewing Machines, L. A. Groth.—(*G. Fraenkel, Berlin.*)
4799. Harvesting Machines, B. Samuelson.—(*The Marsh Harvester Company, Sycamore, U.S.*)
4800. Electro-magnets, J. H. Johnson.—(*E. F. Recordon, Geneva.*)
4801. Forming Plates, &c., for Secondary Batteries, H. J. Haddan.—(*C. F. Brush, Cleveland, U.S.*)
4802. Velocipedes, H. J. Haddan.—(*A. H. Overmann, Massachusetts, U.S.*)
4803. School Slates, H. J. Haddan.—(*G. Gray, R. Gray, G. W. Berrey, and G. O. Clarke, New York, U.S.*)
4804. Nails, H. J. Haddan.—(*A. E. Tenney, U.S.*)
4805. Bearings for Journals, &c., W. R. Lake.—(*R. W. Traylor, Richmond, U.S.*)
4806. Pulverising Machines, W. R. Lake.—(*R. D. Gates, Chicago, U.S.*)
4807. Permanent Way, G. J. Harcourt, Clifton.
4808. Venetian Blinds, A. J. Boult.—(*J. B. Querre, France.*)
4809. Hydraulic Steering Apparatus, D. P. Dey and G. M. Hathaway, New York, U.S.
4810. Registering, &c., Apparatus, W. P. Thompson.—(*J. C. Shoup, St. Louis, U.S.*)
4811. Railway Couplings, F. Hamilton, Liverpool.
4812. Catch for Umbrellas, W. P. Thompson.—(*V. D. Stockbridge, Washington, U.S.*)
4813. Sizing Paper, &c., T. Morgan.—(*F. Lienau, Germany.*)

10th October, 1883.

4814. Picking Motion for Looms, J. Richardson and J. Robinson, Farnworth.
4815. Electric Arc Lamps, H. W. Pendred, Crohill.
4816. Gas Motor Engines, T. M. Williamson, J. Malam, and W. A. Ireland, Southport.
4817. Propelling Velocipedes, &c., J. T. Sibree and T. F. Stenson, Handsworth.
4818. Treating Copper Mattes, F. Claudet, London.
4819. Sewing Machines, J. M'Hardy, Dollar.
4820. Steam Boilers, H. Turner, Oakfield.
4821. Railway Brakes, F. C. Glaser.—(*A. Bolzano, Germany.*)
4822. Strainer Plates, G. Tidcombe, jun., Watford.
4823. Snap-hooks, B. Wesselmann, Hamburg.
4824. Sheet Delivery Apparatus for Printing Machines, W. Conquest.—(*R. Hoe and Co., U.S.*)
4825. Door Knobs, G. W. Davis, Birmingham.
4826. Grinding Tools, A. F. G. Brown, Glasgow.
4827. Railway Brakes, F. R. Ellis, Liverpool.
4828. Cleaning Cotton, &c., J. Elce, Manchester.
4829. Separating Metals, J. J. Shedlock, Barnet.
4830. Pencil-cases, &c., J. Appleby, Birmingham.
4831. Preserving Wine, &c., R. Dunlop, Cardiff.
4832. Steam Heating Apparatus, T. Morgan.—(*H. Martini, Germany.*)

11th October, 1883.

4833. Hammock Chairs, C. Pieper.—(*E. Meyer, Prussia.*)
4834. Packing for Steam Engines, E. Turner, Bristol.
4834. Magneto Generators of Electricity, M. Benson.—(*J. P. Stabler, Maryland, U.S.*)
4836. Forming the Points of Augers, J. W. Simpson and J. M'Fie, Rutherglen.
4837. Spectacles, &c., W. Vale, Birmingham.
4838. Piston Rings, J. Kerfoot, London.
4839. Propelling Tricycles, &c., E. Sturge, London.
4840. Bridle Bits and Reins, J. C. Mewburn.—(*A. Haury, H. Rouvreau, and P. Guérineau, Paris.*)
4841. Screw Press, H. J. Haddan.—(*D. Lille, France.*)
4842. Money Tills, H. A. Costerton, Brighton.
4843. Gas Apparatus, E. Brook, Wigan.
4844. Purifying Lighting Gas, W. E. Gedge.—(*J. E. A. Servel, France.*)
4845. Substitute for India-rubber, R. L. Kirlew, Manchester.
4846. Ordnance Fittings, R. Morris, Blackheath.
4847. Indicating the Heating of Bearings of Engines, &c., H. P. Sherlock, Upton.
4848. Coloured Grained Leather, F. Wirth.—(*Hausmann Brothers, Germany.*)
4849. Controlling the Supply of Gas, W. R. Lake.—(*M. L. Gaillard, Paris.*)
4850. Torpedoes, C. A. McEvoy, London.
4851. Extracting Ores, A. P. Price, London.
4852. Compressing, &c., Powdered Substances, T. Davis, West Bromwich.

12th October, 1883.

4853. Solidifying Liquid Acids, C. Pieper.—(*Vorster und Grüneberg, Prussia.*)
4854. Grinding, &c., Machines, H. Sackur, Berlin.
4855. Penholders, J. M. Spink, London.
4856. Producing Gas, G. F. Redfern.—(*S. A. Giroudon, Paris.*)
4857. Enemas, C. H. Butlin, Camborne.
4858. Valves, M. Williams and A. Schottler, Cardiff.
4859. Boot Uppers, E. Kent, London.
4860. Burglar Alarms, H. J. Haddan.—(*L. Loicq, Belgium.*)
4861. Galvanising Wires, L. A. Groth.—(*E. Deutgen, Germany.*)
4862. Cutting-out Machine, L. A. Groth.—(*G. Fraenkel, Berlin.*)
4863. Stoppers for Bottles, L. Vallet, Liverpool.
4864. Vices and Chucks, J. Heap, Ashton-under-Lyne.
4865. Coupling Shafting, A. Muir, Manchester.
4866. Pencil, &c., Holders, S. Moore, Manchester.
4867. Fire-arms, D. Bentley, Aston.
4868. Water-waste Preventers, W. Smeaton, London.
4869. Porous Vessels, A. G. Biffo and G. Dionisio, London.

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4870. Combined Locket and Telescope, H. Hoheisen, Germany.
4871. Producing Ammonia, &c., H. Simon and W. Smith, Manchester.
4872. Cartridges, C. D. Abel.—(*W. Lorenz, Germany.*)
4873. Pumps or Syphons, J. Longshaw, Salford.
4874. Retort Charging, &c., Machines, J. Woodward, Ancoats, and W. Foulis, Glasgow.
4875. Electric Arc Lamps, W. H. Akester and R. Mitchell, Glasgow.
4876. Kilns, J. Briggs, Buxton.
4877. Cooking Apparatus, J. C. Baxter, Reigate.
4878. Steam Engines, C. Jacobsen, Stockholm.
4879. Treating Gold Ores, &c., H. R. Cassel, London.
4880. Telephonic Apparatus, G. L. Anders, London.
4881. Electrical Bell, C. B. Harness, London.
4882. Tiles, L. J. Meakin, Burton-on-Trent.
4883. Transcribing Marks, &c., M. T. Neale, London.
4884. Ticketing Bobbins, E. Weild, Manchester.
4885. Dynamo-electric Machines, C. Benton, London.
4886. Converting Furnaces, W. R. Lake.—(*P. Manhés, France.*)
4887. Torpedoes, T. Nordenfelt, London.
4888. Street Sweeping Machines, A. Greig, Leeds.
4889. Pumps, W. Cowley, Liverpool.
4890. Boiling Pans, &c., W. Briggs and R. Taylor, Darwen.
4891. Spinning, &c., Machinery, W. J. Kinder, Manchester.
4892. Disinfecting Apparatus, O. Schimmel, Saxony.
4893. Fastenings, R. Lewty, Manchester.
4894. Kilns, S. de la G. Williams, Birmingham.

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4895. Torpedoes, R. H. Brandon.—(*W. E. Winsor, U.S.*)
4896. Torpedoes, &c., J. Mathieson, Stratford.
4897. Packing Cases, D. Rylands.—(*J. B. Groot, U.S.*)
4898. Coupling Electric Accumulators, A. C. Henderson.—(*G. Philippart, Paris.*)
4899. Fastening for the Ends of Machine Bands, J. R. Gould, Birmingham.
4900. Looms, A. G. Bateman, Manchester.
4901. Treating Cotton Seed, P. M. Justice.—(*J. F. O'Shaughnessy, New York, U.S.*)
4902. Lamps, E. Grube, Hamburg.
4903. Mills, W. R. Lake.—(*J. M. Simon, Paris.*)
4904. Heating and Cooling Liquids, W. and G. Lawrence, London.
4905. Treating Paper for Cheques, &c., to Prevent Fraud, W. J. Clapp, Nantyglo.
4906. Centrifugal Machines, E. Fiechter.—(*L. B. Fiechter, Minneapolis.*)
4907. Treating the Lungs and Respiratory Organs, W. P. Thompson.—(*J. Ketchum, jun., Brooklyn, U.S.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

4776. Heating, &c., Gases, W. A. Bartlett, Washington, U.S.—Com. from G. E. Haight, W. H. Wood, and W. E. Winsor, New York, U.S.—*8th October*, 1883.
4803. School Slates, H. J. Haddan, London.—A communication from G. Gray, R. Gray, G. W. Berrey, and G. O Clarke, New York, U.S.—*9th October*, 1883.
4804. Nails, H. J. Haddan, London.—Com. from A. E. Tenney, Rhode Island, U.S.—*9th October*, 1883.
4806. Pulverising Machines, W. R. Lake, London.—A communication from R. D. Gates, Chicago, U.S.—*9th October*, 1883.
4835. Magneto Generators of Electricity, M. Benson, London.—A communicationfrom J. B. Stabler, Sandy Spring, U.S.—*11th October*, 1883.

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

4094. Extracting Copper, &c., from their Ores, W. Elmore, London.—*8th October*, 1880.
4098. Furnaces, G. A. Dick, London.—*9th October*, 1880.
4100. Valves for Gas, &c., J. Woodward, Ancoats.—*9th October*, 1880.
4116. Transmitting Electrical Currents, W. R. Lake, London.—*9th October*, 1880.
4175. Bolt-making Machines, S. Gallie, Birkenhead.—*14th October*, 1880.
4274. Raising and Throwing Water, &c., C. Kesseler, Berlin.—*20th October*, 1880.
4104. Labels, &c., W. R. Harris and J. G. Cooper, Manchester.—*9th October*, 1880.
4143. Purifying Gas, H. and F. C. Cockey, Frome Selwood.—*12th October*, 1880.
4176. Tubes for Railway Brakes, C. Moseley, Manchester.—*14th October*, 1880.
4285. Repairing and Lining Bessemer Converters, &c., S. G. Thomas, London, and P. C. Gilchrist, Redcar.—*21st October*, 1880.
4300. Mowing, &c., Machines, E. Smith, Pittsburgh, U.S.—*21st October*, 1880.
4334. Producing Saccharine Substances, S. H. Johnson, Stratford.—*23rd October*, 1880.
4125. Covers for Cellar Openings, J. Mathewson and G. Tidey, Kilburn.—*11th October*, 1880.
4126. Water-closets, D. T. Bostel, Brighton.—*11th October*, 1880.
4185. Valve Gearing, F. C. Marshall, Tynemouth.—*14th October*, 1880.
4188. Locks, H. K. Bromhead, Glasgow.—*15th October*, 1880.
4251. Portable Hydrant, J. H. Greathead, London.—*19th October*, 1880.
4347. Tunnelling Machinery, T. English, Hawley.—*25th October*, 1880.
4180. Brace-ends, A. S. Taylor, Manchester.—*14th October*, 1880.
4241. Sticks for Umbrellas, &c., C. D. Abel, London.—*18th October*, 1880.
4291. Breech-loading Small-arms, J. F. Swinburn, Birmingham.—*21st October*, 1880.
5153. Adjustable Apparatus, R. W. Gossage, Deptford.—*13th October*, 1880.
4173. Fire-lighters, J. F. Wiles, London.—*13th October*, 1880.
4202. Finishing Cashmere and other Stuff Goods, J., J. W., and J. Reffitt, Leeds.—*15th October*, 1880.
4210. Safety Fastener for the Strikers, &c., of Guns, H. A. Silver and W. Fletcher, London.—*15th October*, 1880.
4269. Hydraulic Lifts, E. B. Ellington, Chester.—*20th October*, 1880.
4280. Securing Ships' Cables, T. Archer, jun., Dunston.—*20th October*, 1880.

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

4101. Lace Machines, E. Simon, Paris.—*23rd October*, 1876.
3909. Wire or Metal Brushes, G., R., and E. Ashworth, Manchester.—*10th October*, 1876.
3921. Double Texture Waterproof Fabrics, T. Forster, Streatham.—*10th October*, 1876.
4011. Circle Combs, &c., T. W. Harding, Leeds.—*17th October*, 1876.
4074. Floors and Roofs, G. Evans, London, and R. Swain, Ludlow.—*21st October*, 1876.
4176. Forming and Maintaining Ice Surfaces, J. Gamgee, London.—*28th October*, 1876.

