SUSPENSION AND CANTILEVER BRIDGES.

THE attempts to make suspension bridges, as the term is usually understood, rigid enough to carry a railway train with the desirable steadiness have hitherto resulted in failures. It is the essential property of a flexible catenary to change its form whenever the distribution of the weights which are suspended from it is changed ; and suspension bridges whose principal carrying members are such flexible catenaries, are, when weighted by a passing load, liable to a geometrical change of form besides that elastic change of form which is common to all structures. Röbling's railway suspension bridges are of this description, although by introducing straight chains—held straight by being suspended at intervals from the catenary—he has to some extent diminished the effect of the passing load as described above.

Mr. Ordish goes a step further, and makes the straight chains carry the whole or the greater part of the load, and uses the catenary only, or chiefly, for the purpose of keeping the carrying chains straight. In the Albert Bridge over the Thames at Chelsea, the whole load, with the exception of the central portion of the middle span, is carried by the straight chains ; and the catenary which carries that portion is kept with the assistance of the parapet girder in such a position of equilibrium, that in a geometrical sense, and apart from secondary circumstances, this bridge would be rigid, but in reality it is not ; and although it is probable that the vibrations under a passing railway train would be much less than in proportion to what they are under a passing carriage and horses, the bridge does not prove successfully the applicability of the system for railway bridges. We cannot on this occasion enumerate and discuss the various circumstances which, in our opinion, produce the greater part of the vibrations—however small they may be in comparison to the undulations to which ordinary suspension bridges are liable—but one of them should be mentioned, viz., the continuity of the parapet girder from end to end of the bridge. If that continuity were broken at the piers as it is in the case of the bridge over the Moldau at Prague, constructed on the same principle, it would probably be almost as rigid, or, if the continuity had been broken at the centre, and if struts had been used in place of vertical tie rods extending between the chains and the platform as provided for in the original specification of the patent, Mr. Ordish would have approached very nearly the present fashionable system of cantilever bridges, and if he will take some hints from the latter there would be enough originality left in his idea to be the basis of a new system for railway bridges of very long spans.

The most scientific system of cantilever bridges, which, at the same time, is the most harmonious in construction, is Ruppert's cantilever bridge, as exhibited in a design for a bridge over the Bosphorus at the Paris Exhibition in 1867, and as described and investigated at great length in THE ENGINEER, vol. xxiv. By reference to pp. 218, 222, 310, the reader will find Ruppert's system fully illustrated, and the mathematical questions involved fully set forth. Referring to Fig. 1 above, B C D and B' C' D' are the cantilevers, and the gap between them is bridged over by a double parabolic girder C C'. The anchorage at A consists of a vertical weight. At one of the points C allowance must be made for expansion and contraction. This may be accomplished by a roller bearing, or simpler by a pendulum, and there are various ways of erection of the girder C C', although this is certainly one of the difficulties in the construction of this system if the bridge is very large. This system may be varied in many ways, as it is not necessary that the catenary should be equal to the arch, nor that they should have parabolic form. The distance C C' may be reduced, the inclination of the strut A D may be increased or diminished, the platform raised or lowered, and the great pressure at B may be distributed over several struts radiating from D, reducing at the same time the total height of the structure, without scarcely any loss of economical advantages. In Fig. 2 we give a sketch of one of these modifications.

The Forth Bridge design is, in its broad features, not unlike that of Ruppert's, and if the arch had been made to intersect the catenary in the way indicated in Fig. 1, instead of joining it somewhat awkwardly to the straight bottom flange of a girder, and if the tensile member had been continued also between points C and C', the design would be more scientific, not quite so objectionable æsthetically, and practically in no way inferior. Other merits of that design, and the unprecedented magnitude of the span, and the great responsibility undertaken by the engineers, silence criticism while it is in course of erection. Not long ago another of these cantilever bridges was erected across the Niagara to carry a line of railway. In this case the platform is very high above the river, and the banks being steep, the situation is eminently suited for an arch bridge. We believe it is generally admitted that an arch bridge, when once erected upon firm abutments, is in every respect superior to any other kind of bridge, and mostly in respect of economy. We can, therefore, form no idea of the motives which may have induced the engineer to construct a cantilever bridge on a site where the erection of an arch bridge would have been particularly easy, while it must contain quite 25 per cent. more material than the arch bridge.

But the latest and most extraordinary production of this kind is the proposed bridge over the Indus at Sukkur, the outlines of which we illustrate in Fig. 3. One can see directly that this design is strongly influenced by that for the Forth Bridge. There, without apparent reason, the uprights near the shore are double, and the chain which connects them at the top horizontally, falls on each side with equal angles. Each upright is supported by a pier, and they are connected by diagonal bracing. Thus the arrangement is similar to that at the central pier where the double pier is required. The only reason for this extra expense of material and foundations probably is an æsthetical one, which we think very doubtful, and which we believe did not enter into consideration until after the first design was completed.

Now, in the Sukkur Bridge the engineer seems to have considered it necessary to imitate these lines. There are the two uprights and the chain connecting them horizontally filled with equal angles on both sides. Unfortunately, however, a pier is only possible under one of the uprights, and the other upright must be suspended. For this purpose two raking members are introduced, both emanating from the one pier, the one terminating at the upper, the other at the lower end of the upright. This enormity, however, does not seem to have struck the mind of the engineer sufficiently to induce him to alter his lines in deference to the circumstances. The chain is then continued until it intersects the line of the platform, where consequently is the end of the cantilever. The remaining gap of 200ft. is then bridged over as in the Forth Bridge by a girder of an entirely heterogeneous character, which, however, here is much more marked than there.

Contemplating the monstrosity of the general design, one would expect that in point of economy and detail construction, a fair degree of excellence had been attained. But neither is this the case. There are many ways of reducing the unsupported lengths of the great uprights and raking struts, and consequently of reducing material ; but as these would involve some calculations of stresses beyond those of the most elementary kind, they were probably not deemed worth the trouble. With regard to detail, we only refer to the most important point in the bridge, which is the bed-plate below water-line. Here the resultant of all pressures is inclined towards the horizontal at an angle of about 60 deg. In such a case every beginner would construct a bed-plate whose bedding surface is inclined at right angles with the resultant, and place it so that the resultant goes through the centre. Instead of that, the bedding surface is horizontal, and the resultant passes considerably outside the centre.

Not having the working drawings at our disposal, we cannot enter into a discussion of the merits of the details, but we believe the single parts and their connections with each other are fairly good, as one might expect from an engineer of great practice and routine. What we find find fault with now is the poverty of the design as a whole. A derrick, the half of an English roof-truss, a Whipple girder, the other half of the roof-truss and another derrick, are very excellent things in themselves, but to string them together upon one line, and thereby making a bridge, is not engineering, nor is it architecture.

FIG. 1

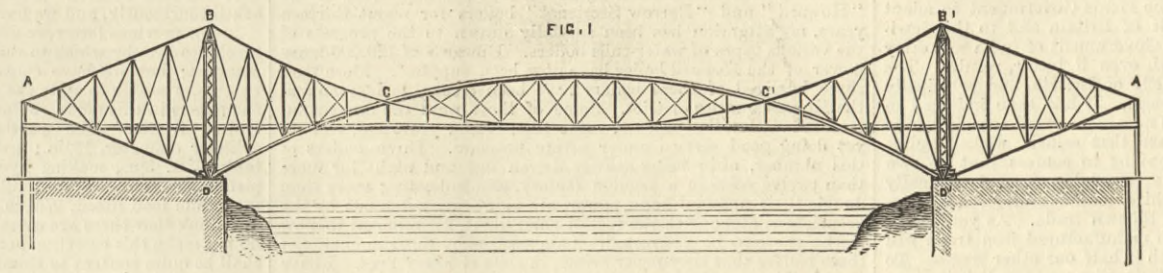


FIG. 2

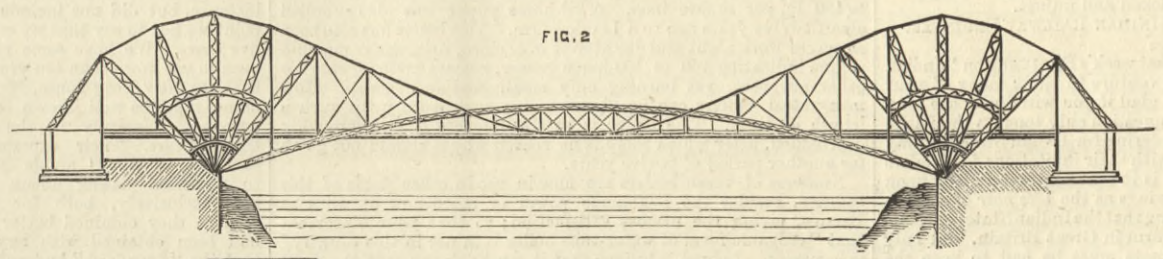
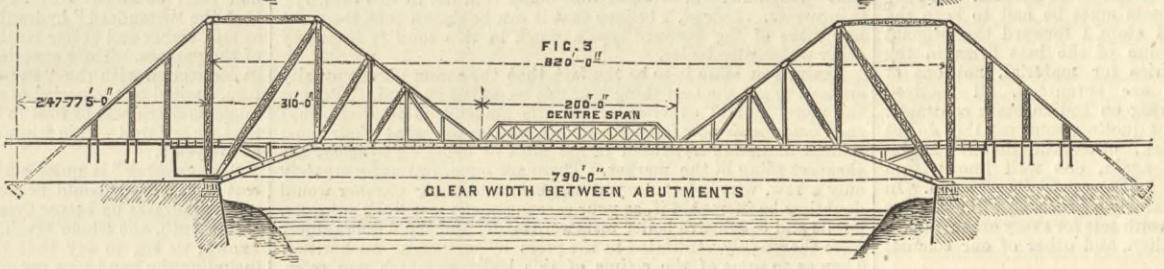


FIG. 3



THE ROYAL SHOW AT SHREWSBURY.

Now that the Royal Agricultural Society is about to hold its fourth competitive trial of sheaf-binding machinery, in connection with this year's show, it may be well briefly to recapitulate the main facts relating to the three previous contests. At Liverpool, in 1877, the Society first offered its gold medal for these inventions, and as the result, some half-dozen machines were entered for competition; but by the time fixed for the field trials all had been withdrawn with the exception of three American machines—those of Walter A. Wood, D. M. Osborne and Co., and C. H. McCormick. After an exhaustive trial the judges came to the conclusion that whilst great credit was due to these inventions, none of them attained that perfection which would justify the award of the gold medal. As a recognition of progress, however, a silver medal was given to Walter A. Wood, and high commendation was bestowed on the binding mechanism employed by D. M. Osborne and Co. The following year, 1878, in connection with the Bristol meeting, seven binders were submitted to trial, the firms already named again entering into the contest with their wire binders. The other competitors were J. and F. Howard, the Johnston Harvester Company, Hetherington and Co., and H. J. H. King, of whom Messrs. Howard were the only exhibitors of a machine employing wire as the binding material. The result of this competition showed that McCormick had made good use of the interval since the 1877 trials, by introducing considerable improvements, and he was ultimately awarded the gold medal, his machine having fulfilled all the conditions laid down. This time Wood's machine took the second place, receiving a high commendation. The next year at Carlisle, although no trials were organised, thirteen sheaf-binders were exhibited by eight firms, and the improvement effected in these machines, as compared with all former exhibits, was so marked that the judges recommended the Council to again offer prizes for competition during the harvest of 1881. At the same time they suggested that the trial should be limited to machines employing some other binding material than wire. Both the recommendation and the suggestion were at once adopted by the Council of the Society, who immediately made public their decision to offer a gold and a silver medal for the best and the second best machines not employing wire. This offer was taken advantage of by thirteen firms, who entered no less than twenty-eight machines for exhibition in the Derby Showyard and subsequent trials in the field. On this occasion, however, new regulations were in force. The machines selected by the judges were allowed to remain in the possession of the respective exhibitors up to the time of trial, instead of being taken charge of by the Society, with a view to enable the exhibitors to work and improve their machines between the close of the Show and the time fixed for the trial. Moreover, the competitors were required to sign an undertaking to forfeit £25 for each selected machine not produced on the trial field at the proper time — an agreement which in three or four cases was enforced. This time the award of the judges gave the gold medal again to McCormick, a silver medal each to Samuelson and Co. and the Johnston Harvester Company, while Mr. H. J. H. King received high commendation for his principle of tying and separating sheaves. The particulars of the entries for the approaching competition will be found on page 32. The following are the official conditions as to trial:—

1. Notice of the place and date of the trials will be posted to every competitor as soon as they are fixed.

2. Every competitor must himself provide for the delivery of his machines on the trial ground, and for the removal of the same after the trials.

3. Horses will be provided by the Society to work machines during the trials, but competitors who desire it may provide their own horses.

4. Every machine must be delivered at the depôt on the trial grounds in proper working order, before 9 a.m. on the first morning of the trials.

5. Exhibitors are expected to provide their own drivers and attendants, but the Society reserves the right to provide men and to work any machine if an exhibitor is absent, or not ready, or who says that his men are absent, after due notice has been given to him to bring his machine out for trial.

6. All machines, whether binders only, or combined reapers and binders, will be tried in the same or similar crops.

7. The binders will be tried on swathes cut for them by a swathe-delivery machine, and also on a crop cut by a sheaf-delivery machine.

8. Before starting work on any plot, the exhibitor must declare the number of men and horses required by his machine. If he personally, or any other extra attendant not included in such declaration, should render any actual assistance in working or adjusting the machine during the trial, the fact will be noted by the judges.

9. The height of cut must not in any case exceed an average of 6in.

10. The judges and engineers will, as far as practicable, note the time occupied, the number and duration of stoppages, the area passed over, the width and height of cut, the mode of delivery and position in which the sheaf is left, the waste of corn in the operation of binding, the size and condition of the sheaves in each trial, and the economy of power.

11. In examining the sheaves and the knots in the bands, the judges will attach most value to binding which is secure for handling without extreme tightness of sheaf.

12. In addition, the following qualifications will be chiefly considered by the judges in assessing the relative merits of the several machines and their performances:—(*a*) Simplicity and efficiency of construction; (*b*) weight; (*c*) cost; (*d*) adaptation for English farms; (*e*) quality, strength, and cost of binding materials; (*f*) security of knot; (*g*) efficiency in binding, &c., wheat—see Condition 10—perfection valued at 100 points; (*h*) efficiency in binding, &c., barley, perfection valued at 100 points; (*i*) efficiency in binding, &c., oats, perfection valued at 100 points; (*j*) efficiency in binding, &c., beans, perfection valued at 50 points.

13. Lots will be drawn for each series of plots.

14. Machines are not to be worked under conditions as to

weather and crop, when such machines would not be used in the actual work of a farm.

The judges are:—Mr. Mason Cooke, The Lawns, Ely, Cambs.; Mr. William Scotson, Mossley Hill, Liverpool; and Mr. Thomas Bell, Hedley Hall, Newcastle-on-Tyne. They commenced their inspection of the whole of the implements in the showyard on Thursday morning, and will probably not finish this work until Saturday evening.

LETTERS TO THE EDITOR.

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

INDIAN RAILWAY GOVERNMENT CONTRACTS.

Sir,—In reference to your article in your issue of the 27th June on the above subject, I would point out that I think you are scarcely correct in insisting that it is entirely opposed to the practice which obtains in civil life for the authorities at the India-office not to make known the names of contracting firms or the amounts of tenders received. As an example in support of your argument you quote corporation engineers as invariably publishing such information. Corporation engineers, however, are not after all very large buyers in the open market, and are certainly no rule whereby the India-office railway authorities should be guided. If they are to follow precedent, should it not be rather that set by other powerful railway administrations? Do any of the great Anglo-Indian railway companies—the East Indian, the Great Indian Peninsular, the Madras, or the Sindh, Punjab, and Delhi—set the example you recommend? Do any of the Anglo-American or any of the great home railway companies do so? I think it would be difficult to cite any one instance.

As to there being certain favoured firms, as you suggest, that is mere gossip. Had you taken the trouble to make inquiries, I think you could easily have got assurance that the idea has existence only in the imagination of disappointed contractors. Those who know most of India-office railway matters generally consider that the rule is to take the lowest tender, except in very special circumstances where time is more considered than money value.

I am myself a fair-trader in principle; but so long as the Government of India is forced by the Home Government to adopt a free-trade policy, all to the benefit of Britain and to the detriment of India, so long, I trust, the Government of India will carry that free-trade policy to its logical, even if bitter, results. The "spoliation of India" for the benefit of Britain, and principally Lancashire, has continued long enough. It has been indulged in equally by Tory and Radical. It is now some small consolation to poor India's sons and friends to see that selfish, wicked policy bearing its own fruit, and Britain having to confess that its own boasted, vaunted, selfish free-trade principles, framed originally solely in the interests of Lancashire manufacturers, are commencing to undermine and destroy its own trade. As you fear, I have not the least doubt the British manufactured iron trade will soon be completely ruined, and with it half our other trades. To attempt to bolster these decaying industries up at India's expense would be as futile as it would be wicked and unjust.

July 1st. An Anglo-Indian Railway Engineer.

Sir,—Adverting to your leader in last week's Engineer on "Indian State Railway Contracts," which I venture to think many of your readers saw with pleasure, I shall be glad if you will find space for a few remarks. I think the leader in question only touches the fringe of the anomalies connected with tendering for Indian State Railway contracts. Dealing for the present with their invitations for tenders for carriage and wagon stock, why is it that contractors look upon Indian State specifications and drawings as the *bête noir* of all contracts. I am not exaggerating in saying that the Indian State contracts are the last resort of nearly every firm in Great Britain, and only seriously tendered for when contracts must be had to keep the works going. In proof of what I state I forward the original replies—not for publication—of some of the best firms in the country, sent in answer to inquiries for material, not one of whom will even quote. There are seventeen, all received about the same date, and all bearing on Indian State contracts.

Amongst the reasons given for not quoting, some say they do not "care to quote for Indian State work," others they do not "appreciate mode of inspection," and, again, one well known firm will not have Indian State work "at any price," and so on. In opposition to this feeling there is scarcely a firm who will not shave down to nearly cost price to secure contracts for every other Indian, New Zealand Government, Australian, and other of our colonial lines, and all our home railways.

Surely it is reasonable to think that Sir J. Hawkshaw, Messrs. Hayter, C. D. Fox, John Fowler, Berkley, Batho, Bruce, Cleminson, Livesey, Carruthers, Meilbeck, Hemans, and others, with engineers on our home lines, know something of rolling stock; yet there is the keenest possible competition to secure their contracts, which at the present time they place at very low prices. The reason is not far to seek—the fact is, with the exception of the Indian State Railways, the specifications are drawn up in a reasonable manner, and contractors are treated with some consideration; in a word, they know they will be treated fairly. The inspectors are invariably practical men who know what a job is, and do not insist on locomotive accuracy, except where it is required. Again, if there is a question the engineers are get-at-able, and contractors are not shuttlecocked from pillar to post between engineer and inspector-general and director-general *à la* Indian State Railways.

Referring again to Indian State Railways, their whole system, one would think, was designed after the most elaborate thought to make the conditions such that their stock shall be bought on the very worst terms. The specifications bristle with pains and penalties; the times for delivery have been in many cases—say in every case where it is fixed by themselves—of the most unreasonable character; their inspectors, with but few exceptions, are men who never used a hammer and chisel in their lives, and when armed with their polished callipers and vest pocket ivory rule, they are—well to use a hackneyed phrase, more easily imagined than described. Let your readers think for a moment on having the designer of the earth wagon, illustrated in your last week's issue, sent to superintend its construction. Could a more unmechanical abortion be well imagined, or one where cost was put on without the remotest utility?

The same remarks apply to nearly every description of rolling-stock designs issued from the Indian State Office—witness the third-class carriage with brake illustrated a few weeks ago—but one would think what our contractors call a "muck wagon" would not tax an ordinary draughtsman's talents to a very high degree, providing he knew anything at all about the object required. For instance, to begin with the floor, this is to be 6ft. by 6ft. by ¼ in one plate of B B iron. Is there a works in North or South Staffordshire can roll this? But if they could—which they cannot—two plates 6ft. by 3ft. by ¼ with a cover strip are equally as good, and as the specifications generally stipulate that the plates are not to be wavy—save the mark!—which of the two is the easiest to planish?

Next we come to the angle iron framing. That for floor and sides and ends must, for Indian State Railways, of course be welded, instead of leaving the standing web solid and nicking a piece out of the floor web. This, however, is distanced by the capping angle which runs round the top, and then still in a piece runs down on each side of door, which the designer no doubt thought was the simplest thing in the world. I do not for a moment say it is not to be done; but why take the most expensive way, when every bit as good a job could be got by having the capping in two pieces and joining at the middle of the end plate, with a separate piece rivetted up the doorway? The check plates for guiding the body into its place are actually shown fixed with a couple of coach screws endways in the timber. Would they remain firm a week? The pedestals, although bolted to timber soles, are to be faced on top! Imagine one of our locomotive engineers specifying for spring shoes or scroll irons even, to be faced before being fixed to timber soles.