Notices of Intention to Proceed with Applications.

(*Last day for filing opposition, 2nd November*, 1883.)

2826. Fixing Stereo Plates in Position, T. T. Hodgson, London.—*7th June*, 1883.
2832. Connecting and Disconnecting Electrical Circuits, &c., H. H. Cunynghame, O. E. Woodhouse, and F. L. Rawson, London.—*7th June*, 1883.
2840. Separating and Sorting Grain, J. H. Gatward, Hitchin.—*7th June*, 1883.
2843. Manufacture of Coke, &c., H. Hutchinson, London.—*7th June*, 1883.
2844. Rolling Tubes, &c., C. Kellogg, Buffalo, N.Y.—*7th June*, 1883.
2860. Looms for Weaving, W. Irving and F. Howarth, Liversedge.—*8th June*, 1883.
2890. Hot-water Boilers, &c., J. Collier and M. H. Smith, Halifax.—*9th June*, 1883.
2895. Producing Light by Electricity, W. P. Thompson, London.—A communication from R. J. Sheehy.—*9th June*, 1883.
2922. Electric Meters, J. E. H. Gordon, London.—*12th June*, 1883.
2937. Steam Tricycle, J. Imray, London.—A communication from La Société Hemart et Compagnie.—*13th June*, 1883.
2970. Disintegrating Rags, &c., C. Pieper, Berlin.—A communication from H. Friederichs and C. Philippi. *14th June*, 1883.
2975. Ends of Braces, G. Walker, Birmingham.—*15th June*, 1883.
3059. Ironing Machine, R. Mindt, Berlin.—*20th June*, 1883.
3165. Attaching Rails to Metallic Sleepers, R. H. Brandon, Paris.—A communication from E. Tölcke and C. Eichhorn.—*26th June*, 1883.
3358. Pistons, J. Elliot, J. S. Jeffery, and T. Kerman, Cardiff.—*6th July*, 1883.
3364. Boots and Shoes, I. Drakeford, Northampton.—*6th July*, 1883.
3396. Door Springs, D. and S. Timings, Birmingham.—*9th July*, 1883.
3410. India-rubber Springs, G. Spencer, London.—*10th July*, 1883.
3594. Box or Case for Parcels Post, R. B. Jackson, London.—*21st July*, 1883.
3751. Pencils, &c., J. Hickisson and W. Lee, London.—*31st July*, 1883.
3835. Counteracting the Thrust of Shafts, G. A. Teulon, London.—*7th August*, 1883.
4216. Metal Heels for Boots, J. W. Jones and E. K. Bridger, London.—*1st September*, 1883.
4291. Gas Engines, C. H. Andrew, Stockport.—*6th September*, 1883.
4332. Boots and Shoes, A. Hannibal, London.—*10th September*, 1883.
4372. Effecting Continuous Feed, &c., of Granular or Pulverulent Material, C. H. Gill, London.—*12th September*, 1883.
4391. Preparing Raw Hide, A. G. Brookes, London.—Com. from O. E. Wait.—*13th September*, 1883.
4746. Raising Water from Wells, A. J. Boult, London.—A communication from J. B. Yeagley.—*5th October*, 1883.

(*Last day for filing opposition, 6th November*, 1883.)

2910. Milling, &c., Felt Hat Bodies, J. Southworth and W. Hamnett, Stockport.—*12th June*, 1883.
2913. Burning Small Pyrites, &c., M. Finch, Silvertown, and W., J., and S. Willoughby, Plymouth.—*12th June*. 1883.
2927. Gas Motor Engine, F. H. W. Livesey, London.—*12th June*, 1883.
2929. Water-closets, F. Piercy, London.—*12th June*, 1883.
2932. Cowls, &c., J. W. Holland, London.—*12th June*, 1883.
2935. Looms for Weaving, R. S. and R. Collinge, Oldham.—*13th June*, 1883.
2942. Spinning Machinery, F. Heslop, Leeds.—*13th June*, 1883.
2955. Regenerative Lamps and Gas-burners, C. Pieper, Berlin.—A communication from H. Studer.—*14th June*, 1883.
2956. Boilers, E. G. Rock, London.—A communication from J. Lees and J. W. Rock.—*14th June*, 1883.
2957. Tricycles, &c., R. C. Jay, London.—*14th June*, 1883.
2960. Looms for Weaving, W. H. Kenyon, Denby Dale, near Huddersfield.—*14th June*, 1883.
2964. Enamelling Moulded Articles, C. D. Abel, London.—A communication from A. Schierholz.—*14th June*, 1883.
2965. Storing and Retaining Electric Energy, F. J. Cheesbrough, Liverpool.—A communication from C. T. Tomkins.—*14th June*, 1883.
2974. Pencils, J. F. Williams, Liverpool.—*15th June*, 1883.
2981. Autotypographical Machine for Engraving Types, L. A. Groth, London.—A communication from D. F. Berdugo y Ortiz.—*15th June*, 1883.
2983. Washing and Scouring Wool, H. J. Haddan, London.—Com. from E. Tremsal.—*15th June*, 1883.
2984. Electric Wire Conductors, &c., J. Greenwood, Bacup.—*15th June*, 1883.
2999. Washing, &c., Fabrics, J. and P. Hawthorn and and J. P. Liddell, Newtown.—*16th June*, 1883.
3009. Steam Boilers, T. Carter, Sunderland.—*16th June*, 1883.
3021. Stoppering Bottles, &c., J. Phillips, London.—*19th June*, 1883.
3042. Breech-loading Cannon, &c., S. Pitt, Sutton.—Com. from R. S. Ripley.—*19th June*, 1883.
3046. Lathes for Watchmakers, &c., A. M. Clark, London.—Com. from M. Potter.—*19th June*, 1883.
3060. Feeding Thrashing Machines, R. R. Holben and S. Wilkersen, Cambridge.—*20th June*, 1883
3074. Dynamo-electric Machines, M. Deprez, Paris.—*21st June*, 1883.
3179. Tricycles, &c., C. Harvey, jun., Yardley, and W. Paddock, Birmingham.—*26th June*, 1883.
3471. Fastenings for the Hames of Horses, F. B. Goodman, Birmingham.—A communication from F. O. Minor.—*13th July*, 1883.
3531. Manufacturing Steel, W. Naylor, Penistone.—*18th July*, 1883.
3791. Direct-acting Pumping Engines, W. Clark, London.—A communication from E. G. Shortt.—*2nd August*, 1883.
3817. Polishing and Grinding Metallic Tubes, &c., C. Harvey, jun., Yardley, and W. Paddock, Birmingham.—*4th August*, 1883.
4054. Universal Joints, W. G. Edmonds, Devonport.—Com. from R. Edmonds.—*21st August*, 1883.
4152. Producing Prints, &c., of Photographic Pictures, E. de Zuccato, London.—*28th August*, 1883.
4153. Producing Prints, &c., of Photographic Pictures, E. de Zuccato, London.—*28th August*, 1883.
4154. Producing Prints, &c., of Photographic Pictures, E. de Zuccato, London.—*28th August*, 1883.
4159. Sewing Machines, H. Grellier, London.—*28th August*, 1883.
4190. Attachment to Tricycles, &c., E. Wiedlich and M. Mitchell, London.—*30th August*, 1883.
4293. Operating Corliss Valves, J. Musgrave, Bolton.—*6th September*, 1883.
4421. Signalling, A. P. Price, London.—*15th September*, 1883.
4678. Attaching Buttons to Fabrics, J. F. Atwood, Boston.—*2nd October*, 1883.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 12th October*, 1883.)

1516. Coffee Roasters, G. H. Pfeifer, Germany.—*22nd March*, 1883.
1895. Generating, &c., Electricity for Medicinal and other Purposes, R. V. Ash, London.—*14th April*, 1883.
1899. Trap for Rats, &c., E. Edwards, London.—*14th April*, 1883.
1904. Looms for Weaving, T. Singleton, Over Darwen.—*14th April*, 1883.
1905. Winding Yarn and Thread, J. Liddell, J. S. and S. H. Brierley, F. W. Hirst, and D. Hamer, Huddersfield.—*14th April*, 1883.
1914. Furnace Bars and Fire Grates, G. L. Scott, Manchester.—*16th April*, 1883.
1929. Metallic Springs, J. Pring, Sandbach.—*17th April*, 1883.
1939. Boxes, Cases, &c., A. G. Speight, London.—*17th April*, 1883.
1943. Albums, R. Mosar, Berlin.—*17th April*, 1883.
1947. Hand-weaving Devices, E. Wernicke, Berlin.—*17th April*, 1883.
1958. Padding and Oiling Apparatus, C. A. Paterson, Lennoxtown.—*18th April*, 1883.
1971. Exposing Articles to the Action of the Sun's Rays, W. Cooke, London.—*18th April*, 1883.
1975. Reversing Valve Mechanism for Marine Engines, A. Paul, Dumbarton.—*19th April*, 1883.
1991. Dynamo-electric Machines, W. P. Thompson, London.—*19th April*, 1883.
2001. Drilling Boiler Flues, &c., S. Borland, Manchester.—*20th April*, 1883.
2019. Locking the Nuts upon the Bolts by which Fish Plates are Secured to Rails, G. Grover, London.—*20th April*, 1883.
2125. Tricycles, &c., O. Pihlfeldt, Redcar.—*26th April*, 1883.
2126. Filtering Water, &c., F. H. Atkins, London.—*26th April*, 1883.
2135. Cutting, &c., Patterns on Textile Fabrics, H. Pataky, Berlin.—*27th April*, 1883.
2192. Gas Engines, P. M. Justice, London.—*1st May*, 1883.
2213. Steam Road Engine Traction Wheels, A. J. Boult, London.—*1st May*, 1883.
2216. Manufacturing Horn and Bone Strips, H. A. Lyman, London.—*1st May*, 1883.
2232. Spinning, B. A. Dobson and W. H. Singleton, Bolton.—*2nd May*, 1883.
2296. Dyes, G. A. Bang, Leeds.—*5th May*, 1883.
2320. Submarine Torpedo Boat, J. Davies, near Farnborough.—*8th May*, 1883.
2334. Vegetable Oils, C. F. Stollmeyer, London.—*8th May*, 1883.
2535. Artificial Stone, F. H. F. Engel, Germany.—*21st May*, 1883.
3086. Railway Chairs, J. Hopkinson, Rowsley.—*21st June*, 1883.
3125. Spades and Shovels, J. Sidaway, Halesowen.—*23rd June*, 1883.
3149. Lubricating Compounds, T. Colgan, Brooklyn.—*26th June*, 1883.
3255. Exhausting, Forcing, and Pumping Gas, &c., W. B. Wright, Bromley-by-Bow.—*30th June*, 1883.
3288. Busk and other Fastenings, H. A. Lyman, London.—*3rd July*, 1883.
3526. Marine Drags, W. Clark, London.—*17th July*, 1883.
3553. Electric Meters, G. Hammersley and C. H. Worsey, London.—*19th July*, 1883.
3577. Producing Embroidery, C. F. Bally, Switzerland.—*20th July*, 1883.
3822. Treatment of Drawings or Designs Printed on Paper, G. Rydill, London.—*4th August*, 1883.

(*List of Letters Patent which passed the Great Seal on the 16th October*, 1883.)