I should like any of our railway contractors to express an opinion on the buffers 1ft. 8½in. long by 6in. by 4in., without even the support of a buffer line. But not to prolong comment, the whole of the parts of this earth wagon not bored or turned—this is delicious—must be cleaned up with the file, and finished in first-rate style. I note the bolts are to be screwed down to 3 diameters; that is, an inch bolt must be screwed 3in. down, a fairish margin. No less than seven complete sets of tracings and twenty well-executed photos are required of this "elegant" wagon; in other words, the fortunate contractor for the time being will need another tracing clerk and maybe a photographer.

Does it not stand to reason that the Indian State Government have paid a heavy penalty for their bureaucratic style of business? I shall not be wide of the mark in saying that almost any of the Indian, colonial, or home lines could have procured the six to seven millions worth of plant you refer to in your leader, and have had equal value, for full £500,000 less than the Indian State paid.

The fact is the military element should be entirely swept away, and a man of engineering and business knowledge should be placed at the head of affairs to supervise specifications, times of delivery, and above all, the selection of suitable men as inspectors. Then, and not till then, will the Indian State be able to buy as cheaply as the home lines and our other colonial dependencies.

If any one doubts the statements I have put forward, let a commission of inquiry be instituted, and manufacturers invited to cite cases of unreasonable and unbusiness-like oppression, and I warrant some startling facts will be disclosed. C. E.

London, July 2nd.

WATER TUBE BOILERS.

Sir,—Will you permit me, in accordance with your invitation, to draw your attention to several inaccuracies in your article of the 13th inst., on water-tube boilers. Your jocular challenge to the representatives of the various types of boilers to point out the special merits of their competitors, relieves your article from the suspicion of having been written specially in the interest of any one type of boiler.

Having been the London agent for the manufacturers of the "Howard" and "Barrow Sectional" boilers for about thirteen years, my attention has been specially drawn to the progress of the various types of water-tube boilers. Upwards of 120,000-horse power of the Howard boiler have now been supplied. More than three hundred of these boilers have been erected in London and the Home Counties district. Some of these were the first manufactured under the patents, more than fifteen years ago, and are yet doing good service under severe pressure. Three boilers of this number, after being heavily driven day and night for more than twelve years in a London factory, and indicating more than double their nominal horse-power, are now being taken out by the proprietors, along with the rest of their plant, for removal to new works, there to be re-erected. I am assured by those in charge of these boilers that they never prime, in spite of heavy fires. I have repeatedly seen their steam gauges indicating a pressure of 170 lb. to 180 lb. per square inch. A 50-horse power was also supplied about twelve years ago to a London firm. This boiler has also been at severe work night and day almost ever since, driving a compound engine indicating 140 to 150-horse power, besides giving steam for other purposes, yet burning only small coal and breeze. How many steel boilers can be shown doing such a duty for such a length of time? This boiler is at this moment being thoroughly overhauled, after which there is no reason why it should not go on for another period of twelve years.

Numbers of these boilers are now in use in other parts of this country, besides the 1500-horse power or more now at work at Barrow, giving the utmost satisfaction; so that your statement that "only one form of water-tube boiler is in use in this country" is incorrect. Indeed, I believe that it can be shown that there are now more of the Howard type at work in this country than any other water-tube boiler.

Again, you state it to be the fact that the steam user is usually anxious to get the best thing that can be had of its kind. Is it not the more general experience that the tendency is to avoid what they describe as new fangled notions, and to use what their most remote ancestors have been in the habit of using, or to select the cheapest thing in the market. There are some, but unfortunately only a few, who select as you suggest; and their number would doubtless be increased if, as your correspondent last week suggests, public and conclusive boiler tests were made, and the whole subject were thoroughly ventilated in the press by competent authorities. Then as to some of the claims of this boiler to which you refer, viz., safety and economy, which are the most important qualities a steam boiler can possess.

There are many hundreds of boilers of the various water-tube types now in operation in this country, yet how seldom we hear of a dangerous accident to one of them. Perhaps half a dozen in all have occurred during the last fifteen years. And compare an accident to this type with one to the shell boiler. With the latter whole factories have often been razed to the ground, and much loss of life to persons, even outside the factories. Only this week a shell boiler is reported to have exploded and caused more deaths and damage than all the water-tube boiler accidents on record. With the water-tube boilers not a brick of any building has ever been displaced. Cases of severe scalding to persons in immediate proximity to the boilers are on record, but very few deaths are attributable to water-tube boiler accidents. Surely this immunity from terribly disastrous accidents, so common to the shell boiler, is worth something, considering the thickly populated neighbourhood in which many boilers are erected, and the thousands of hands employed around and about the boiler-houses.

These boilers have been carefully and repeatedly tested for evaporative duty, and it has been found to range from 9 lb. to 12 lb. of water per lb. of coal consumed. There is also an economical gain in the erection and brickwork which is of the simplest.

In the early types of the water-tube boiler faults existed which experience has enabled the various makers to remove. (1) Steam space was too much restricted. (2) Cast iron was too freely used. (3) Joints were too many, and were imperfectly made. India-rubber—always an uncertain material in such a position—was used, and strange to say is still used by some makers. But now experience has enabled the boiler-maker to master the difficulties that surrounded his early experience, and with ample steam space and large connections, with wrought iron or mild steel, and a rigid exclusion of cast iron, and with coned-faced joints instead of india-rubber, and with greatly decreased number of joints, besides the various other minor improvements, the water-tube boiler has grown into a cheaper, safer, more reliable, and more economical boiler by far than it ever was, and those we are now supplying are giving complete satisfaction, and they will compare favourably with any shell boiler in the points your article enumerates.

John H. Hackworth, Managing Director.
The Machinery and Hardware Company,
147, Queen Victoria-street, London.

Sir,—*Apropos* of the article on water-tube boilers in your issue of the 13th inst., in which was expressed the desirability of having the views of some authority on the subject, we beg to enclose copy of a letter written by a gentleman acknowledged to be at the head of his profession in America, which we trust may prove of some interest, and that you will give it space in your valuable columns. The gentleman in question is Mr. Charles E. Emery, Ph. D., of New York, who has conducted to successful operation the gigantic enterprise for the distribution of steam throughout the city of New York known as the New York Steam Company, whose first station or central plant has now been in use some two years or more. In this plant 16,000-horse power are to be massed ultimately, 10,000-horse power of which are already in, and, during the winter months, in full demand. (The Babcock and Wilcox Company.)

107, Hope-street, Glasgow, June 30th. Charles A. Knight.

[COPY.]

Office of the New York Steam Company,
16, Cortland-street, New York, January 9th, 1883.

W. P. Shinn, Esq., Vice-President the Cable Towage Company, New York.

Dear Sir,—In response to your inquiries as to the considerations that led us to select the Babcock and Wilcox boiler for use in our station, I would state that as the boilers are to be massed together on four storeys of the same building, it was essential for safety that boilers of the sectional type be employed. Of the several kinds, it was considered that the Babcock and Wilcox boiler had the best mechanical details, remaining perfectly tight, not only under ordinary conditions, but under circumstances of abuse and neglect. They are also easily repaired in case the water is allowed to get so low as to permit the tubes to be overheated.

As respects economy, the heating surfaces of the Babcox and Wilcox boiler lie transversely to the current of hot gas, and are, therefore, more efficient than an equal extent of surface in a fire-tube boiler. Of course economy bears a relation to the extent of heating surface per unit of coal consumed, but the Babcock and Wilcox boilers will always be more economical than fire-tube boilers, as ordinarily proportioned; and when worked at the same rate of combustion per square foot of heating surface, will always maintain their advantage, whatever the proportions.

I may add that both Mr. Babcock and Mr. Wilcox are thorough engineers, who have made the subject of boilers a study, eliminated all the old familiar mechanical troubles, and produced a boiler with a much larger factor of safety than ordinary boilers, and one which gives superior results in an economical sense, with the comfort and safety and low expense of maintenance due to good mechanical details.

There was altogether too much to do in making new designs for our work here to think of designing boilers, particularly when boilers possessing the advantages of those furnished by the Babcock and Wilcox Company could be secured at once. Very truly yours,

(Signed) Charles E. Emery,
Engineer and Superintendent.

HYDRAULIC LIFTS.

Sir,—In your paper of the 4th we find a letter from "Economiser," and we have great pleasure in furnishing the additional information asked for by him. Of course, we have no knowledge as to the personality of "Economiser," and have supposed him to be a consulting engineer not interested pecuniarily in the manufacture and sale of lifts. However this may be, his questions are asked courteously, and we have great pleasure in replying to them.

In our previous letter we explained that we have as yet no large machines here by which to show how high a degree of efficiency is attained; but we have contracts for some such lifts, and will by-and-by be able to state the results attained. Upon looking over the papers in this office we find the minutes of a test made in the United States. The particulars are as follows:—"Elevator cylinder diameter, 14½in.; area, 165·13in. Height of water from tank, 93ft. 3in., making hydrostatic pressure 40½ lb.; stroke of piston, half the rise of car; full pressure exerted on piston, 3344 lb.; maximum load lifted, 2751 lb.; percentage of effective power, 84." We think that there are cases which will excel even this; but we do not make this assertion because we have no present proofs. We shall be quite content to stand upon this record.

"Economiser" says that we gave the repairs for two years in one instance, but did not include the cost of new ropes. Upon this point we beg to say that we estimate the life of a suit of ropes at five years. We have some ropes in our own factory which have been in use more than ten years. It is proper to say at this point that our New York house, Messrs. Otis Brothers and Co.—whose names must be well known to many of your readers—have been engaged exclusively in the manufacture of lifts for the last thirty years. Their experience may therefore be considered such as to afford ample ground for a correct opinion. Up to a period dating about six years ago they built steam lifts exclusively, both for passengers and freight; and this because they obtained better results with that type of lift than had been obtained with any other type. They saw, however, that the "Standard" hydraulic elevator made it possible to arrive at still higher and better results, and they became the purchasers of the patents. Their experience as to the life of ropes when used in connection with the "Standard" hydraulic elevator is, therefore, limited to the period of about six years. As there has been no general renewal of rope in those which were first fixed, we feel that we are well within bounds when we estimate the life of a rope at five years.

"Economiser" is quite correct in suggesting that the average cost of new rope should be added to the cost of repairs, and as nothing pleases us better than to give precise figures and to have "the truth, the whole truth, and nothing but the truth" fully known, we beg to say that the cost of an entire suit of ropes, including the hand rope for one of the highest instances named in our letter appearing in your paper of 27th ult., was £6 19s. 3d. The time required to fix new ropes upon a lift would be, for one skilled man and a helper not less than four nor more than six hours. Taking the latter time, viz., six hours, we should be very happy to execute orders to any extent. Six hours' labour, therefore, for the two men, added to the cost of the rope already cited, will give the sum, which, divided by the number of years during which the ropes will last, will give the cost per annum of new rope. Although our experience warrants us in assuming five years as the life of the rope—and we will show many instances very much longer—"Economiser" may object; if so, it will answer our purpose almost as well if he counts the life as four years; and even so the results will be eminently satisfactory for us.

We have thus indicated the sum which should be added on account of new rope. We now turn to "Economiser's" question in regard to the cost of packing. While in our previous letter we gave sufficiently full information to enable anyone to understand the theory and working of our lift, we did not, of course, go into every minor detail. You might have rebelled at the space required for that, and, obviously, we should not deem it expedient to advertise to other manufacturers a great many points in practice which are the results of our own experience.

The packing is internal, but "Economiser" is quite mistaken in supposing it to be difficult of access. We packed a machine recently, one of those in the Albert Hall-mansions. The work was begun at 2.30 p.m., and the elevator was in use by the tenants again at 6.30 p.m.; the time during which it was out of use being therefore, say, four hours. To repack the piston we simply run the car to the top, which brings the piston at the bottom of the cylinder; the car is then secured to the overhead timbers, and the water is emptied from the cylinder. The man, sitting upon the ground, simply takes off the lower cylinder head; the follower is there at his hand; that is removed, the old packing is removed, the new put in its place, the follower replaced, the cylinder head put on again, the cylinder filled, the car freed, and work resumed. This is a brief description of the process. It is perfectly easy, occupies no more time than we have stated, and the cost is very slight. In giving the cost of repairs at the Alliance Insurance Company's building in our last letter, the cost of packing was included. In fact, if the owners or occupants of any building will simply attend to the ordinary lubrication which all moving machinery requires, the only repairs that will be needed are for packing and the per annum charge for new ropes. While upon this point, we beg to say that our machines are in use throughout the United States and in many foreign countries, as shown by our prospectus, and that the packing is always done in distant places, either by the people owning the lift or by local mechanics; and when once a lift is erected, we expect not to hear of it again, except in terms of commendation. More than this, we have sent machines to distant parts of the United States, to Australia, and to India, and have not even sent a man to fix them in the building. We have sent such full instructions that local mechanics have been enabled to fix the machines in perfect working order, and they will be enabled to perform the occasional packings and to put up new ropes without requiring anything whatever from us. It is but a

little while since an eminent London house purchased from us a lift for a new palace in India, and all the work of fixing has been done simply from our instructions.

We reply to "Economiser's" further question that the necessity for new packing, when it exists, is made evident by the fact that water can pass the piston. This, again, is made evident by the fact that the car will settle, so that should it be left at any particular floor for a long time, it would be found to move slightly. Even this would not indicate that water was being wasted, for in order to waste it must pass also the valve packing. If that should occur it would at once be made evident by the almost imperceptible rise of the car, so that in either case this failure to stand immovably at a fixed point indicates that the time has arrived for packing. We think nothing more need be said upon this point save to remark that we expect the first packing will need to be replaced in from three to six months after fixing, thereafter we expect the packings to last from six months to a year. In large buildings where large and powerful machines are used, and where a skilled machinist is employed to care for the machinery, the packing will last much longer. For example, in the case of the building mentioned in our last letter, viz., the United Bank Building, New York, the packings had been in use more than two years when the writer left that city, and notwithstanding the enormous work, they gave not the least indication of a need to be replaced. It may be that they are still running. If "Economiser" and any others interested will take the trouble to go into the testimony as before suggested, they will get abundant and satisfactory testimony upon all these points. If they will not take the trouble to do this in the face of our offers to furnish explicit particulars, list of places, and to pay any reasonable expense, is it too much to expect that they shall take our own testimony when the particulars are thus recited? "Economiser's" last paragraph has already been answered in part. It only remains to allude to his remark that we appear "to need reminding that safety gears do fail." In reply to this we have simply to say that we have been building lifts for more than thirty years, and that our safety gears have never failed. No one has ever been hurt or killed by the failure of our machinery. We did not describe all our safety appliances in our last, and will not ask for space to do so now. We will simply say that many engineers have called at our office, have had our safety appliances explained to them, and have been asked to show how our safety appliances could fail, they have been unable to do so, and have frankly admitted that safety appeared to be absolutely secured. If "Economiser" will give us the pleasure of a visit, we have no doubt that his examination will lead to a similar result.

In view of the interest which is being excited, we have written to our New York house to procure affidavits from those using the Standard hydraulic elevator in the United States, as to all the points which have been touched upon in this correspondence, viz., as to cost of power, cost of maintenance and repair of every kind, life of ropes, &c. &c.; to have these affidavits executed before H.M. Consul-General at New York, and to forward them to us as speedily as possible. When these shall have arrived, it will give us great pleasure to submit them to any or all who may be interested. Such affidavits in connection with information obtainable here in London will, we believe, furnish a complete body of testimony. If it be not complete, we respectfully ask to be informed what more can be done?

Your paper contains other letters calling for reply from us. Before entering upon this reply, we beg to say that in writing our former letter, and in writing the present one, we have had in view three classes, viz.:—(1) Consulting engineers, or those not pecuniarily interested in elevator manufacture; (2) architects seeking that full knowledge that will enable them to advise their clients wisely; (3) present or prospective owners of buildings using or proposing to use lifts. In addressing these classes, it was right for us to put down plain unvarnished statements of fact. We said nothing about other makers. If we confined ourselves to facts, we gave no occasion for any others to indulge in unfriendly attacks. If we did not give facts, then it was right that the errors should be pointed out, and we certainly furnished every possible means of doing so. First we turn to the letter from Messrs. Smith and Stevens. Before proceeding with this, we beg to lay down this proposition: In deciding upon the use or purchase of a lift, the following points should be considered by each of the classes before referred to, and to whom we address ourselves more particularly:—(1) Safety; (2) certainty of uninterrupted use; (3) cost of power; (4) cost of maintenance and repair; (5) durability or longevity; (6) first cost.

We think we have stated these points in their order of relative importance, but of course architects and owners may change the order to suit themselves if they wish. Bearing these points in mind, and referring Messrs. Smith and Stevens to the remarks already addressed to "Economiser," we now proceed to say that we shall follow the plan adopted in our former letter, viz., to recite facts which can be verified. It is to be regretted that Messrs. Smith and Stevens have not adopted this plan. Since they have failed to do so, we shall feel constrained to furnish a few additional facts. It may be possible that we shall indulge in what Messrs. Smith and Stevens call "roseate hues." If this be so, it will be because the facts create the hues. Certainly Messrs. Smith and Stevens will not consider themselves included in either of the classes to whom we have addressed ourselves, and we fear it is certain that Messrs. Smith and Stevens will fail to be convinced by anything that we say, however fortified by testimony.

Messrs. Smith and Stevens say that their system of hydraulic balance lifts has on several occasions been submitted to eminent consulting engineers, with the especial object of comparison with the American lift, and invariably with the same result—that the American lift has been rejected. The number of orders we have received are, at least, so many proofs to the contrary. They further say that in the cases of at least nine lifts the purchasers were led by their professional advisers to decline the Standard elevator, and to adopt that made by Messrs. Smith and Stevens. We have only to say with regard to this that it is to be regretted that they have not named the cases. It may be true—and certainly we shall not be so rude as to impute an untruth to Messrs. Smith and Stevens—but we have only to say that we are in ignorance of the cases. Our lift probably enjoyed the eloquent advocacy of Messrs. Smith and Stevens. It certainly did not enjoy our own. Let us be candid, however, and admit that there are those who would select the Smith and Stevens lift, even when we had had every opportunity to promote our own interests. We have lived quite long enough to learn that there are buyers for everything, and that the best thing is not invariably chosen.

Messrs. Smith and Stevens refer to one large building where one of the "Standard" elevators has been working for three or four years, and where the Smith and Stevens hydraulic balance machine was adopted when a second passenger lift was required. In this case we regret extremely that they have not mentioned the names. We will do so, and will give all the particulars to those who may call upon us, but perhaps it may not be best to print it just now. Later on we think there may be ample reason why we should. We may simply say that the building is not owned by a private firm, but by a corporation having very many members, some of whom may be very glad to learn some of the facts. The building has not one but four Standard elevators, viz., one passengers', one goods', and two short lifts. They have been working for several years, and a 6-horse power gas engine has been working the pump which delivers all the water required. The working of these lifts has been, and is, eminently satisfactory. We too have received, not one letter, but two from the architect, and these, as well as his verbal statements, assured us of their satisfaction. In one letter the architect says:—"The proposed new lift does not imply dissatisfaction with the machines put up at ——— by your company," and, in another place, that "the lifts fixed by your company at ——— were very satisfactory." In a later letter he says:—"Your lifts at ——— work admirably." These letters will be shown, and all particulars given, to any disinterested inquirers who may call. Now, the remaining facts in regard to this case are simply as follow:—A lift was wanted in a stair-well to go to the top floor of the house; there was not room enough, if the car went to the top floor, to furnish a support for the overhead sheave timbers, and the architect was not inclined to make the necessary provisions for such support. On account of this decision was made in favour of a ram lift. So well satisfied was the architect with our work, that he offered to give us the contract for the work if we would make a ram lift. We declined to do so upon any terms, and thereupon the order was given to Messrs. Smith and Stevens. We had pointed out to the architect as well as to his principals that the giving of this order did injustice to us, and would be used to our great disadvantage, but the unwillingness to provide the overhead supports appeared to control, and the order was given. We freely admit that it was a matter of extreme regret to us. We are happy now to say that the regret has quite disappeared, and that the event—like many other events in this life which appear dark and forbidding as they approach—has been found to assume very roseate hues for us as it recedes into the past. Not long after the Smith and Stevens lift was fixed, a very wealthy and very eminent London Corporation, wishing to order a first-class passenger lift, entered upon an exhaustive investigation through their own engineer. We do not feel at liberty to print the names without permission, but they are entirely at the service of disinterested inquirers. The engineer visited the large building to which Messrs. Smith and Stevens have referred, and made a careful comparison with our own passenger elevator. As a result, the order was given to this company, and not only was that order given, but other and numerous orders are to follow, as we are informed. This is one of the many engineers who have not invariably preferred Messrs. Smith and Stevens. We are warranted in saying that it was found that the first cost of this lift was very much in excess of the first cost of that which we had proposed to put in—more we believe than twice as much; and that the cost of working is materially more than the cost of working our own. The cost of maintenance and repairs is of course not yet known, as the case is too recent. We have simply to say that disinterested inquirers have only to visit this place and examine the two passenger lifts in order to arrive at a conclusion which will not be a happy one for Messrs. Smith and Stevens. We will drop this with the simple remark that, just as it stands, nothing can be better for our interest than this case with those willing and able to understand the truth. Messrs. Smith and Stevens say that two considerable contracts for lifts are now pending in London, and that in each, under the advice of engineers, the American and all other suspended lifts are excluded from competition. We have only to say that we have no knowledge of these cases. We know one case where they have got or are to get the order for a contract for lifts in the City, but in this case we are informed that a committal was made to Messrs. Smith and Stevens before we were known or understood, and that, had it been otherwise, we should have got the order.