1401. Top Notches for Umbrellas, W. Milner, Carbrook.—*16th March*, 1883.
1935. Vessels for Holding Oils, G. A. J. Schott, Bradford.—*17th April*, 1883.
1938. Life Boats, N. Hamblin, jun., London.—*17th April*, 1883.
1946. Cutting Cloth, A. J. Boult, London.—*17th April*, 1883.
1963. Paring the Brims of Hats, F. L. Marsh, Bristol, and J. Cree, Denton, near Manchester.—*18th April*, 1883.
1965. Oil Lamps, H. E. Phillipson, Dublin.—*18th April*, 1883.
1976. Felt Hats, J. Eaton, Stockport.—*19th April*, 1883.
1980. Regulating the Speed of Machinery, &c., W. O. Aves and G. Moss, London.—*19th April*, 1883.
1981. Tires, W. O. Aves and G. Moss, London.—*19th April*, 1883.
1987. Burner for Oil Lamps, A. Rettich, London.—*19th April*, 1883.
1989. Sewing Machines, J. Fox, London.—*19th April*, 1883.
1997. Doors, &c., for Furnaces, J. Shepherd, Manchester.—*19th April*, 1883.
1998. Electric Batteries, B. W. Webb and H. P. F. and J. Jensen, London.—*19th April*, 1883.
2002. Fire-extinguishing Apparatus, W. Miller, Glasgow.—*20th April*, 1883.
2004. Stentering, &c., Woven Fabrics, J. Smith, Renfrew.—*20th April*, 1883.
2008. Registering the Number of Games of Lawn-tennis, E. J. C. Baird, Ripple House, near Deal.—*20th April*, 1883.
2016. Grooving Metal, &c., Rolls, A. B. Wilson, Holywood.—*20th April*, 1883.
2027. Displaying Goods, W. P. Thompson, London.—*21st April*, 1883.
2035. Concentrating Sulphuric Acid, S. B. Bowen, Llanelly.—*21st April*, 1883.
2041. Indicating the Velocities of Air Currents, J. Thompson, Bolton-le-Moors.—*21st April*, 1883.
2057. Electric Lamps, &c., W. Hochhausen, New York.—*23rd April*, 1883.
2058. Magneto, &c., Machines, W. Hochhausen, New York.—*23rd April*, 1883.
2072. Ash Buckets, R. D. Jones, Liverpool.—*24th April*, 1883.
2099. Flushing Water-closets, J. and I. Haigh, West Bromwich.—*25th April*, 1883.
2106. Giving Motion to Fluids, W. Smedley, Liverpool.—*26th April*, 1883.
2163. Tackle for Hauling, H. Johnson, jun., West Bromwich.—*28th April*, 1883.
2169. Jet Nozzles of Garden Engines, E. Hainer, Horsmonden.—*28th April*, 1883.
2173. Fulling Machines, P. Legrand, Paris.—*30th April*, 1883.
2214. Apparatus to be Used in Connection with Electrical Accumulators, C. A. A. Capito, Blackheath.—*1st May*, 1883.
2268. Measuring the Strength of Electric Currents, F. V. Andersen, London.—*4th May*, 1883.
2277. Facilitating Measurement, W. R. Lake, London.—*4th May*, 1883.
2372. Ship Windlasses, F. S. Manton, Providence, U.S.—*9th May*, 1883.
2442. Plates for Secondary Batteries, W. Hochhausen, New York.—*15th May*, 1883.
2445. Controlling the Supply of Gas, S. Hyams, Guernsey.—*15th May*, 1883.
2670. Dynamo-electric Machines, W. Hochhausen, New York.—*29th May*, 1883.
3050. Rotary Blowing and Exhaust Fans, H. Aland, London.—*20th June*, 1883.
3123. Electrical Apparatus, &c., W. Hochhausen, New York.—*23rd June*, 1883.
3289. Perspective Drawing Apparatus, H. J. Haddan, London.—*3rd July*, 1883.
3329. Boring Holes in Coal, &c., G. E. Vaughan, London.—*5th July*, 1883.
3565. Plates or Electrodes for Secondary, &c., Batteries, R. Cunningham, London.—*20th July*, 1883.
3684. Iron Ships' Compasses, B. Biggs, Cardiff.—*27th July*, 1883.
3931. Fluid Meters, H. H. Lake, London.—*14th August*, 1883.
3966. Button Fastener, W. R. Lake, London.—*15th August*, 1883.
4036. Fertilisers, H. J. Allison, London.—*21st August*, 1883.
4044. Fibrous Packing, S. Pitt, Sutton.—*21st August*, 1883.
4051. Stoppers for Bottles, H. H. Lake, London.—*21st August*, 1883.

List of Specifications published during the week ending October 13th, 1883.

*983, 4d.; *2443, 6d.; *3134, 4d.; *5220, 4d.; *5184, 4d.; *2330, 6d.; 3809, 4d.; 24, 3s. 10d.; 713, 4d.; 797, 2d.; 804, 6d.; 821, 2d.; 825, 2d.; 832, 4d.; 841, 2d.; 853, 2d.; 856, 2d.; 857, 2d.; 862, 2d.; 866, 2d.; 867, 6d.; 868, 2d.; 869, 10d.; 874, 2d.; 878, 2d.; 881, 2d.; 883, 2d.; 886, 2d.; 887, 2d.; 888, 2d.; 898, 6d.; 901, 2d.; 902, 2d.; 904, 6d.;

908, 2d.; 909, 2d.; 912, 2d.; 913, 2d.; 916, 1s. 4d.; 919, 2d.; 921, 6d.; 926, 2d.; 929, 2d.; 930, 2d.; 932, 6d.; 934, 2d.; 935, 6d.; 936, 2d.; 939, 2d.; 941, 6d.; 946, 2d.; 947, 6d.; 951, 2d.; 952, 6d.; 953, 6d.; 954, 4d.; 955, 6d.; 956, 4d.; 957, 4d.; 958, 2d.; 962, 6d.; 964, 10d.; 965, 8d.; 966, 2d.; 969, 2d.; 970, 2d.; 971, 6d.; 972, 6d.; 973, 6d.; 974, 2d.; 975, 2d.; 976, 2d.; 977, 6d.; 978, 6d.; 979, 6d.; 981, 6d.; 983, 2d.; 983, 8d.; 985, 6d.; 986, 6d.; 988, 2d.; 990, 2d.; 991, 4d.; 992, 6d.; 993, 2d.; 994, 6d.; 995, 4d.; 997, 2d.; 1000, 6d.; 1001, 2d.; 1003, 2d.; 1004, 6d.; 1005, 2d.; 1006, 6d.; 1007, 6d.; 1009, 6d.; 1010, 6d.; 1011, 2d.; 1012, 2d.; 1013, 6d.; 1014, 1s. 2d.; 1015, 2d.; 10 6, 2d.; 1017, 2d.; 1018, 6d.; 1019, 6d.; 1020, 6d.; 1022, 6d.; 1023, 2d.; 1024, 6d.; 1025, 6d.; 1026, 6d.; 1027, 6d.; 1028, 6d.; 1029, 6d.; 1030, 6d.; 1031, 2d.; 1032, 4d.; 1033, 6d.; 1035, 6d.; 1036, 4d.; 1037, 4d.; 1038, 2d.; 1040, 6d.; 1041, 6d.; 1042, 6d.; 1043, 6d.; 1044, 6d.; 1045, 4d.; 1047, 6d.; 1049, 6d.; 1050, 2d.; 1055, 6d.; 1058, 6d.; 1059, 6d.; 1060, 8d.; 1061, 4d.; 1064, 6d.; 1067, 6d.; 1070, 6d.; 1073, 6d.; 1082, 2d.; 1091, 6d.; 1093, 6d.; 1117, 4d.; 1126, 4d.; 1127, 6d.; 1215, 8d.; 1351, 4d.; 1356, 2d.; 1434, 8d.; 1442, 6d.; 1545, 1s. 8d.; 1546, 1s. 2d.; 2868, 4d.; 3096, 4d.; 3111, 2d.; 3655, 1s.

*** 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.*

3809. Manufacture of Certain Chemicals and their Purification from Iron, *J. W. Kynaston, Liverpool.*—10*th August*, 1882. 4*d.*

The object is the manufacture more especially of sulphate of alumina free from iron, but it also relates to the extraction of ferruginous matters from other salts that will not suffer decomposition by the addition of peroxide of manganese.

24. Generation, Storage, Distribution, Regulation, Measurement, and Utilisation of Electricity, &c., *J. S. Williams, Riverton, New York, U.S.*—1*st January*, 1883. 3*s.* 10*d.*

The inventor utilises the earth, railway lines, water and gas pipes, and water channels as one conductor, the return being made by an insulated conductor. This lengthy specification contains seventy-eight pages, and relates to a method of distribution, regulating the supply of energy, the construction of dynamo-electric generators and electro-motors, to the employment of windmills, water-wheels, gas engines, &c. Reference is made to seven former specifications.

369. Machinery for Breaking, Scutching, and Combing Textile Plants and Materials, *B. J. B. Mills, London.*—16*th February*, 1883.—(*A communication from N. de Landtsheer, Paris.*)—(*Not proceeded with.*) 10*d.*

This consists in an arrangement of machine whereby the breaking, scutching, and combing of the textile plants and materials can be effected automatically and simultaneously either in the dry or green state.

713. Hose Reels, &c., *J. T. Foot, Hammersmith.*—9*th February*, 1883. 4*d.*

This relates, First, to a turnover handle as applied to hose reels; Secondly, the combination of a pump with the hose or tubing and the reel; Thirdly, a valve plug.

797. Dynamo-electric and Magneto-electric Machinery, &c., *F. Wynne, London.*—13*th February*, 1883.—(*Not proceeded with*) 2*d.*

Relates to the application of differential gearing to electric motors, in which both the armature and field magnets revolve and drive discs, these in turn driving a coned cylinder.

804. Construction of Dynamo-electric Machines, &c., *H. T. Barnett, London*—14*th February*, 1883. 6*d.*

To suppress the induced currents in the core pieces of the armatures and field magnets of electric generators, the coils are wound on a false core, which is afterwards removed, and a core composed of finely divided magnetic metal, each granule of which is coated with a film of varnish, is inserted in the space left. The coils are fixed to the face of the disc armature by bolts and nuts.

821. Calendar Ring, *A. E. Maudslay, Littlebourne.*—14*th February*, 1883.—(*Provisional protection not allowed.*) 2*d.*

This relates to a calendar which may be worn as a finger ring or necktie ring.

825. Apparatus for Irrigating Gardens with Waste Water from Households, *W. Blakeley, Bournemouth.*—14*th February*, 1883.—(*Not proceeded with.*) 2*d.*

The apparatus consists of a slop sink in communication, by means of conduits, with pipes laid in the garden, at or near the surface of the earth.

832. Machinery to be Operated by Hydraulic or other Power for Raising Weights, &c., *W. R. Lake, London.*—15*th February*, 1883.—(*A communication from A. S. de la Pena and L. Drumen, Madrid.*) 4*d.*

This relates to the peculiar arrangement of levers in connection with pumps, counterweights for maintaining the equilibrium, a drum, pinions, and a ratchet device.

841. Stoppers for Drawing off and Stoppering Liquids in Bottle, *E. Wright, Leyton.*—15*th February*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to provide a stoppering device and a draw-off tap.

853. Rock Drills, *J. W. Larmuth and R. B. Howarth, Pendleton.*—16*th February*, 1883.—(*Not proceeded with.*) 2*d.*

The principal object is to economise the consumption of the fluid pressure.

856. Apparatus for Registering Fares, *W. Taylor, Tottenham.*—16*th February*, 1883.—(*Not proceeded with.*) 2*d.*

This refers to registering alarm punches to be used for punching tickets and registering one or more fares on and by the same ticket.

857. Apparatus for Decorating Pastry, &c., *E. Raths, Switzerland.*—16*th February*, 1883.—(*Provisional protection not allowed.*) 2*d.*

This relates to the application of metallic patterns.

862. Manufacture of Fire Lighters, *G. W. von Nawrocki, Berlin.*—16*th February*, 1883.—(*A communication from C. Mohr, Berlin.*)—(*Not proceeded with.*) 2*d.*

This relates to a novel combination of substances for producing fire lighters.

866. Apparatus for Hat-pressing Machines, *H. C. Birley, Manchester.*—16*th February*, 1883.—(*Void.*) 2*d.*

This relates to the machines used for pressing hats by hydraulic pressure, in which a flexible bag is used to receive the water and act as the top or internal die of the pressing machine.

867. Apparatus for Generating and Utilising Electricity, *F. M. Newton, Belfast.*—16*th February*, 1883. 6*d.*

The commutator consists of a copper tube attached to an insulated hub, and cut into four parts by diagonal slits, at such an angle to the axis that each section of the tube shall embrace about three-eighths of the circumference. Ordinary brushes, having a width equal to the length of the tube, are used. The core of the armature is formed of iron filings mixed with insulating material. Various methods of winding the armature are described. In an arc lamp the carbons are impelled through porcelain tubes provided with projecting fingers near their ends.

868. Pads, Sponges, and Mops for Baths, Washing and Cleaning Carriages, Windows, Horses, &c. *C. Jack, London.*—(*Not proceeded with.*) 2*d.*

The pad, sponge, or mop is provided with a reservoir for containing cleansing fluid or materials.

874. Apparatus to be Attached to Candles for the Prevention of Guttering and for Ensuring a Steady Light, *J. B. Goodwin, London.*—17*th February*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the employment of a cap and shade.

878. Apparatus for Ventilating Ships. *D. Gilchrist, Pollockshields, and J. Barr, Kilmarnock, N.B.*—17*th February*, 1883.—(*Not proceeded with.*) 2*d.*

The apparatus may be arranged and worked so as to promote continuous ventilation either by an exhausting or by an injecting action, or by both.

881. Manufacture of Batting Gloves used by Cricketers, *J. G. Heap, Manchester.*—17*th February*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to allow the cricketer to obtain a firm grip of the bat handle, at the same time that the backs of the fingers are safely protected from injury.

883. Apparatus for Giving Medicine to Animals, *A. Patchett, Mill Green, Lincolnshire.*—17*th February*, 1883.—(*Not proceeded with.*) 2*d.*

The medicine is forced down the throat by a piston working in a barrel and discharged by a spring trigger.

886. Dating and Endorsing Hand Stamps, *G. K. Cooke, London.*—17*th February*, 1883.—(*Not proceeded with.*) 2*d.*

This refers particularly to those stamps having letters or figures in relief on india-rubber rods fixed on flexible bands, which can be turned as required around an interior fixed piece of suitable form.

887. Apparatus for Measuring and Laying down the Shape of Articles of Clothing, *E. Edwards, London.*—17*th February*, 1883.—(*A communication from P. Guiyonnet, Paris.*)—(*Not proceeded with.*) 2*d.*

This relates to a number of horizontal, and more or less vertical, strips of flexible steel, divided into inches and fractions of inches, or other convenient divisions.

888. Looms for Weaving, *J. Almond, Blackburn.*—17*th February*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to several improvements in the general construction.