Let us bring out another fact for the benefit of Messrs. Smith and Stevens. The papers report last week—*vide Building News*—that Messrs. Smith and Stevens have been awarded a contract for a patent suspended lift for a new building in Victoria-street. In this case we had tendered, but the contract had been given to Messrs. Smith and Stevens simply and only because their price was much below our own. This was the only objection made to our proposal by the owner, whose idea was that the other "would do, and cost much less." The order is not for a patent balance lift, which costs very much more than ours, but for the suspended lift. Perhaps Messrs. Smith and Stevens have said that the suspended lift is just as good as the American. If they have done so, we have only to suggest that they publish a cut of that machine, as we have done, and allow an opportunity for engineers and others to pass opinions upon that question. It certainly would never be purchased were it not for the existence of a class of people whose idea seems to be to get for the least possible sum something that "will do." Certainly the people who buy this class of lift do not appear to mind the importance of those points which we have laid down in our proposition. It will be seen that we are not talking generalities, but stating facts. Let us go a little further. Messrs. Smith and Stevens say that many of the points of advantage claimed by us are common to every hydraulic lift, and, of course, this is quite true. Then they proceed to examine the statement for cost of water for the Alliance Insurance Company's lift, and they quote our statement that the cost of water is not more than £20 per annum. It is worth while to quote this passage in its entirety: "This is given as a rate of £20 per annum, and farther on, in a calculation relating to the same lift, it is implied that the lift makes ten journeys per hour. This at ten hours per day for 300 working days per year, with water at 1s. per 1000 gallons—the average rate in London—would cost £135. At the same rate £20 worth of water will allow of fifteen journeys only per day. Some of our lifts make from 180 to 200 journeys per day." We said that the cost of water in this case did not exceed £20 per annum. We gave the cost of repair, and the repair bills did include packing. We proceeded to say that if in this case it were not possible to get the water from the street main, and if it were necessary to pump sufficient water for ten complete journeys per hour, only 0·4-horse power would be required. Commenting upon this, Messrs. Smith and Stevens say that the use of 9000 gallons of water per day for a year at 1s. per 1000 would amount to £135. This is a pleasant little arithmetical statement, and indicates a commendable knowledge of the multiplication table. It might have been amplified for the pleasure of Messrs. Smith and Stevens, if not for the gratification of your readers. For instance, it might have been said that at 2s. per 1000 it amounts to £270, and at 4s. to £540, &c. But what has this to do with the question? Does it disprove the statement that in that building the cost for water does not exceed £20 per annum? Does it disprove the statement that to pump fifteen gallons of water per minute 69ft. high is 0·4-horse power?

Messrs. Smith and Stevens say we appear to have written for that very small section of your readers who do not know anything at all of hydraulic lift details. For what class did Messrs. Smith and Stevens write this? We have given a variety of facts and figures, not one of which is challenged; and they give neither facts nor figures which have any bearing. Who do they expect to affect by what they have said? They say that 1s. per 1000 is the average rate in London. We reply to this that two water companies have distinctly agreed to supply water at 6d. per 1000 gallons. This is another fact; but of what use is it to cite such things? Let us here bring in another case which may interest Messrs. Smith and Stevens. We have given the case of the Alliance Insurance Company. We have stated exactly the cost of running and the cost of repairs. In our previous letter and in the present one we have exhausted that subject. The statement is not challenged, and cannot be.

Since Messrs. Smith and Stevens' modesty forbids them to cite their own cases, let us try to elicit complete information respecting one of their patent balance lifts: and we will take for this purpose the building called the St. James' Residential Chambers in the neighbourhood of the Alliance Insurance Company's building. We suppose that the first cost of this lift with all its appurtenances, one gas engine, &c. &c., is more than twice the first cost of the lift in the Alliance Insurance Company's building. The cost of working the Alliance is, as already cited, not more than £20 per annum. It is ready for use at any hour of the night or day. No special person is employed for its care. Let the facts be published in regard to the St. James' building, as to whether the first cost is not double that of ours; as to the amount of room taken up in the building; as to whether any rooms have been injured by the presence and use of the lift; as to the cost of working, including the wages of the skilled attendant, &c. &c.; as to the effect upon the building from noise and smell of the engine; as to the effect upon the comfort of the tenants by their inability to use the lift after the gas engine is stopped at night. Let all these points be brought out and a comparison made.

The two closing paragraphs of Messrs. Smith and Stevens' letter must receive a word of comment, and it is difficult to speak of these two paragraphs patiently. We have before claimed absolute safety. It may be well to point out here again that we use never less than four lifting ropes for a passenger machine, each of which is entirely independent of the other. Sometimes we use six, sometimes eight. To speak of danger with this multiplicity of ropes, and with all the other features of safety, is simply an absurdity. Messrs. Smith and Stevens say that they are making a suspended lift, "which is as economical, works as smoothly, is as noiseless, and is fully as safe as the American lift, and costs about half the money." We distinctly except to this statement, in each and every of its particulars; and, since we may not charge these gentlemen with a deliberate attempt to mislead, we simply say that the statement betrays an absolute ignorance of the Standard hydraulic lift. We ask these gentlemen for facts in support of their statement. How many ropes do they use? Do they have solid water on both sides of the piston at all times? Let them state the facts, and where such a machine can be seen.

Perhaps, however, we have gone far enough at present; we are taxing your space heavily we know, but can only plead that we have not made it necessary. We again repeat that we are seeking to reach only the classes before named. We have neither time nor disposition for personal controversies. We have stated our sincere and unqualified belief in the superiority of our lift. We have given some of the facts upon which our belief is based. There are a multitude of facts yet to be given. Not one statement of fact is challenged or overthrown, and we believe that no similar degree of merit can be shown by any other lift. If it can be, let it be shown. Of course, the comparison must be upon all of those points named in our proposition, for one machine may have one merit equal to our own, another may have another. We may concede safety in one case, smoothness of working in another, &c.; but what one contains them all to the same degree? and what one can be relied upon for uninterrupted working as ours? It is the combination of all these qualities, and notably the second of the points named, which has wrought the wonderful change witnessed in the United States during the last six years, and which we expect to produce in this country. Messrs. Smith and Stevens' questions as to cost of packing, &c., have already been answered.

Perhaps we may be allowed just one word as to the other correspondents. To Mr. Bernays, M.I.C.E., we have only to say that it will afford us very great pleasure to make his personal acquaintance and to explain our machine, and, further, that we are abundantly satisfied as to the validity of our patents.

To Mr. Hayes we may say that we are a little surprised that he speaks of the excessive speed in America as a defect. Excessive speed is used there simply because it is required. We began at slow speeds, but as people became accustomed to the elevator they required higher and higher speed, so that in a multitude of offices in the lower part of New York no speed less than 350ft. per minute would be tolerated. Mr. Hayes evidently does not understand the machine, or he would know that any desired speed, from 10ft. per minute up to the maximum, is at the command of the attendant, or any required quickness or slowness of starting. It is this perfect flexibility, this perfect answering to every requirement, which, in part, gives this machine its place of superiority. In some instances this high speed is a matter absolute necessity. For example, in the new building of the Western Union Telegraph Company in Broad-street, next the Stock Exchange, there are two of these lifts running at a speed of over 400ft. per minute. Has Mr. Hayes ever heard of a lift made by Otis Brothers and Co.—our New York House—being the cause of any casualty or accident whatever, or of any elderly person suffering from a severe strain of the nervous system? Mr. Hayes admits that "on the score of economy in working, would also doubtless compare favourably with anything we are doing here in London." Does Mr. Hayes know any place in London where equally good results are attained on the score of economy? If there are such cases, we are trying to learn where they are. It occurs to us at this moment to say that the Liverpool and London and Globe Insurance Company, of this city, have a fine building in New York in which our lifts are used. No doubt they can give testimony as to their economy, efficiency, and safety.

We again, and in conclusion, simply appeal to the facts. Thousands and scores of thousands of Englishmen have gone to the United States in the prosecution of their business. They have had hearty welcome, fair play, and full scope, and in due season they have returned to their own country to enjoy the rich reward which they have earned by their ability and enterprise. We ask for that which they have had. We ask for that candid and intelligent examination, and for that fair play, which we still believe to be British, notwithstanding some conspicuous examples of very unfair play and misrepresentation.

WM. AUG. GIBSON, President.

American Elevator Company, 38, Old Jewry, July 8th.

PERKINS' STEAM OVEN.

SIR,—In your account of the performance of Perkins' steam oven for baking bread, in your issue of the 4th inst., you state that ninety sacks of flour per week can be baked at a cost, for fuel, of 15s., being at the rate of 2d. per sack. I have erected several of the steam ovens in this district, and have obtained a much better result, for one of my clients informs me that the result of careful experiments he made shows the cost of fuel to amount to only 1½d. per sack of flour baked, and as only thirty-five sacks were being baked per week, in one oven, and often intervals of one hour between each batch, my client informs me that if the oven was worked to its full capacity the cost of fuel would not exceed 1d. per sack. Gas coke was the fuel used, and the price was 6s. per ton.

JAMES JOHNSTON, Assoc. M. Inst. C.E.

Manchester, July 7th.

JOHN BRAITHWAITE.

SIR,—I notice in your number of June 6th you have a short paragraph relating to the death of Mr. A. S. Braithwaite, of New Zealand. Your information is not correct, for that gentleman was not in any way connected in business with his brother John, who, you remember, died some ten years back in London. I have heard my father, John Braithwaite, state that Mr. A. S. Braithwaite did ride on the engine on the day of race.

Bescot Lodge, Walsall, July 2nd. ROBT. BRAITHWAITE.

(*For continuation of Letters see page* 32.)

TENDERS.

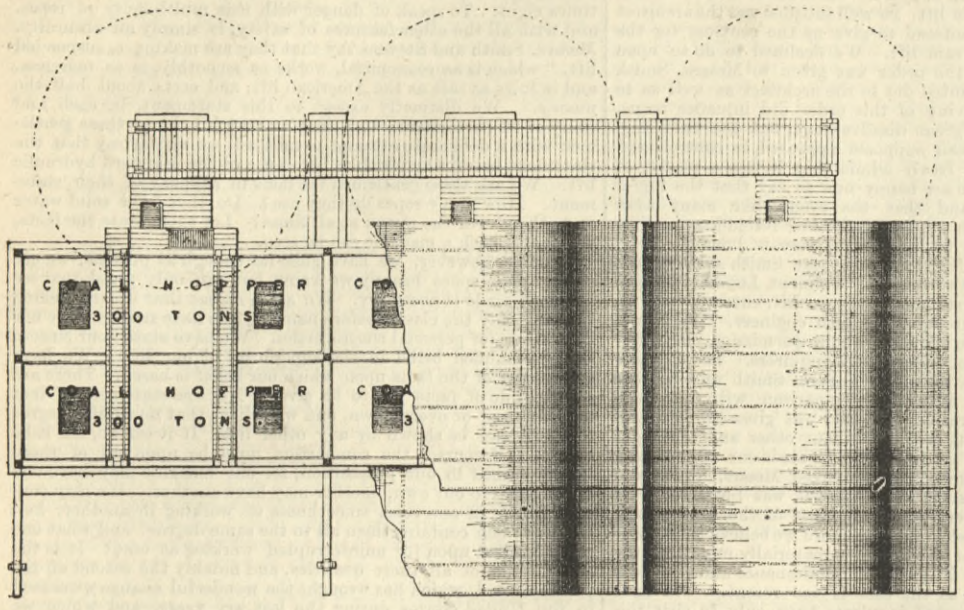
STRATFORD-UPON-AVON SEWAGE WORKS.

E. PRITCHARD, C.E., engineer, Westminster and Birmingham. Contract No. 3.—For constructing pumping station, pipe laying, and other works.

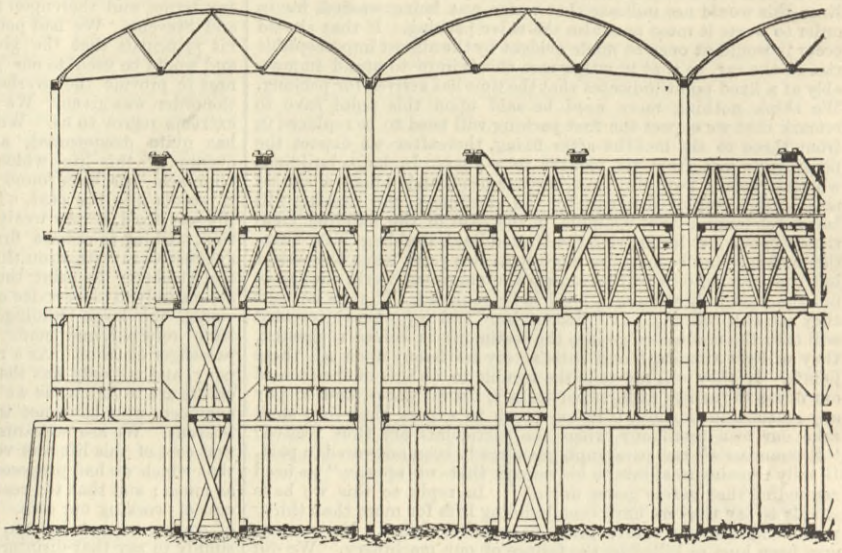
	£	s.	d.
Pervins and Sons, Dudley	5689	15	11
G. F. Smith, Milverton	5600	0	0
B. Cooke and Co., London	5500	0	0
Holme and King, Wigan	4777	0	0
Roberts, Stratford-on-Avon	4500	0	0
Hilton and Sons, Birmingham	4430	0	0
Currall and Lewis, Birmingham	4318	0	0
Cunliffe Leigh, Lancashire	4067	0	0
Law, G., Sutton Coldfield—accepted	4017	0	0

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending July 7th, 1884:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 8612; mercantile marine, Indian section, and other collections, 3318. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 6 p.m., Museum, 1575; mercantile marine, Indian section, and other collections, 238. Total, 13,738. Average of corresponding week in former years 19,930. Total from the opening of the Museum, 21,170,885.

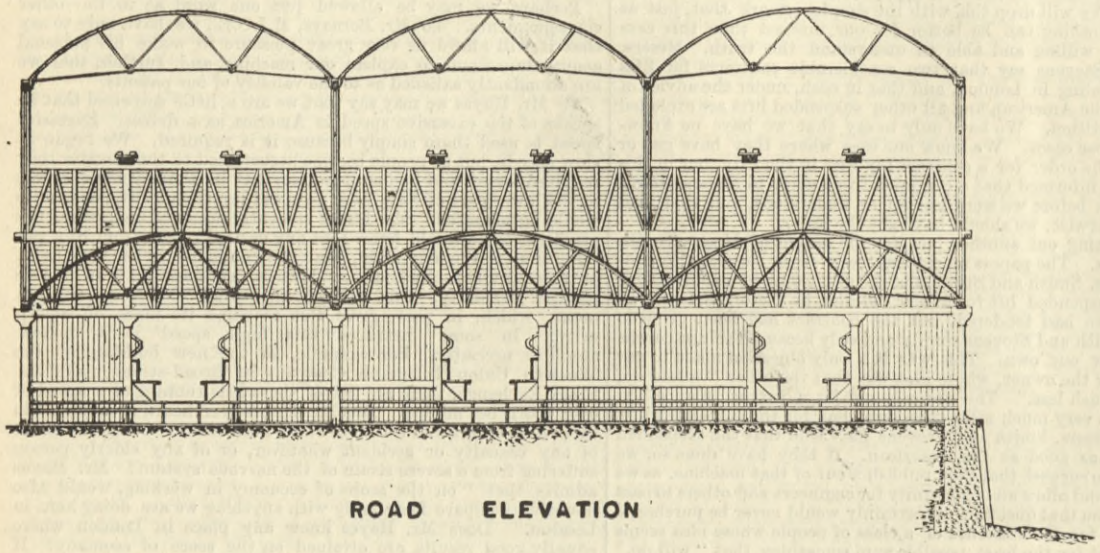
NEW COAL WHARF, NINE ELMS.



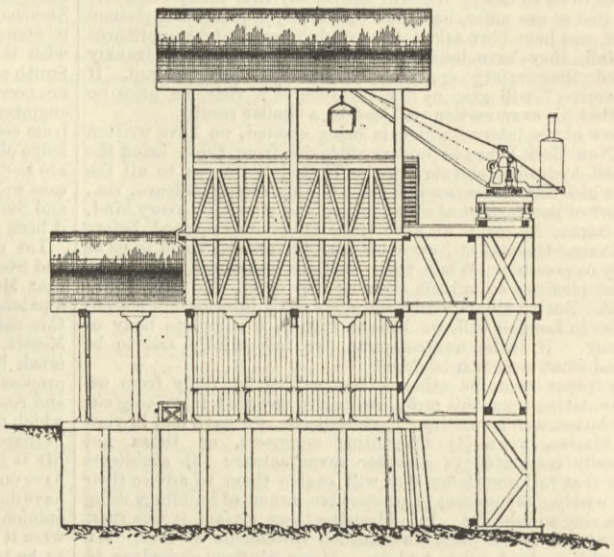
PLAN



RIVER ELEVATION



ROAD ELEVATION



END ELEVATION

SCALE OF FEET

THE Marquess of Londonderry has recently acquired an extensive site at Nine Elms, alongside the river Thames, for the purpose of developing on a large scale his scheme for supplying coal from his own collieries in the county of Durham direct to consumers in London. Mr. Henry Adams, M.I.C.E., Queen Victoria-street, was instructed to prepare plans for the necessary works, and we now illustrate above the arrangement decided upon. A series of six flat-bottomed coal hoppers, each containing 300 tons, is carried upon cast iron columns and roofed over. In front of the wharf an overhead tramway, supported on piles, has upon it three portable steam cranes, by which the coals will be unloaded from the steamers direct into the front hoppers with a minimum of breakage. For supplying the back row of hoppers the coal tubs will be landed on to a novel form of trolley running on rails over the hoppers, from which they can be tipped to avoid transshipment into trucks and consequent breakage. Each hopper is fitted with two double 9ft. screens inclined towards a gangway, which runs from front to back, and the small coal falls through the screens into the space under the hoppers, which is cased in to contain it. Under the mouth of each screen is placed a sack-weighing machine of the most approved construction, and being arranged in pairs, only half the labour will be required in attending to them.

Along the rear of the hoppers upon the ground level is a bench, against which the vans will back to receive the coals, the gangway for the men being kept at a dead level throughout. This standing space is roofed over in similar spans to the hoppers above, and the whole is arranged to admit of unlimited extension without interfering with the hoppers and buildings about to be constructed. The timber, of which there will be a very large quantity, is all creosoted Memel. The supporting columns are forty six in number, with an aggregate weight of over 60 tons. The foundations for the columns consist of concrete beds 6ft. 6in. square and 16ft. deep, going through the made ground and resting upon a firm substratum. In the front part of the yard a suite of offices and foreman's residence, with men's mess-room, &c., will be built from Mr. Adams's designs, still leaving ample space for any other buildings which may hereafter be required.

The manufacture of patent fuel from the small coal will probably be carried on, the coal being brought to the apparatus by means of travelling belts.

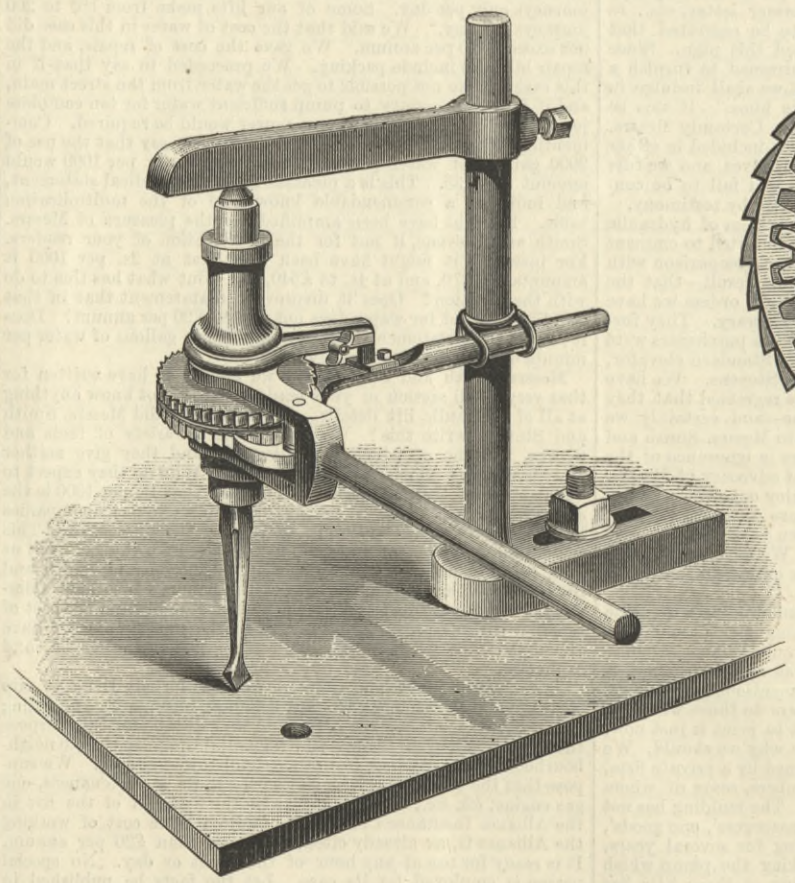
The wharf, being very near the main line of the London and South-Western Railway, could by a short viaduct be placed in a good position for delivering sea-borne coals on that railway.