898. Condensing and Distilling Apparatus for Ships, *J. Tweedy, Walker.*—19*th February*, 1883. 6*d.*

This consists in fitting a surface condenser to be used either for condensing the exhaust steam from the winches, cranes, or other similar machines, or for distilling fresh water from salt or other impure water, combined and fitted with donkey pumps so arranged that the pumps shall be available both for performing the ordinary duties of such pumps on board ship, and for being used as air and circulating pumps in connection with the condenser when condensing exhaust steam, or as circulating pumps when distilling fresh water.

901. Machinery or Apparatus for Printing Calico, &c., *C. Hindle, Rawtenstall, and J. H. Canavan, Salford.*—19*th February*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to improvements in an arrangement of the "doctor."

902 Velocipedes, *G. P. Smith, Tunbridge Wells.*—19*th February*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to improvements in the mode of propelling velocipedes on ordinary roads and of increasing the power of ascending hills; and relates also to improvements in the construction of the frame and other parts, and also in the steerage of these vehicles.

904. Waste-preventing Cisterns, *B. C. Cross, Leeds.*—19*th February*, 1883. 6*d.*

The object is to provide a waste-preventing cistern for closets, &c., where a certain quantity is required at each discharge of the cistern.

908. Lenses for Signal Lamps or Lanterns, *J. Rogers, London.*—16*th February*, 1883.—(*Not proceeded with.*) 2*d.*

The lens is constructed of two plano-convex lenses of ordinary white glass placed with their plane surfaces contiguous to each other, and between them is placed a disc of glass of the colour required.

909. Manufacture of Bricks, Tiles, or Slabs, *J. C. Bloomfield, Blen-y-luny, and J. Mcburn, Ballymagharan, Fermanagh.*—19*th February*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to render the bricks, tiles, or slabs impervious to liquid.

912. Davits and Apparatus for Raising and Lowering Ships' Boats, *D. Pattison, London.*—19*th February*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to an improved construction and arrangement of the davits used for suspending ships' boats, by which their safe launching under all circumstances can be effected to leeward or windward.

913. Electrical Fuses and their Application to Electrical Firing, *S. J. Mackie and J. S. Warburton, London.*—19*th February*, 1883.—(*Not proceeded with.*) 2*d.*

To prevent the withdrawal of the fuse, the conducting wires are looped back and secured to the fuse.

916. Manufacture of Gases and Vapours for Heating and Illuminating Purposes, &c., *W. Arthur, London.*—20*th February*, 1883.—(*A communication from G. P. Gill, New York.*) 1*s.* 4*d.*

This relates to improvements in the general construction of the apparatus.

919. Water Waste Preventers, *F. G. Fleury, London.*—20*th February*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the construction of an automatic water waste preventer.

921. Water Gauges of Steam Boilers, *J. Holden, Swindon.*—20*th February*, 1883. 6*d.*

The object is to provide a water gauge for steam boilers, in which both the steam and water cocks are worked each time the gauge is blown through also in which the cocks may be shut in case of a broken glass with less risk to the operator than at present.

926. Appliances for Carriage Wheels for Easing the Lateral Motion thereof on their Axles, and for Preventing Noise, *J. A. Turner, near Manchester.*—20*th February*, 1883.—(*Void.*) 2*d.*

This relates to the employment of annular plates or washers so formed as to have a certain spring action.

929. Muffs, *H. J. Haddan, Kensington.*—20*th February*, 1883.—(*A communication from F. Hüsgen, Bruxelles.*)—(*Not proceeded with.*) 2*d.*

The usual filling material is replaced by an air reservoir.

930. Cocks, Taps, or Valves, *W. J. Welsh, Wells.*—20*th February*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to control the delivery of water at high pressure or otherwise.

932. Carding Engines for Carding Cotton, Wool, &c., *R. Tatham, Rochdale, and R. Sellers, Scholes.*—20*th February*, 1883. 6*d.*

This relates to arrangements for removing dirt, moats, seeds, burrs, or short fibre from the material being acted upon by the carding engines or other similar preparing machines.

934. Manufacture of Steel and Alloys to be used in said Manufacture, *A. Armitage, Sheffield.*—20*th February*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to the introduction of from 0·1 to 2·0 per cent. of chromium into the molten metal.

935. Railway Permanent Way, *P. M. Justice, London.*—20*th February*, 1883.—(*A communication from S. G. Thomas, Calcutta.*) 6*d.*

This consists in the construction of railway permanent way, in which short rolled steel or wrought iron profiled plates are employed in place of the various forms of sleepers now in use.

936. Sewing Machines, &c., *E. P. Alexander, London.*—20*th February*, 1883.—(*A communication from C. H. Crawford, New York.*)—(*Not proceeded with.*) 2*d.*

This relates to that class of sewing machines used for over-seaming and cat-stitching, and consists of a machine and certain details and appliances, some of which are adapted also for use with other machines whereby to form the stitches rapidly without noise and abrupt jarring movements to secure a ready manipulation and adjustment of the parts, an automatic variation of the stitch and an automatic presentation of the edges of a button-hole to the fabric. It further relates to a binding or button-hole stitch formed by interlocking two threads.

939. Process for Manufacturing Tiles, Bricks, &c., *E. Edwards, London.*—20*th February*, 1883.—(*A communication from P. A. Sazerac, Peruzet, France.*)—(*Not proceeded with.*) 2*d.*

The object of the invention is a novel method of and process for manufacturing tiles, bricks, or other articles of the like kind, of burned clay or suitable earth, coloured black or slate grey throughout their substance by means of finely divided carbon, and the preservation of such material by the introduction into its pores whilst it is at a high temperature of such finely divided carbon.

941. Manufacture of Uninflammable and Incombustible Products for Writing and Printing Purposes, &c., *A. M. Clark, London.*—20*th February*, 1883.—(*A communication from G. Meyer, Paris*) 6*d.*

This relates to a process and to the products resulting therefrom for rendering uninflammable and incombustible printed matters and manuscripts of all descriptions, and also paper hangings, stage scenery, &c.

946. Spinning Tops to be used either as Toys or for Testing and Exercising the Human Lungs, *W. R. Lake, London.*—20*th February*, 1883.—(*A communication from C. M. Kimball, Toledo, U.S.*)—(*Not proceeded with.*) 2*d.*

The invention consists as a whole in a top adapted to be rotated by the pressure of air or other fluid or vapour, a support or step for the spindle of the top, and one or more passages in a structure or base supporting the step, said passages being adapted to direct jets of air or other fluid, as vapour or gas, against the top so as to rotate the latter.

947. Life-saving and other Mattresses, &c., *W. R. Lake, London.*—20*th February*, 1883.—(*A communication from L. Heath, Boston, U.S.*) 6*d.*

This relates to improvements in the general arrangement of the parts.

949. Manufacture of Ink or Printing Materials for Use in Printing Postage Stamps, &c., *A. A. Nesbit, London.*—21*st February*, 1883.—(*Not proceeded with.*) 4*d.*

The inventor claims the use of auchusine or alkanine in the manufacture of ink or printing material for use in printing postage stamps and other like stamps, and bankers' cheques and other monetary documents,

951. Electric Arc Lamp, *H. Trott and C. F. Fenton, London.*—21*st February*, 1883. 2*d.*

Relates to regulating the feed of the carbons by means of a horseshoe magnet differently wound with fine and coarse wire; to maintaining the focus; and to a lamp for burning two or more pair of carbons.

952. Horseshoes, *J. Ferris, Athlone.*—21*st February*, 1883. 6*d.*

This consists in forming cogs or projections on the underside of the shoe, whereby a secure foothold is afforded for the animal without the disadvantages heretofore attending the use of such cogs.

953. Production of Dense Metal Castings, *C. M. Pielsticker, Kilburn.*—21*st February*, 1883.—(*Partly a communication from Dr. F. C. G. Muller, Brandenburgh, Prussia.*) 6*d.*

This relates to the production of dense metal castings by subjecting the molten metal to the action of centrifugal force.

954. Sliver or Card Can Rings, *J. Rothwell and G. McMillan, Farnworth.*—21*st February*, 1883. 4*d.*

This relates to improvements in the form of the can rings, whereby a ledge or shoulder is obtained.

955. Machinery or Apparatus for Cleaning Wool, *J. C. Walker, near Leeds, and T. Beaumont, Roubaix, France.*—21*st February*, 1883. 6*d.*

This refers to the treatment of "burrs" and other foreign matters for the purpose of freeing them from the wool.

956. Production of Bases for Colouring Matters, *E. G. Brewer, London.*—21*st February*, 1883.—(*A communication from The Chemische Fabric auf Actien vormals E. Schering, Berlin.*) 4*d.*

This refers to the production of bases which are closely allied by their composition and in their properties to the Chinoline bases; the same is produced by the reaction of acetic aldehyde, and of certain other aldehydes upon the salts of primary aromatic amines.

957. Brewing Process and Arrangement of Apparatus for the Continuous Working of the Same, *E. P. Alexander, London.*—21*st February*, 1883.—(*A communication from C. Zimmer, Frankfort-on-the-Main.*)—(*Not proceeded with.*) 2*d.*

This consists mainly in the use of malt from which the useless parts have been previously removed by any suitable or well-known decorticating apparatus, and which malt thus treated and when ground fine can be separated into two qualities, a darker and a lighter; also in the separation of the albumen from the worts by centrifugal action.

958. Casting Iron, Steel, &c., *D. Davies, Crumlin.*—21*st February*, 1883.—(*Not proceeded with.*) 2*d.*

The object is to improve the method of casting metals into ingots, so as to make them as free as practicable from air holes, scruff, gases, and other impurities.

959. Harness Saddles or Collar Pads, *J. G. Tongue, London.*—21*st February*, 1883.—(*A communication from D. Curtis, Madison, U.S.*) 6*d.*

This relates to a horse collar pad, consisting of a curved body of leather or other like flexible material, and a narrow metal bearing plate (advantageously zinc) pressed into the under side of the top or arch flush with the surface of the leather.

961. Miners' Safety Lamps, *G. H. Timmis, Stourbridge.*—21*st February*, 1883. 6*d.*

This relates to improvements in the general construction and arrangement.

962. Machines for Mortising Wood, *J. H. Johnson, London.*—21*st February*, 1883.—(*A communication from J. B. Alexandre, Paris.*) 6*d.*

This consists essentially in the addition to mortising machines of means for regulating the penetration of the wood by the mortising tool in an automatic manner. The shaft carrying the rotating tool has a longitudinal movement imparted to it by an arm operated automatically by the machine, for which purpose it is hinged to a sliding bar having a plate engaging with a screw thread on a shaft capable of being driven at variable speeds by a band and cone pulley.

963. Guards for Carving Forks, *A. M. Clark, London.*—21*st February*, 1883.—(*A communication from T. F. Curley, Brooklyn.*) 4*d.*

This consists in means for locking the guards in either the raised or lowered position, so that they may not become displaced.

964. Apparatus to be Employed for the Process of Producing Designs or Figures on or in Wood in Imitation of Carved Work, *A. Guattari, Paddington.*—21*st February*, 1883. 10*d.*

This relates to improvements on patent No. 5516, dated 31st December, 1880. The object is to improve the construction and practical working of the whole system of apparatus used in combination for the purposes of the said process, comprising the furnace, the moulds, the mould carriages, and the press.

965. Apparatus for Transmitting Audible Signals by Electricity, *A. F. St. George, London.*—21*st February*, 1883. 8*d.*

Contact is made by a wall of carbon pendent by a fine wire and touching lightly the vibrating disc. The receiving discs are made of mica electro-plated on one side. Sensitised discs are used to photographically record the message. Frictional electricity is used, and a number of fine insulated parallel wires are employed to obviate the inductive action. In submarine lines conductors of dissimilar metals, exposed to the action of the sea, are employed.

966. Railway Carriage Lamps, *W. Blakely, Bournemouth.*—21*st February*, 1883.—(*Not proceeded with.*) 2*d.*

The object is, First, to ensure a better supply of air to support combustion in the lamp; Secondly, to facilitate the placing of lamps in and their removal from the carriages.

969. Manufacture of Precipitated Phosphate of Lime and Recovery of Sulphur from Alkali Waste, *W. Weldon, Burstow.*—22*nd February*, 1883.—(*A communication from E. Lombard, Marseilles.*)—(*Not proceeded with.*) 2*d.*

This consists in substituting for the solid precipitant hitherto used in the manufacture of precipitated phosphate of lime, a solution of calcium sulphydrate, and in combining the manufacture of precipitated phosphate of lime with the recovery of sulphur from alkali waste by obtaining from alkali waste the solution of calcium sulphydrate.

970. Coal Cutting Machinery, *T. C. Fawcett and F. H. Stubbs, Leeds.*—22*nd February*, 1883.—(*Not proceeded with.*) 2*d.*

The principal feature consists in the use of a serrated bar working in grooves, to the end of which bar the cutters are fixed.

971. Window Fasteners, *T. H. Collins, Winchester.*—22*nd February*, 1883. 6*d.*

This relates in a sash frame to the employment therewith of notches or recesses in combination with the sash of a spring catch carrying a tongue or bolt.

972. Separating Liquids from Solid Matters Suspended therein, *H. J. Haddan, Kensington.*—22*nd February*, 1883.—(*A communication from Gaillet and Huet, France.*) 6*d.*

The invention is particularly applicable for the clarification of the feed-water of boilers, and its consists in causing the water to flow alternately upwards and downwards between inclined plates, between which sufficient space is left to allow the solid particles to settle at the bottom of the channels formed by the plates, and from which they can be easily discharged.

973. Dynamo-electric Machines, *J. Hopkinson, London.*—22*nd February*, 1883. 6*d.*

The improvements consist in increasing the sectional area of the field magnets and reducing their length. In the example illustrated the sectional area of the cores of the magnet approximately equals the whole area of a cross section of the armature through its axis, the length of the core being about two and a-half times the diameter of the armature. The sectional arc of the core of an Edison armature is increased by replacing the securing bolts and nuts by washers and nuts running upon screws cut on the shaft.

974. Railway Signalling, *W. W. Linscott, London.*—22*nd February*, 1883.—(*Not proceeded with.*) 2*d.*

This apparatus is intended especially for signalling in foggy weather, and it consists of a gong to be set in the required position from the signal-box, and actuated by passing trains.

975. Preparing Steel for Watch and other Springs, *E. de Pass, London.*—22*nd February*, 1883.—(*A communication from A. H. Elliott, New York.*)—(*Not proceeded with.*) 2*d.*

This relates to the process of preparing wire or flat strips of steel for watch and other springs.

976. Springs for Watches, &c., *E. de Pass, London.*—22*nd February*. 1883.—(*A communication from A. H. Elliott, New York.*)—(*Not proceeded with.*) 2*d.*

One or both sides of the springs are convexed in cross section, so that when coiled for use, the coils are only in contact along the central line, whereby the friction is reduced.

977. Weighing Machines, *E. Wolner, Liverpool.*—22*nd February*, 1883. 6*d.*

The inventor claims, First, a system of levers with diagonal lever connecting them with the indicating apparatus; Secondly, a counterpoise consisting of an immersed box or cylinder oscillating over a fixed piston, so as to form a water cushion; Thirdly, a cistern with cover and narrow slot formed in the base of a weighing machine; Fourthly, an indicating apparatus consisting of dial and finger wheel or its mechanical equivalent, arranged so that the finger wheel shall show the small weights, and the movement of the dial the larger weights; Fifthly, a relieving apparatus for taking the weight off the levers when the machine is not being used.

978. Apparatus for Effecting Illuminations by Means of Liquid Hydrocarbons, *C. D. Abel, London.*—22*nd February*, 1883.—(*A communication from J. Pintsch, Berlin.*) 6*d.*

The apparatus is especially applicable to floating lights and lighthouses, and it consists mainly of a receptacle for the liquid illuminant, a receptacle for compressed air or gas, which, through the mediation of a regulator, causes the liquid to be propelled to the place of combustion, and the burner with its lantern. A special form of burner without a wick is also described.

979. Apparatus for Working Railway Signals, *H. O. Fisher, Cardiff.*—22*nd February*, 1883. 6*d.*

The object is to control a home signal and a distant signal by means of the same hand lever and gear in the signal cabin, the arrangement being such that the movement of the lever to take off or lower the signal first draws down the home signal, and the further movement lowers the distant signal, while in putting on the signals the distant signal is first actuated. The connection between the two signals is through a slotted lever, which permits the signals to be actuated in the manner described.

981. Lifts or Hoists for Warehouses, &c, *A. B. Dansken, Glasgow.*—23*rd February*, 1883. 6*d.*

In carrying out the invention there is provided for each of the openings formed through the floors of a building for the passage of the cage a horizontal movable shutter, or pair of shutters, and the cage is formed or provided with parts for acting directly or indirectly on the doors, so as to open each door as the cage approaches it either from above or from below, the doors being arranged to close again automatically after the passage of the cage.

982. Furnaces, *G. Taylor, Middleton.*—23*rd February*, 1883.—(*Not proceeded with.*) 2*d.*

This consists of improvements upon patent dated 12th May, 1876, No. 1996, the object being to prevent the valve or damper from becoming closed till a certain time after the furnace door has been closed.

983. Knitting Machinery, *F. Johnson, Nottingham.*—23*rd February*, 1883. 8*d.*

To either end of a knitting machine, arranged to produce narrowings by automatic means, a bracket is secured, and carries an axle, on which a ratchet wheel revolves, the bracket also forming bearings for sliding bolts, actuated by cam plates on the axle, and which operate at will narrowing bars, which, when the machine is making the gusset or the ordinary narrowings, are operated by the narrowing screws in the usual way, but when making the toe of a hose or half-hose, such bars are operated by the cam plates, so as to produce narrowings by either one or more needles at a time. A sufficient number of points or coverers are employed to move as many loops as required from selvages inwards. When making what is known

as the French foot or toe, the point or coverer boxes are operated by the cam plates to take off the required number of loops from such selvage to the first row of narrowings, and having delivered the loops, the covered box slides are again operated by the cam plates, and again traversed the required number of needles to form the second row of narrowings, thus forming four distinct narrowings in each course to the length required. The cam plates are revolved by a driver, carried by a right-angled lever, connected by a link to a truck bearing lever, operated by a cam on the cam shaft, each revolution of the cam shaft racking the tooth wheel one or more teeth.

984. Chimney-pots or Apparatus for Facilitating Draught in Chimneys, &c., *F. Hammond, London.*—23*rd February*, 1883. 6*d*.

The object is to secure an upward draught in chimneys and to avoid a down draught.

985. Apparatus for forming Letters or other Characters on Paper, &c., from a Distance, *M. T. Neale, Bayswater.*—23*rd February*, 1883. 6*d*.

The object is to form letters or other characters on paper or other material from a distance, through the medium of fluids, such as air, which is for this purpose confined with a special apparatus.

986. Pirn and Spool Winding Machines, *P. H. Marriott and J. Hall, Stockport.*—23*rd February*, 1883. 6*d*.

The object is to secure a more firmly and evenly wound pirn or spool, and to reduce the friction at present caused by the rubbing of the yarn against the surface of the slotted cup or its equivalent now employed. In carrying out this invention the inventors dispense with the slotted cup or its equivalent, and substitute therefor two or more conical or cylindrical rollers.

988. Heating by Hot Water, *H. and C. F. Longden, Sheffield.*—23*rd February*, 1883.—(*Not proceeded with*) 2*d*.

This relates to radiators of hot-water apparatus for heating buildings, the object being to improve the circulation of the water in the pipes of the radiator, and to obtain a maximum radiating or heating surface in a minimum of space. The radiator has a horizontal main pipe forming the base, and which is in connection with and preferably over the horizontal portion of the hot-water mains, to which it is connected by a short pipe at each end, provided with stop cocks Connected with and opening into the main pipe is a series of vertical or double or twin pipes, the lower ends of which are connected to the main pipe, and the upper ends to a horizontal pipe with a cock to permit air to escape.

990. Children's Cots or Cradles, *J. Brown, Montrose.*—23*rd February*, 1883.—(*Not proceeded with.*) 2*d*.

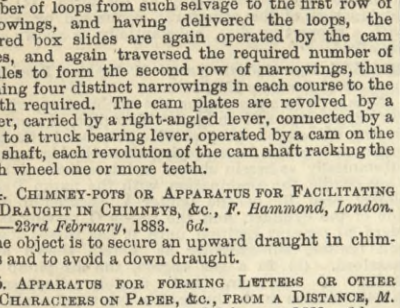
The object is to arrange and combine with children's cots or cradles, mechanical devices for rocking or swinging them.

991. Furnaces, *W. E. Gedge, London.*—23*rd February*, 1883.—(*A communication from L. A. Perrin and J. E. A. Servel, France.*)—(*Not proceeded with.*) 4*d*

This relates to an economical furnace for elevated temperatures, and it consists principally of, First, a feeder to feed the fireplace with coal and nascent gases; Secondly, a hot air chamber utilising the lost heat for heating the air to support combustion; and Thirdly, a system of hermetical and indestructible closers or fastenings which complete the insulation already produced by the masonry, and particularly by the dry sand preferably used.

992. Steam Boiler and other Furnaces, *P. W. Willans, Thames Ditton.*—23*rd February*, 1883. 6*d*.

The object is to prevent the exit of gases from the fire door of steam boiler or other furnaces when air is supplied under the bars by a fan or other mechanical contrivance, and at the same time to avoid the trouble and inconvenience of a closed stokehole. The drawing is a sectional elevation of a return tube boiler. G is an air chamber arranged to cover the fire door and the opening in front of the ashpit. Air is supplied under pressure to the chamber by a fan through the air passage or pipe *g*. In front of the chamber is a hinge door *f*, through which access is obtained to the fire door *e*. The door *f* is connected by a link *d* to the



fire door *e*. When the door *f* is closed the link *d* holds the fire door *e* closed also. On opening the door *f* the fire door at first remains closed, as the link *d* is at first merely turned on its pin at its upper end, and the fire door only commences to open when the door *f* has been opened to such an extent as to draw downwards the link *d*. In this way the pressure of air is reduced in the furnace before the fire door is opened without stopping the fan by which the air is supplied. When the door *f* is fully opened free access can be had to the fire to break it up and recoal it in order to prevent too strong a current of air escaping at this time from the front of the air chamber; a tail piece on the door is then made to partially close the air passage *g*, as shown.

993. Wheels of Velocipedes or other Vehicles having Spider Wheels, *J. Orme, Barbican.*—23*rd February*, 1883.—(*Not proceeded with.*) 2*d*.

This consists in a method of detaching one or two or more spokes in order to insert what are commonly known as hub lamps.

994. Floating Docks and Apparatus in Combination therewith, *G. B. Rennie, London.*—23*rd February*, 1883. 6*d*.

The invention relates to arrangements of machinery and form of hull, so that floating docks may be made capable of being propelled by steam and water and of a sectional form, so that by means of water ballast the dock may be inclined up to centre line 'of bottom of dock, first put one side then the other, so that repairs or cleaning of the bottom may be easily effected whilst the dock is afloat.

995. Purification of Coal Gas and Preparation and Treatment of Materials Employed therein, *J. T. McDougall, Manchester.*—23*rd February*, 1883. 6*d*.

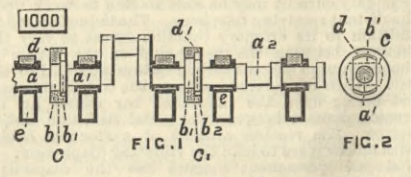
The object is an improved means of removing sulphuretted hydrogen from coal gas.

997. Apparatus for Distributing Type, *W. L. Wise, London.*—23*rd February*, 1883.—(*A communication from F. C. Wyvill, Westphalia.*)—(*Not proceeded with.*) 2*d*.

This relates to improvements in apparatus in which the distribution is effected by means of nicks or wards milled or cut into the letters, so that each nick serves to act certain mechanism in motion, which releases the letter and delivers it into its proper tube.

1000. Crank and other Shafts, *A. Jack and H. MacColl, Liverpool.*—24*th February*, 1883. 6*d*.

The drawing is a longitudinal view of a crank shaft constructed in accordance with one part of the invention. *a* a^1 a^2 are portions of shaft constructed with parallel sided pieces or couplers *b* b^1 b^2 having rounded ends. The said pieces or couplers fit into and are free to slide in grooves, slots, or recesses in the disc couplings *c* c^1. *d* d^1 are rings formed in one piece with the couplings *c* c^1 for the purpose of retaining the parts in correct position. The said rings may be separate from the couplings and be secured thereto by set screws or equivalent means. The grooves, slots, or recesses in the couplings are two in number, one in each side, and at right angles or nearly so to one another. Adjustable wedge pieces may be used to provide for wear and tear in the slots. *e* are bearings. If any unequal or irregular wear in the bearings takes



place, so that the longitudinal axes of two abutting portions of the shaft are not in the same straight line, each portion of the shaft is able to revolve freely in its bearings without being subjected to transverse strains on account of the coupling sliding on the end pieces or couplers of the shafts whilst rotating therewith, and so adjusting itself to any irregularities of position of the said end pieces or couplers.

1001. Mechanical Relay Apparatus for Governing, Regulating, Starting, Steering, and Analogous Apparatus, *D. J. Dunlop, Port Glasgow.*—24*th February*, 1883.—(*Not proceeded with.*) 2*d*.

The most important peculiarity of the invention consists in a device whereby the greater force brought into action by the relay apparatus is made to act to an extent corresponding precisely to the extent of movement of the primary apparatus.

1002. Fixing the Blades of Screw Propellers, *E. P. Timmins and J. Rose, Cardiff.*—24*th February*, 1883. 6*d*.

This consists in fixing the blades of screw propellers in the bosses by fitting the wedge-shaped roots into corresponding grooves formed in the bosses, and maintaining the same in place by means of wedges, keys, bolts, or guard rings.

1003. Attaching a Handle to a Stone to Enable it to be Used for Ironing, *L. A. Groth, London.*—24*th February*, 1883.—(*A communication from Laura v. Ducken, Stuttgart.*)—(*Not proceeded with.*) 2*d*.

This relates to the means of attaching a movable handle.