A substantial retaining wall has been built with a main frontage of 150ft., and a return frontage of 50ft. Tenders have been accepted for the building and necessary appliances, and it is expected that the wharf may be ready for work by the autumn.

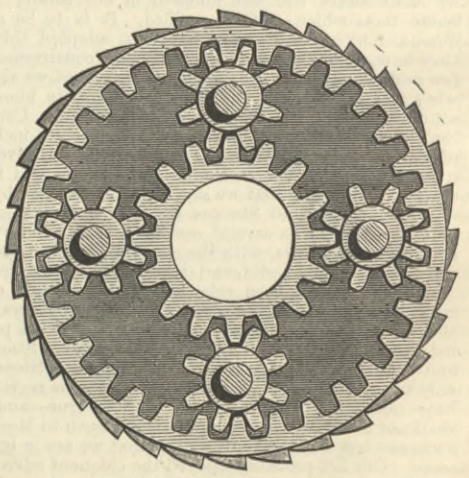
Messrs. Edward Withy and Co., of Hartlepool, who have built several vessels for the Marquess's fleet of colliers, have now in hand an order for two boats, one being a special steamer capable of passing under the bridges, and which will load at his own harbour, Seaham, within a mile of the collieries, and be discharged alongside the wharf, which will hereafter be known as the Seaham Coal Wharf, County Durham.

DOUBLE-ACTING RATCHET BRACE.

THAT we may become accustomed to almost anything is not more forcibly shown in tool mechanics than it is with the common ratchet brace with which we are, and allow our men to be, content to give a drill, say, a quarter of a cutting revolution for each equivalent of half a revolution of the hand by which it is worked. If the back stroke of the ratchet brace lever could be made to do half the work, then the time occupied by it would be no loss. As it is, however, the back stroke is wholly lost, unless we may consider the rest which the hand gets to be some set off. Many attempts have been made to utilise the back stroke in the continuous movement of the drill, but no simple arrangements have been brought out, and a complicated thing for this purpose will not answer. Small bevel gearing is out of



place where so much heavy work has to be done. The feeding device is more difficult of arrangement in a double-acting brace, and this has proved an obstacle to its production. The greater efficiency of such a brace will compensate for some extra cost and weight, while some gain will also be made, not only due to the continuous action of the drill, but to the finer point and edge which can be put on a drill not liable to pressures so heavy as when single-action is used. A double-acting brace, illustrated above, has been brought out by Mr. R. K. Jones, of the Eureka Works, Birkenhead, with the object of overcoming the objections to the old brace, and to the double-acting braces which have yet been proposed. It is constructed so that it can be used for speed or power; that is to say, to work fast for drilling small holes, or at slow speed for drilling large holes, this being effected by using one or both handles, shown in the accompanying engraving. When holes above $\frac{3}{4}$in. are to be drilled, one handle is made fast to the drill-post, as shown, by a wire clip. The arms may be extended until they have 180 deg. between them, and in this way a 2in. hole may be drilled with a 16in. ratchet brace, and a 1in. hole through a $\frac{3}{8}$in. plate has



been drilled with a 22in. brace. Besides the application of the brace for general ordinary work it has been adapted by the maker for mining purposes, drilling rock, coal, &c. The brace and its construction are clearly shown by the engravings above. From the sectional engraving it will be seen that in one stroke the drill is driven by the ratchet and pawl direct, and in the other stroke by the other ratchet and pawl, through the intervention of the spur gear between the two ratchet wheels hollowed out to receive it. The action of the brace is thus rendered continuous.

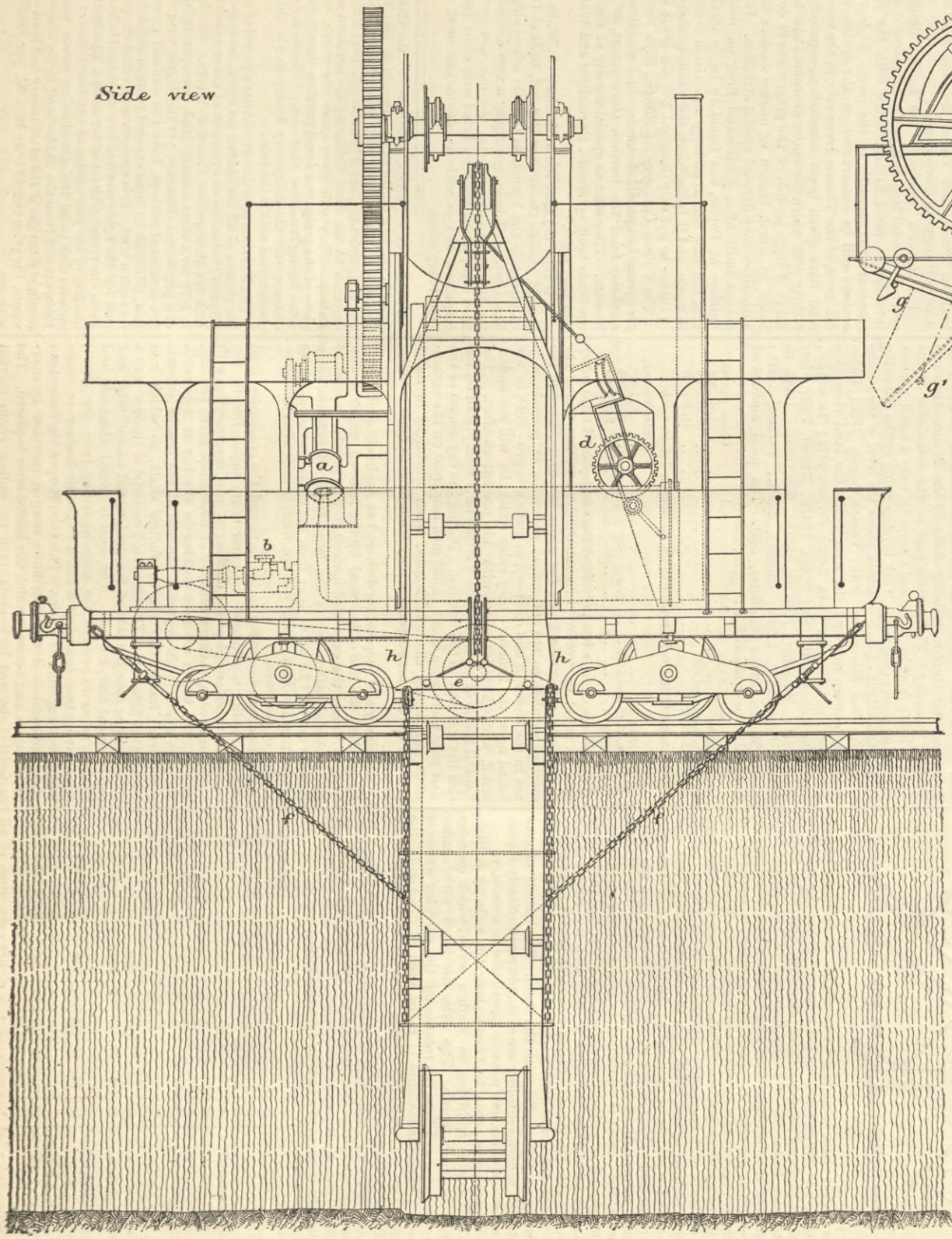
NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—Alfred Waters, chief engineer, to the Neptune; Andrew Spalding, chief engineer, to the Sphinx; Robert Hall, chief engineer, to the Crocodile; H. G. Johnston, chief engineer, to the Asia, for the Emerald; W. E. Blackburne, chief engineer, to the Orontes; H. J. Rampling, engineer, to the Achilles; Thomas Owen (b), to the Pembroke, for the Warspite; Horatio H. Walton, to the Asia, supernumerary.

EXCAVATORS, PANAMA CANAL.