1004. Operating on and Treatment of Vegetable Fibrous Substances for Manufacture of Paper and Millboards, *C. Court, London.*—24*th February*, 1883 6*d*.

This relates to a mode or means of treating vegetable fibrous substances in combination to make what is known as half stuff for paper making.

1005. Fastener Buttons for Articles of Clothing, &c., *E. G. Colton, London.*—24*th February*, 1883.—(*A communication from E. Wuerfel, Brooklyn, U.S.*) (*Not proceeded with.*) 2*d*.

This consists of a button, the head of which is made in three parts—a face plate, an intermediate recessed spring plate, and a bottom plate, having a tubular shank, through which the post of the base plate or shoe of the button is inserted, the post being engaged by the interior ends of the recessed spring plate below the conical head of the same.

1006. Machines for Warping and Chaining or Linking Yarn or Thread, *W. McGee and T. Watson, Paisley.*—24*th February*, 1883. 6*d*.

The invention has mainly for its object to effect by mechanical means the operation, hitherto effected by hand, of linking into chains the yarn or thread delivered from warping machines or similar apparatus. The invention also comprises improvements applied to ordinary warping machines for stopping such machines when a thread breaks or fails.

1007. Apparatus for Supplying Sensitive Plates in Photographic Cameras, *J. H. Hare and H. J. Dale. London.*—24*th February*, 1883. 6*d*.

This relates to means of supplying sensitive plates to a photographic camera, the object being to have a number of such plates ready to be acted on by exposure in the camera either in direct succession or in any desired order, and to retain these plates protected against farther active action until they can be conveniently developed.

1008. Saddles of Bicycles, Tricycles, &c., *J. A. Lamplugh, Birmingham.*—24*th February*, 1883. 8*d*.

The seat has no internal rigid support, but has a leather foundation, between which and the cover stuffing is inserted. At the rear of the seat is an opening extending to near the middle, being widest at the back, the object being to prevent pressure on the rectum and under the spine of the rider, and to allow the saddle to yield on either side. The seat is supported by a three-branched plate, concave on its upper side, and fixed at its end to the front and two back portions of the saddle. Three flat bars are also fixed to the saddle at the same points, and their inner ends connected by a spring, so as to form an elastic support.

1009. Sewing Machines, &c., *J. Warwick, Manchester.*—24*th February*, 1883. 6*d*.

The object is to obtain an oscillating movement of high speed in sewing machines and other machinery, and it consists in imparting such a movement to the shuttle by a novel ball motion, such ball being fitted on the horizontal shaft under or at the base of the machine, and having a groove round it at an acute angle from a hole through which the shaft passes. Over the centre of the ball is the shuttle race with a hole in the centre through which a stud is fitted, and carries on top the shuttle carrier within the race. To the base of the stud a half ring of metal is fixed, and carries at each end a stud, each carrying a segment of a circle or a bowl, which lie in the groove in the ball. The shuttle may be worked vertically from the end of a rocking shaft at the base of the machine, by fixing the ball on a vertical shaft.

1010. Gas Engines, *C. H. Andrew, Stockport.*—24*th February*, 1883. 6*d*.

The object is to obtain a more explosive mixture of air and gas supplied to gas engines, and it consists in supplying the gas and air to the explosion cylinder through a slide valve as usual, a second supply of gas and air being allowed to pass into the cylinder through a slide valve opened to admit it by the suction of the piston, and closed in any convenient manner. The second supply may be taken from the main gas supply pipe before it reaches the slide valve. By this second independent supply the piston is able to draw a small quantity of the mixture into the cylinder as required, and the working of the engine thereby improved.

1011. Canton Crape and other Woven Goods, *N. Kumagaya, Blackburn.*—24*th February*, 1883.—(*Not proceeded with.*) 2*d*.

The object is to temporarily retain the hard twist in the weft by the application of starch or size, which enables the weft to be woven without snarls or knots when passing through the shed in the loom for the purpose of weaving Canton crape and similar goods. The size or starch is washed out after the cloth is woven, and the cloth will crimp up as required.

1012. Lubricating the Axles of Perambulator, Invalid Carriage, Bicycle, and other Wheels, *R. Cunliffe and J. Croom, Manchester.*—24*th February*, 1883.—(*Not proceeded with.*) 2*d*.

The cap which screws on to the hub of the wheel has a cavity closed by a spring plate opening inwards, and which can be forced back by the spout of an oil-can to introduce the lubricant.

1013. Ladies' Costume Stands, *B. Sigrist, London.*—24*th February*, 1883. 6*d*.

This consists in making such stands so that they can be closed up or folded when not in use, and also to so construct the stands that they, together with the costume thereon, can be turned round without moving the support.

1014. Tramways and Apparatus for Propelling Tram-cars by Electric or Steam Engines, *M. H. Smith, Halifax.*—24*th February*, 1883. 1*s*. 2*d*.

Relates to apparatus for collecting and transmitting the current from the conductors, preferably formed as a central rail, to the electric conductors.

1015. Galvanic Batteries, *O. C. D. Ross, London.*—24*th February*, 1883.—(*Not proceeded with.*) 2*d*.

Relates to the coupling up of the electrodes, to the means of emptying and filling the cells, and to the exciting liquid.

1016. Electric Secondary or Storage Batteries, *R. H. Courtenay, London.*—24*th February*, 1883.—(*Not proceeded with*) 2*d*.

The negative and positive electrodes are placed in separate cells and coupled up in the usual way, the charging current being conveyed by metallic conductors immersed in the liquids. The cells are charged with oxygen until the positive electrodes are saturated therewith.

1017. Furnaces or Apparatus for Burning, Calcining, or Roasting Sulphur Ores, Spent Oxide of Iron, and other Materials, and Apparatus for Separating Dust and Solid Impurities from the Gases Obtained, *I. S. McDougall, near Manchester.*—24*th February*, 1883.—(*Not proceeded with.*) 2*d*.

This relates principally to furnaces for burning, calcining, or roasting sulphur ores, spent oxide of iron, or other materials, and is especially adapted for producing sulphurous acid gas for conversion into sulphuric acid or for other purposes, and it consists of a series of superposed chambers furnished with agitators and feeders to feed the material continuously through them whilst being submitted to the burning or roasting process. The agitators and feeders are fixed to a main shaft, and they are made of hollow cast iron and provided with inner wrought metal pipes, so as to prevent them warping. The invention also relates to means for freeing the gases from dust and solid impurities after they leave the furnace and before passing to the chambers in which they are utilised.

1018. Damping Fabrics, *J. B. Jackson and G. Bentley, Bury.*—24*th February*, 1883. 6*d*.

This consists in the use of an air blast to distribute a spray of water on to fabrics in place of the brush usually employed, such blast being produced by a blower, pump, or fan.

1019. Operation of Electrical Generators by Gas Engines, *T. J. Handford, London.*—24*th February*, 1883.—(*A communication from T. A. Edison, N.J., U.S.*) 6*d*.

A cam arrangement actuated by the engine throws into circuit a variable resistance, the amount of which is greatest at the moment when the explosion occurs, and gradually decreases as the speed gets less. Incandescent lamps, arranged in branches and multiple arc, are preferably employed as the resistances, the branch containing the greatest number of lamps being thrown into circuit last.

1020. Applying Variable Resistances to Electric Currents without Commutator, *L. Gaulard and J. D. Gibbs, London.*—24*th February* 1883. 6*d*.

The apparatus consists of two solenoids, the smaller one being capable of sliding within the outer one, and upon an iron core cut with a screw thread, which engages with the interior of the smaller solenoid.

1022. Construction of Electrical Railways, *T. J. Handford, London.*—24*th February*, 1883.—(*A communication from T. A. Edison, N.J., U.S.*) 6*d*.

The line of connected rails has its conductivity increased by means of continuous conductors clamped to the rails by means of the fish-plates.

1023. Measuring Liquids, *R. Jobling, London.*—24*th February*, 1883.—(*Not proceeded with.*) 2*d*.

As applied to registering the quantity of liquid drawn from a cask, a pipe leads from the cask and has a cock opening into a bent tube leading to a fan chamber, the blades of the fan in which divide such chamber into equal parts. The outlet of the fan chamber is provided with an ordinary bib piece. The spindle of the fan is connected by gearing to a counter or index.

1024. Cribs for Children, *A. M. Clark, London.*—24*th February*, 1883.—(*A communication from Mrs. R. Opdyke, New Jersey, U.S.*) 6*d*.

One of the sides of the crib is made to slide vertically in grooves in the ports, and is counterbalanced by weights and cords, the object being to facilitate putting the child into and removing it from the crib, and further to allow of free access to the crib during the night by lowering the side and placing it at the side of a bed.

1025. Hydraulic Machinery for Punching, Shearing, Rivetting, Stamping, &c., *W. R. Lake, London.*—24*th February*, 1883.—(*A communication from C. Jouffray, France.*) 6*d*.

As applied to a punching machine a cylinder is fixed to a frame and its piston operated by hydraulic power is provided with a rod having rack teeth engaging with a pinion at the end of a lever, the other end of which is counterweighted. The punch is fixed to the piston-rod and the counter punch or die is placed in the frame. The stroke of the piston can be regulated to omit the thickness of material. The water is forced into the cylinder by a pump through a pipe and entering the cylinder by the cover causes the leather forming the joint of the cover, as well as of the piston, to stretch and be forced against the sides of the cylinder. The tool is caused to return automatically by means of a valve actuated by a lever.

1026. Actuating Cross-cut Saws and means therefor, *J. Richmond and W. Whiting, London.*—24*th February*, 1883. 6*d*.

A circular cross-cut saw is mounted in bearings supported by a vibrating lever arm which is connected by a rod to a slotted lever provided with a sliding block, the second lever being fulcrumed on a bracket supporting a large wheel driven by a pinion on the driving shaft. This wheel is connected with and gives motion to the block, and so causes the saw to be moved to and fro automatically for cutting lengths of blocks of wood across the grain into shorter lengths. The saw is caused to revolve by an independent strap.

1027. Tramway, Traction, and other Steam Engines, *J. W. Boulton, Ashton-under-Lyne.*—26*th February*, 1883. 6*d*.

This relates to means for superheatiug exhaust steam from an engine and boiler, so as to discharge it into the atmosphere mixed with the products of combustion from the furnace noiselessly as invisible vapour or gases. As applied to vertical boilers a smoke-box is formed in the upper part, and into it the flue tubes from the furnace terminate. Within this smoke-box is a heating vessel through which the steam is caused to pass, and may afterwards mix with the products of combustion which heat the chamber and then serve as the blast for the furnace.

1028. Construction of Furniture and other Repositories, *W. Shepherd, Bermondsey.*—26*th February*, 1883. 6*d*.

This relates to the combination of improved detached fire-proof or other blocks of buildings, with improved hoists worked by hydraulic or other power, travelling platforms, and other appliances for moving and hoisting or lowering furniture or other goods to the various floor levels and positions in the blocks of buildings.

1029. Hoops or Sockets for Securing Picks and other Similar Tools to their Shafts, &c., *T. Brown, Sheffield.*—26*th February*, 1883. 6*d*.

This relates to the construction and form of hoops or sockets with eyes, to secure picks and other tools on their shafts, the pick blade being recessed, and a suitable wedge provided.

1030. Self-acting Grabs and Grapple Tools and Scoops, in which are Employed Tines or Prongs, *W. D and S. Priestman, Kingston-upon-Hull.*—26*th February*, 1883. 6*d*.

The tine frame consists of parallel bars separated by distance blocks, the bars being fastened together by rivets or bolts through the blocks, thus forming spaces in the tine frame, into which the ends of the tines slip, and are secured by keys which are driven between the tines and the blocks.

1031. Jacquard or Pattern Pegs employed in Weaving, *E. O. Taylor, near Huddersfield.*—26*th February*, 1883.—(*Not proceeded with.*) 2*d*.

This consists in so forming the pegs that they can be readily removed from hole to hole, according to the pattern to be woven, the part inserted in the hole in the peg lag or barrel forming a spring by being made of hollow metal slit longitudinally.

1032. Appliances or Apparatus for Scraping and Scrubbing Ships' Bottoms and Sides under Water whilst at Sea, *G. W. Mallet, West Greenwich.*—26*th February*, 1883. 4*d*.

A metal cylinder has propellers at each end inside and fastened to it, the whole revolving on an iron shaft. Four scrubbers are fastened to the cylinder, and each consists of wood with bars running obliquely from the sides. The apparatus is lowered over the side of the vessel, the progress of which through the water causes the apparatus to revolve and rise up to the vessel's bottom and sides.

1033. Rolling Metallic Tubes, *P. M. Parsons, Blackheath.*—26*th February*, 1883. 6*d*.

This consists in the use, in combination with suitable rolls, of mandrils rotating upon their axes in lieu of stationary mandrils. The mandrils are enlarged near one end, in the space between the rolls, and their opposite ends are fitted with suitable gearing to cause them to revolve.

1035. Signal Lamps and Lanterns, *J. Rogers, London.*—26*th February*, 1883. 6*d*.

In order to transmit coloured light in signal lamps, the lens is made of two or more parts with a sheet or layer of coloured glass between them.

1036. Cartridges, *T. Nordenfelt, Westminster.*—26*th February*, 1883. 4*d*.

This relates more especially to cartridges for use with machine guns of larger dimensions than the military or Martini-Henry cartridges. The case consists of a cylinder of thin drawn metal closed at the base, which is held between a cup and a solid disc of the same diameter as the cylinder, and having a flange around its outer end.

1037. Generating Electricity, *A. M. Clark, London.*—26*th February*, 1883.—(*A communication from H. A. Archereau, Paris.*) 4*d*.

Relates to the production of electricity from chemical substances having affinity for oxygen.

1038. Treatment of Peat, *J. Kendall, Kingston Hill.*—26*th February*, 1883.—(*Not proceeded with.*) 2*d*.

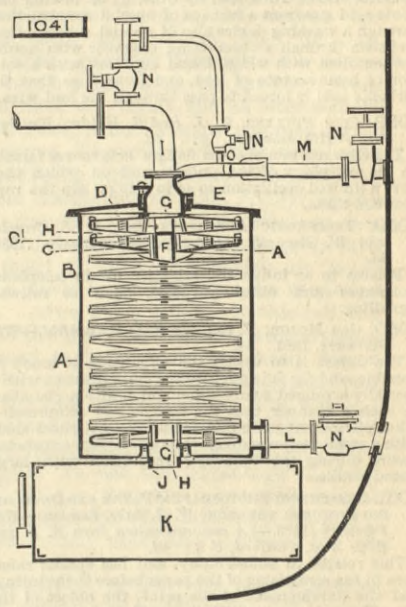
The surface of bog is cut off by knives arranged horizontally or at a convenient angle, and attached to a travelling frame actuated by horse or other power, and the part removed is cut into blocks and dried by compression under rollers, and afterwards in a covered shed heated by flues or pipes.

1040. Ventilating Ships, *G. A. Calvert, Cork, and F. C. Kelson, Liverpool.*—27*th February*, 1883. 6*d*.

A steam or air jet is combined with ordinary ventilating cowls having a turning or adjustable mouth, so that ventilating air currents may be induced through the ventilating pipe when required by putting the jet into action.

1041. Surface Condensers, *R. Norton, Newcastle-on-Tyne, and J. B. Edmiston, Liverpool.*—27*th February*, 1883. 6*d*.

In the drawing A are convex-like metal cells fitted one on the other within the cylindrical container B; C C^1 are internal and external joints, constructed with recesses and projections; D are passages or ways through the cells to allow of more effective circulation of the condensing water; E cover of container resting



on cells A, so as to keep them in position; F perforated pipe, extending down the central opening G; H stay bolts; I steam inlet or supply pipe, leading from a suitable generator; J condensed water outlet; K condensed water tank; L condensing water inlet; M outlet; N stop valves; O steam jet for increasing the flow of the condensing water when required. A steam filter or purifier may be inserted in the pipe leading from the steam supply to the condenser.

1042. Making Cigars and Cigarettes, *A. M. Clark, London.*—27*th February*, 1883.—(*A communication from O. Hammerstein, New York*) 6*d*.

This consists in the use of a hollow movable table with a perforated upper face, and connected with suction apparatus communicating with the hollow space in the table, for the purpose of holding the wrappers of cigars and cigarettes in place before and at the time they are being applied to the cigars or cigarettes.

1043. Treatment of Metallic Ores by Combined Action of Electricity and Water, *W. J. Tanner, London.*—27*th February*, 1883. 6*d*.

A vessel which is connected to the negative pole of an electric supply is used to contain the pulverised ore, and is fitted with a metallic stirrer connected to the positive pole.

1044. Tin and Terne Plates and Machinery Employed in their Manufacture, *W. A. Johns, London.*—27*th February*, 1883. 6*d*.

This relates, First, to a new or improved tin or terne plate produced by taking an ordinary "black plate" and coating it in any known manner first with lead alone or with a lead alloy, and then with a final and much thinner protective coating of pure tin by passing it between one or more pairs of rollers over which a small quantity of molten tin is allowed to trickle during the passage of the plate; Secondly, to apparatus for coating and finishing tin and terne plates so as to obviate the tendency of the plates to stick in the guides

in the metal bath; and Thirdly, to an instrument for handling the plates so as to prevent the marking the surface.

1045. Manufacture of Coke, *W. W. Pattinson, Durham.*—27*th February*, 1883. 4*d.*

This consists in the use, in conjunction with processes for the recovery of products in the manufacture of coke, such as described in patent No. 1947, A.D. 1882, of a series of main pipes extending along the range of ovens, and with the separate suction pipe to each oven connected to each main by branches and sluice cock, so that communication may be established between the oven, and any one main only, and that at a certain stage of the coking, communication can be opened to a certain main, and at a later stage to another main, and so on, and thus the different qualities of gas and products given off at different times are separated, and at the same time a simple mode is provided for regulating the suction applied to the ovens at different stages, and condensation is applied, so as also to some extent separate fractionally the products condensed, which fractional separation is effected by tapping the condensers at various points, according to the degree of cooling. A main pipe is also capable of being connected to the ovens when desired to quench the coke.

1046. Holders for Knife Blades, Pencil Leads, &c., *J. H. Johnson, London.*—27*th February*, 1883.—(*A communication from J. Reckendorfer, New York.*) 6*d.*

This relates to the employment of a locking device, and means of actuating same.

1047. Attachment for Spinning Frames, *A. Gilmore, Ireland.*—27*th February*, 1883. 6*d.*

This relates to mechanism for automatically stopping the feeding of the rove in spinning frames when the same becomes broken after passing through the rollers, which give motion to the same. Attached to the rove guide is a bracket, supporting a vertical shaft, and above this bracket, and secured to the shaft, is an arm, through which the rove runs to the feed rollers. Below the latter is a second arm, bifurcated at its outer end, and between the branches the rove passes. The second arm has a quadrant rack, engaging with a weighted rack or pinion, pivotted to the bracket. An eye is fixed to the lower edge of the beam of the frame, and forms a further bearing for the vertical shaft, to the lower end of which a third arm is secured, and is pivotted to a horizontal axis, and at its outer end consists of a wire rod, its inner end being so weighted that the wire, if left free in a certain position, would be raised towards a vertical position. When the thread is broken, the vertical shaft is caused to partly revolve, and its arms withdraw the thread from the feed rollers.

1049. Producing Figured Designs on Textile Fabrics, by Raising the Pile or Nap thereof, *C. D. Abel, London.*—27*th February*, 1883.—(*A communication from La Société A. Labrosse et J. Richard, France.*) 6*d.*

A continuously revolving card cylinder acts on the fabric, which is moved continuously over an edge presented towards the card, so as to raise a pile on the fabric, a thin sheet of metal, perforated with a suitable design, being interposed between the cylinder and the fabric, with the latter of which it is caused to travel uniformly.

1050. Bicycles, *W. Morgan-Brown, London.*—27*th February*, 1883.—(*A communication from M. Raschke, Berlin.*)—(*Not proceeded with.*) 2*d.*

The two axles are rigidly connected by two vertical tubular rods whose upper and lower ends are jointed by connecting rods, so as to form a frame in the shape of a rhomboid. The lateral tubes are in two parts, the lower entering the upper and free to move in them within certain limits determined by springs fixed to the upper part of the frame. The treadles are connected by a cord passing over a pulley, and motion is conveyed to the driving axle by bevel wheels from an intermediate shaft. Other improvements are described.

1055. Manufacture of White Lead, *L. Brumlen, Wrexham.*—27*th February*, 1883. 6*d.*

This consists in the process and apparatus for the manufacture of white lead by drawing or forcing carbonic acid gas from a furnace of special construction, through a washing device also of special construction, and then through an oscillating chamber with double bottom filled with wires of lead kept wet with a solution of basic acetate of lead, and formed so that the carbonic acid is forced to pass through the lead wire.

1058. Clip Pulleys, *R., J., and H. Wilder, Wallingford.*—27*th February*, 1883. 6*d.*

The clips are mounted on flanges or grooves formed on the periphery of the pulleys, and on which they have a limited oscillation so as to grip or nip the rope between them.

1059. Telephonic Apparatus, &c., *L. J. Crossley and W. Emmott, Halifax.*—27*th February*, 1883. 6*d.*

Relates to an indicating relay for use in telephone exchanges and other purposes, such as railway signalling.

1060. Gas Motor, *F. von Martini, Frauenfeld.*—27*th February*, 1883. 8*d.*

The object is to utilise the expansion as much as possible, and for this purpose the engine works with a specially arranged compression and ignition chamber, in such a manner that the suction and compression takes place during one rotation of the fly-wheel shaft with a small piston stroke, while a complete expansion occurs during the following revolution with large piston stroke.

1061. Sensitising Photographic Paper and Developing Pictures thereon, *W. R. Lake, London.*—27*th February*, 1883.—(*A communication from R. B. and B. C. West, Guilford, U.S.*) 4*d.*

This relates to photography, and has special reference to the sensitising of the paper before the printing, and the development of the print, the object of the invention being principally to avoid the necessity for using the expensive silver solution now generally employed in this class of work.

1064. Apparatus for Heating Air for Warming Buildings, &c, *W. Brierley, Halifax.*—27*th February*, 1883.—(*A communication from R. Tungler, Prussia.*) 6*d.*

The apparatus is constructed wholly of brick and mason work, except the doors and furnace bars.

1067. Holder for Ribbon and other Similar Fabrics in a Roll, *A. M. Clark, London.*—27*th February* 1883.—(*A communication from J. Mellette, Winamac, U.S.*) 6*d.*

This relates to a ribbon holder constructed of two wire spring prongs, and also to the construction of a roller.

1070. Manufacture of Emery, Glass, or other Abrasive Substance in Combination with Woven Fabrics, or other Flexible Materials, &c., *R. J. and A. Edwards, London.*—27*th February*, 1883. 6*d.*

This relates partly to the method of applying and fixing abrasive powder to the surface of flexible materials in alternate strips of coarse and fine powder.

1073. Apparatus for Transferring Liquid from one Vessel or Place to Another, *F. J. Brougham, London.*—27*th February*, 1883.—(*A communication from Messieurs Hazard et Cie., Paris*) 6*d.*

This relates partly to the combination of an inverted syphon of india-rubber or other suitable elastic material, with two compressing rollers adapted to roll along the syphon, so as to flatten the same, and drive out the air and two removable wedges.

1079. Mechanical Telephone Apparatus, *H. J. Allison, London.*—28*th February*, 1883.—(*A communication from G. F. Shaver, Erie, U.S.*) 6*d.*

This consists, First, in the mode of and means for supporting and maintaining the tension of line wires; Secondly, in the mode of, and means for, connecting and tightening line wires; Thirdly, in the manner of constructing and supporting the telephone; Fourthly, in the construction and arrangement of other parts of the central office apparatus.

1082. Steam and other Boilers, *T. Robottom, Nuneaton.*—28*th February*, 1883. 2*d.*

This consists in applying a stuffing-box and gland to end of firing tube or box or smoke pipe, and in end of shell of boiler, and stuffing the same with asbestos or other packing to allow of the free expansion and contraction of firing tube or fire-box, and to facilitate the withdrawal of the same for the purpose of cleaning or repairs.

1091. Apparatus for Supplying Lubricant, &c, *S. Kershaw, Manchester, and J. Bromilow, Heywood.*—28*th February*, 1883. 6*d.*

This relates principally to apparatus designed to supply oil or melted fat or lubricant to the cylinders or other parts of steam engines, or to the bearings and parts of engines or machines.

1093. Preparing Insulated Wires, *H. E. Newton, London.*—28*th February*, 1883.—(*A communication from A. A. Cowles, New York, U.S.*) 6*d.*

The wire is first covered with a layer of fibrous material, then with a layer of paint (preferably white lead), and before this dries with a second layer of fibrous material, the whole being coated with waterproof material, such as asphalte, rubber, or japan.

1117. Manufacture of Alcohol and Food for Animals from Amylaceous Substances, *W. R. Lake, London.*—1*st March*, 1883.—(*A communication from K. Trobach, Berlin.*)—(*Complete.*) 4*d.*

This relates to the manufacture of alcohol, and its object is to produce alcohol, preferably a pure alcohol free of fusel oil, in one process directly from amylaceous fruits or cereals without resorting to the numerous intermediate processes heretofore employed, and at the same time to produce an article of food for cattle in the shape of cakes, the said food being obtained as a waste product in applying the said process of manufacturing alcohol.

1126. Brackets for Support of Rods or Rails, &c., *J. Beech, Wolverhampton.*—2*nd March*, 1883. 4*d.*

The object is that the angle of the supporting surfaces of brackets employed for the support of rods or rails and other articles may be readily varied.

1167. Boiler Furnaces, *H. J. Haddan, Kensington.*—5*th March*, 1883.—(*A communication from E. W. Van Duzen, Cincinnati, U.S.*)—(*Complete*) 6*d.*

The main objects are to prevent smoke in the burning of soft bituminous coal, &c., and to secure a perfect feed of the air to the furnace chambers.

1181. Manufacture of Buttons, *H. E. Newton, London.*—5*th March*, 1883.—(*A communication from A. Mader, Schluckenau, Bohemia*) 6*d.*

This relates to improvements in the manufacture of buttons with soft shanks, and the improvements consist in the means for fastening the said shanks to the button heads, which may be formed of horn, wood, bone, &c.

1207. Filtration, and Apparatus therefor, *W. R. Lake, London.*—6*th March*, 1883.—(*A communication from J. W. Hyatt, New Jersey, U.S.*)—(*Complete.*) 1*s.*

This relates to the general construction of the apparatus.

1215. Breech-loading and Magazine Fire-arms, *G. Macaulay-Cruikshank, Glasgow.*—7*th March*, 1883.—(*A communication from M. V. Kacer and W. J. Kriz, St. Louis, U. S.*) 8*d.*

The improvements consist in a cartridge case, into which the cartridges are introduced, by forcing them in one at a time in an oblique position at the fore end of the case, the breech-block having been first retracted.

1218. Electro-magnetic Signal Apparatus for Railways, &c., *F. J. Drewry, Burton-on-Trent.*—7*th March*, 1883.—(*A communication from J. D. Gould and B. M. Plumb, New York, and G. W. Daniels, Somerville, Mass., U.S.*) 1*s.*

The main signal is held at safety by the attraction of an electro-magnet, the circuit controlling instruments being operated by the train entering the block section. A secondary signal is operated on the train leaving the section.

1229. Producing Permanent Coloured Photographic Card Pictures, *A. H. Dawes, Windermere.*—7*th March*, 1883. 4*d.*

The process embodies the placing of colouring matter between the transparented photograph and the paper, card, or other substance upon or before which it is laid or mounted.

1351. Machinery for Rolling on Edge Spiral Bands of Steel and other Metal, *R. H. Brandon, Paris.*—13*th March*, 1883.—(*A communication from L. Poilvache and A. Nagelmackers, Liege.*) 4*d.*

This consists in a machine for rolling or coiling on edge bands of metal of any cross section, and composed mainly of two helicoidal parts, each being made in one or several parts, of a rod or shaft passing through the centre of them and serving as a cord for coiling the band of metal, and of a roller for the purpose of guiding the band whilst being coiled.

1356. Apparatus Applicable to Stitching Machines, *B. Hague, Nottingham.*—14*th March*, 1883.—(*Not proceeded with.*) 2*d.*

This relates to an apparatus for preventing the two edges of the fabric from curling over upon itself, before the edges are stitched together.

1434. Screw Propellers, *G. E. Vaughan, London.*—19*th March*, 1883.—(*A communication from C. H. MacDonald, Paris*) 8*d.*

This relates to the form given to the blades.

1442. Bogies for Transporting Furnace Slag, *J. Paterson, Workington.*—19*th March*, 1883. 6*d.*

This relates to a slag bogie constructed with a bottom plate formed in longitudinal sections of cast iron, bound together and secured to open box-like supporting frames, on which are formed or attached the axle bearing blocks, the whole being carried on ordinary wheels and axles.

1545. Trochilic or Rotary Engine, *H. A. Bonneville, Paris.*—27*th March*, 1883.—(*A communication from I. N. Forbes, Lawrence County, U.S.*)—(*Complete.*) 1*s.* 8*d.*

The subject of the invention is an engine in which steam or other motor fluid actuates teeth placed radially upon a wheel, which latter is keyed to its shaft.

1546. Locomotives, *H. A. Bonneville, Paris.*—27*th March*, 1883.—(*A communication from I. N. Forbes, Lawrence County, U.S.*)—(*Complete.*) 1*s.* 2*d.*

A trochilic or rotary engine is used, having recessed abutment rollers geared to rotate in unison with a piston wheel. One or more of these engines are mounted directly on an axle or axles of the locomotive, so as to apply the power directly thereto, thereby avoiding the loss of power and other injurious effects which result from the indirect application of force in the use of reciprocating engines.

1813. Carriage Wheels, *B. J. B. Mills, London.*—10*th April*, 1883.—(*A communication from C. Degrange, Lyons.*)—(*Complete.*) 4*d.*

This consists in strengthening wheels of wood, or partly of wood and partly of metal, by a metallic mounting uniting the spokes to the nave in a rigid manner, and facilitating compensation for play of the parts caused by shrinkage.

2270. Actions of Pianofortes, *J. Herrburger, Paris.*—4*th May*, 1883. 6*d.*

This relates to the combination of the hammer provided with a regulating screw, the prolonged butt of which serves as a back check, with a system of jack connected at its lower part by means of a spring to the guide with which it is joined, furnished with the check with an oval hole for the passage of the regulating screw and with a jack knob.

2322. Transmitting and Receiving Telephones, *C. W. Hayes and S. R. Beckwith, Washington, U.S.*—8*th May*, 1883.—(*A communication from M. L. Baxter, Illinois.*)—(*Complete.*) 6*d.*

The transmitter has a vibrating diaphragm carrying or actuating a metal stud in unstable contact with a piece of carbonaceous material attached to a freely suspended bar, and an induction coil for producing the intense intermittent induced secondary current, all of ordinary construction. The object is to increase the variation, so that a much more powerful induced or secondary current may be sent to line to work upon the distant receiving telephone. The induction coil in addition to its ordinary function serves to vary the pressure between the metal stud on the centre of the diaphragm and the carbon button attached to the bar. When the current increases the core of the magnet acting upon the suspended bar causes an increased contact between the metal stud and carbon button. The receiver consists of a stock or holder with an ear piece to hold the vibrating diaphragm. A U-shaped permanent magnet has the diaphragm attached to one of its legs by a screw, whereby a stronger magnetic effect is produced between the other pole of the magnet and the diaphragm. The inducing coil consists of concentric parts made of a central part of fine insulated copper wire, a middle part of fine insulated iron wire, and an outer part of fine insulated copper wire. The current passes through the coils of all the parts successively, so as to form in addition to the central magnet core a tubular electro-magnet made of the iron wire, which while acting as an inducing helix to the central magnetic core is itself acted upon and rendered magnetic by the action of the outer copper wire coil, and to a considerable extent re-acts upon itself to produce the same result, whereby the vibrations of the diaphragm are amplified.

2475. Window Sashes, *A. Rudolph, San Francisco.*—17*th May*, 1883.—(*Complete.*) 6*d.*

This relates to windows in which the frame is pivotted in side bars sliding in the casing, and consists in forming the sashes and side bars with tongues and grooves so as to make a tight joint when closed in combination with central pivots and centre pieces with double inclined sides, and which slide obliquely through slots in plates fixed to the side bars, so that the bars and sash may be separated when the sash is to be turned, and kept apart by a gravitating lever.

2556. Separating, Feeding, and Rivetting or Setting Shoe-lace Studs or Hooks, *H. H. Lake, London.*—22*nd May*, 1883.—(*A communication from W. C. Bray, Massachusetts.*)—(*Complete.*) 8*d.*

This relates to the general construction of machines for effecting these operations.

2561. Operating Gas Engines, *L. H. Nash, Brooklyn, U.S.*—22*nd May*, 1883.—(*Complete.*) 1*s.*

The invention comprehends as co-operating members an engine adapted to work with a supply of compressed air and gas, an independently operating air compressor serving both as a motor to start the engine and supply it with compressed air when running, and means for converting the fuel into gas under sufficient pressure to be supplied direct to the engine, and of burning without smoke, the several members working independently, and combined to produce a motor under perfect control, and capable of adapting itself to varying conditions of use. It also comprehends a gas engine in which the cylinder is totally enveloped by a boiler encasement, which also envelopes flues for the escape of waste gases, so as to utilise waste heat. Also a gas engine in which provision is made for a slow combustion of the gases in contradistinction to an explosion. There are thirty-two claims.

2606. Obtaining Artificial Light and Heat, &c., *J. S. Muir, London.*—25*th May*, 1883.—(*Complete.*) 6*d.*

The object is to produce light and heat by the volatilisation of mineral oils or hydrocarbons, which is effected in close proximity to the burner, where the resultant gas is burnt, whereby no holders or receivers are necessary. In one form of apparatus the oil flows to the burner, which is surrounded by a curved metal exposed to the flame of the gas when burnt, and which becoming heated, volatilises the oil as it is supplied to the burner. Other arrangements are described.

2616. Corset, *W. R. Lake, London.*—25*th May*, 1883.—(*A communication from I. Strouse, Newhaven.*)—(*Complete.*) 4*d.*

This relates to that class of corsets which are specially designed to form a spinal support.

2781. Apparatus for Carburetting Air and Delivering or Distributing the Same for Lighting and Heating Purposes, *J. S. Muir, London.*—5*th June*, 1883.—(*Complete.*) 6*d.*

This relates to apparatus for carburetting air, and has for its object the construction of a simple apparatus which at the same time as it effectually carburets the air, delivers or distributes the carburetted air to the burners where it is to be used in a steady equable flow without the use of governors, or regulators, or accumulators, or the like, so that the carburetted air will reach the burners at a certain determined pressure, whether there are one or more burners in use.

2789. Machinery or Apparatus for Disintegrating Fibrous Plants, *W. L. Wise.*—5*th June*, 1883.—(*A communication from D. Prieto, Washington, U.S.*)—(*Complete.*) 6*d.*

A set of crushing grooved rollers, carrying chains, friction rollers, and scraping knives, are combined so that the fibrous plants to be treated are first broken or crushed, then acted upon by one set of knives which scrape one part of the plant, and then by another set of knives which scrape the remaining part, whereby all matter is removed from the fibres.

2903. Presses for Printing and Embossing, *M. Gally, New York.*—11*th June*, 1883.—(*Complete.*) 6*d.*

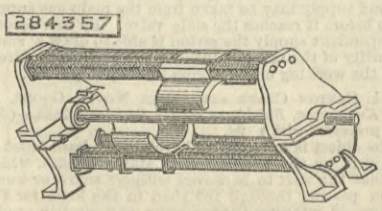
This relates to several improvements in platen machines.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

284,357. Dynamo-electric Machine, *Charles E. Ball, Philadelphia, Pa.*—*Filed February* 19*th*, 1883.

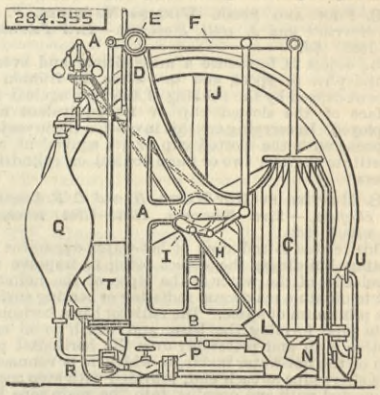
Claim.—(1) In a dynamo-electric machine, the combination of two armatures on the same shaft, coupled or connected together as set forth, each of said armatures being located and adopted to be rotated in the inductive field of only one pole of a magnet, said machine having two unlike magnetic poles, substantially as shown and described. (2) The combination in a dynamo-electric machine having pole pieces on opposite sides of the machine, of magnet bars of



different lengths on the two sides of the pole pieces, said bars being wound over their entire extent, except where the pole pieces are located, substantially as shown and described. (3) The combination, in a dynamo-electric machine, of two armatures coupled or connected together, as set forth, and two pole pieces on opposite sides of the machine, both of said armatures being on the same shaft or adapted to be rotated in the same direction, each of said armatures being located and adapted to be rotated in the inductive field of only one pole, and said poles being of unlike sign, substantially as set forth. (4) The combination of the armatures, connected by wires with a supporting disc, substantially as shown and described.

284,555. Gas Engine, *George M. Hopkins, Brooklyn.*—*Filed February* 17*th*, 1883.

Claim.—(1) In a gas engine, the combination, with a gas supply pipe and an igniter blow pipe, of a pump, serving the double purpose of a governor to the gas supply and means for supplying air to the blow pipe, substantially as herein shown and described. (2) In a gas engine, the combination, with the pump T and blower pipe U, of the igniter V, secured in the side of the cylinder, and the piston G, serving as a guard to prevent ignition until it has passed above said igniter, substantially as herein shown and described. (3) In a gas engine, the air pump T, having a reservoir, and flexible diaphragm, in combination with the flexible gas supply tube R, as shown and described. (4) In a gas engine, the combination of the flexible air pressed diaphragm, flexible gas supply tube R, and adjusting screw, as specified. (5) In a gas engine, constructed as herein described, the air pump T, having the diaphragm and



regulating valve, the gas supply pipe R, and blow pipe U in combination, as and for the purposes specified. (6) In a gas engine, the piston slide valve K, made in two parts, mounted adjustably on the valve rod, as herein specified. (7) In a gas engine, the shaft, carrying the crank arms, and journalled excentrically in relation to the main shaft I, the link, and crank H, in combination for operating the valve K, as herein specified. (8) The combination of the disc and adjusting screw with the air check valve, as herein specified. (9) In a gas engine, the concave cylinder bottom M, filled with granular or fibrous non-combustible material, and provided with the perforated plate, as shown and described.

CONTENTS.

The Engineer, October 19th, 1883. PAGE

The Meteorological Society.—The Home Secretary has acquainted the Meteorological Society that her Majesty has been graciously pleased to grant it permission to adopt the prefix "Royal." The society accordingly becomes the "Royal Meteorological Society."