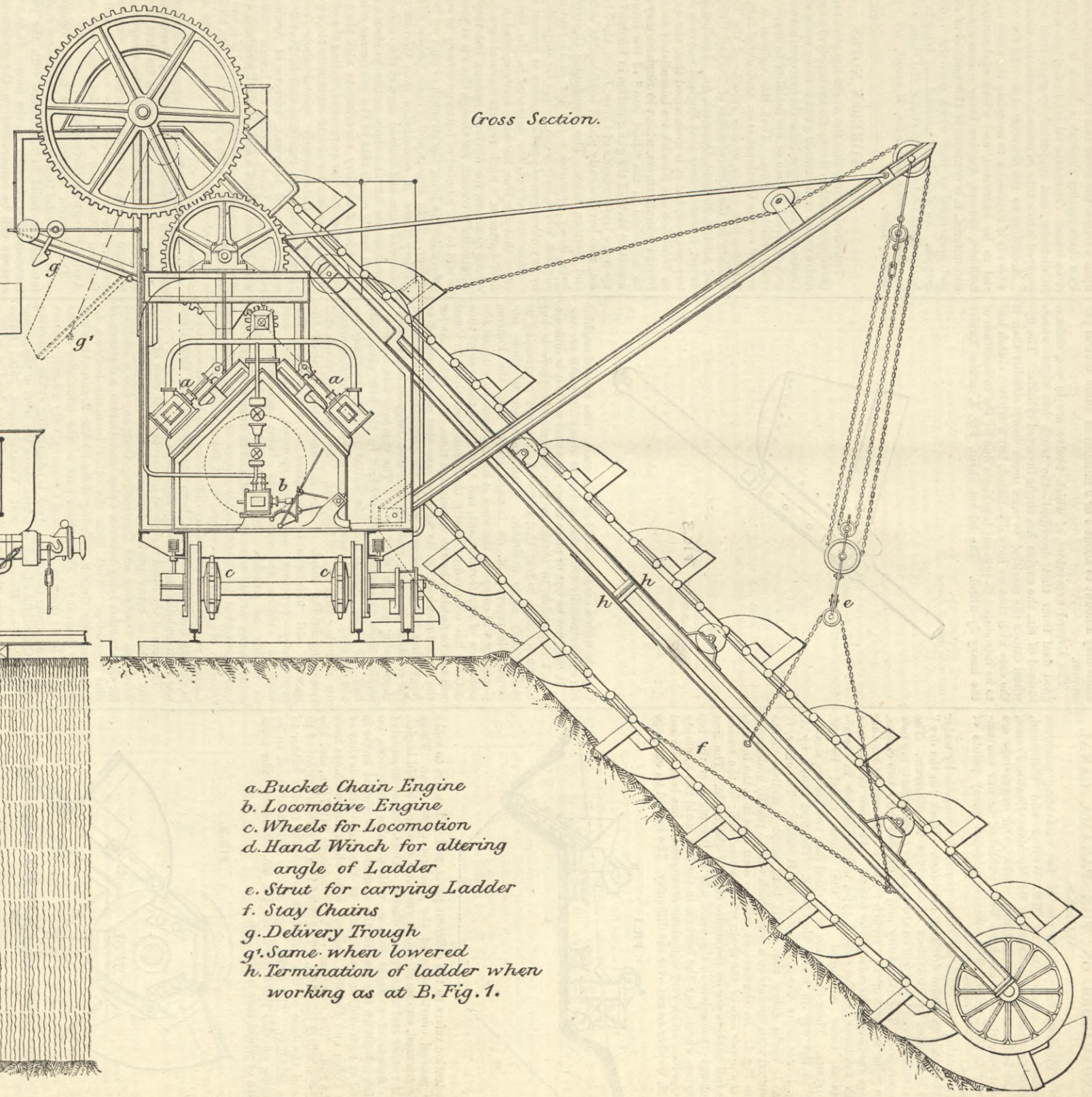
MM. WEYHER AND RICHMOND, ENGINEERS, PANTIN, FRANCE.

(*For description see page 24.*)

Side view



Gross Section.



a. Bucket Chain Engine
b. Locomotive Engine
c. Wheels for Locomotion
d. Hand Winch for altering angle of Ladder
e. Strut for carrying Ladder
f. Stay Chains
g. Delivery Trough
g¹. Same when lowered
h. Termination of ladder when working as at B, Fig. 1.

EXCAVATORS ON THE PANAMA CANAL WORKS.

WE illustrate on page 23 one of the excavating machines designed and constructed by MM. Weyher and Richmond, Société Centrale de Construction de Machines, Pantin, France, for the Isthmus of Panama Canal works. Our engravings are copied from those which have been published in our contemporary *Le Génie Civil*. The machine presents many points of interest.

In cutting the canal, all those portions accessible by water will be made by steam dredging machines. Work "in the dry" will be effected by excavators of the type we illustrate. The total number employed will be about eighty; about forty are now in operation. The excavators may be divided into two classes. One going in front opens a trench; this is followed by another whose function is to enlarge the trench. We have to deal now with machines of the second type, which resemble in certain respects those employed on the Suez Canal by M. Couvreux. These may again be divided into two classes, according to the way in which they work. The first shown by A, Fig. 1, acts above the level on which it stands. The other, B, Fig. 1, works below that level; both employ endless chains mounted with buckets in a way which will be readily understood from Fig. 1. In the first, it will be seen that it is the buckets on the upper side of the chain which ascend full; in the second the full buckets are on the under side of the chain. The first discharge themselves in the usual way by turning over the top carrying wheel; but the buckets in the last could not so empty themselves, and a very ingenious arrangement has been devised by M. Weyher to get over the difficulty. The legend on our page

FIG. 1

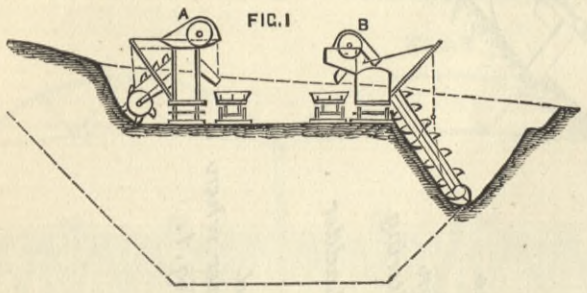
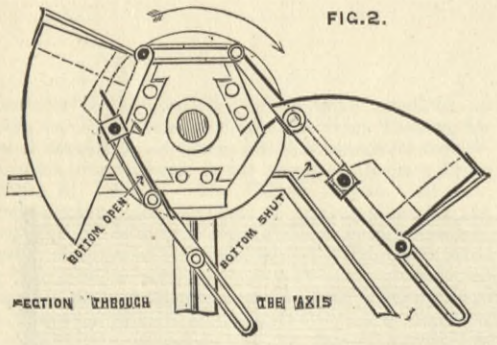


illustration refers to the different parts, and will suffice to make the general construction of the machine quite clear. Three rails are used, on one of which run two double-wheeled bogies, on the other rest six carrying wheels. The truck is composed of two frames of wrought iron *u*, with suitable crosspieces, on which is built up the rest of the machine. A central buffer is fitted at each end, and the gauge of the rails—5ft.—is that of the Colon and Panama Railway, over which the machines have to be run. The diameter of the wheels is 2ft. 7½in., and the extreme wheel base 10ft. The third line of rails is employed to extend the base of the structure toward the bucket ladder to give stability. The small bogie wheels before referred to as running on this third track are 1ft. 6in. diameter. The total width of wheel base is 6ft. 7½in.

FIG. 2.



The bucket chain is worked by an engine of 22-horse power, making 150 to 200 revolutions per minute. It has two cylinders set at an angle of 45 deg., 6½in. diameter, and 9½in. stroke. The tubular boiler has a heating surface of 153 square feet. The gearing is so arranged that the bucket chain wheel makes 20 revolutions per minute. Each bucket chain is composed of twenty-two parts, each carrying one bucket. Each bucket has a capacity of about 16 gallons. The mode in which they discharge their contents will be readily understood from Fig. 2. Each bucket is secured to the chain by a pin at the mouth end, and another at the middle of its length. To the open link is secured a flat plate, and so long as the bucket lies parallel with the chain this plate forms half of its back. When turning over the top cam wheel the bucket is compelled to rotate on the middle pin, and therefore it is pulled away from the plate, the then lower half is left for the time without a back, and the contents are discharged into the shoot. Fig. 2 shows one bucket just turning over, while the other having discharged its contents is now descending empty parallel with the chain. The details of construction of the bucket ladder are so simple, and so clearly shown, that we do not think any minute description is necessary.

The machine is made to travel along the rails by a little horizontal engine *b*, driving an endless screw, which operates a couple of chain wheels. The axles are fitted with similar chain wheels *c c*, and thus the rotation of the carrying wheels is effected. When the machine is to be used at A—Fig. 1—the bucket ladder we have described is removed and replaced by one of the ordinary construction.

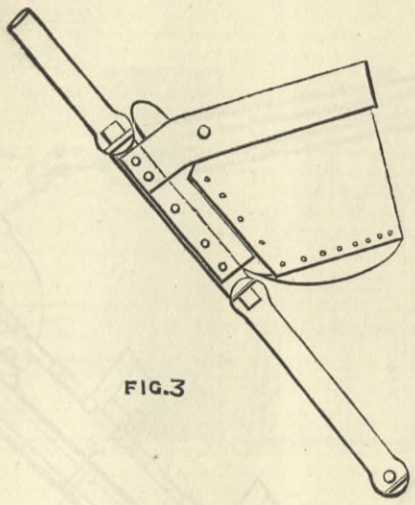
In the following table we give particulars of the various machines employed; the two systems of working are known as "fouille," Fig. 1, B; and "décapement," Fig. 1, A. We have not thought it necessary to translate this table:—

Type des appareils.	Force de la machine.	Nombre de tours par minute.	Nombre de godets par minute.	Capacité des godets.		Rendement théorique par heure.		Rendement théoriquepar heure et par force de cheval.	
				fouille	décapem't		décapem't	fouille	décapem't
	ch'v			lit's	lit's	m³	m³	m³	m³
Weyher et Richmond..	22	200	30	75	90	135	162	6 136	7 363
De Ville-Chatel (grand modele)	30	70	18	130	115	140	124	4 666	4 134
De Ville-Ghatel (petit modele)	10	„	30	30	50	90	90	9 000	9 000

It is estimated that the work of the eighty excavators of all kinds may amount to about 8 or 9 millions of cubic metres per annum.

The Evrard excavators, of which twelve are in use, differ a good deal from that described—the truck has eight wheels instead of six, the engine has single inverted cylinder. The fly-wheel causes the machine to work much more steadily than is the case with that we have illustrated, but a friction clutch had to be introduced to prevent breakages due to the momentum of the heavy fly-wheel. The bucket chain, Fig. 3, carries twelve

FIG. 3



buckets with a capacity of 35 gallons each. The Evrard machine can excavate easily 400 cubic metres, or about 525 yards per day.

It may not be out of place to say here that while it is difficult, if not impossible, to obtain certain information, there is but too much reason to fear that the works are not progressing as satisfactorily as is desirable. With reference to these unfavourable reports, M. de Lesseps states that the Panama Company will complete the work it has undertaken without the assistance of any Government, and that up to the present time nothing has occurred to justify the assumption that the Canal will not be finished by the anticipated time, viz., 1888. As for the capital required, M. de Lesseps says that people seemed to forget that the preliminary works, the purchase of machinery, the creation of ports, stations, &c., cost large sums, without there being much to show for it. The company has, however, ample means to continue the works. In the first place, only half the share capital has been called up. The company has 150,000,000f. at its disposal, and has power to issue obligations for a further sum of 129,000,000f. Moreover, the funds still remaining in the hands of the Administration insured the regular and uninterrupted progress of the work. The preliminary expenses had been incurred, and the real work of cutting the canal was being proceeded with as rapidly as possible. In the month of May 660,000 cubic metres of soil were removed, and in June the work done was represented by 700,000 cubic metres of earth. The total quantity of ground removed was 6,565,534 cubic metres. M. de Lesseps repeats that no greater difficulties had been encountered in cutting the canal than had been anticipated, and that there was no foundation for contrary assertions.

The line of the canal is divided into sections, at each of which the work is being pushed forward in both directions. The American Dredging and Contracting Company has a contract for that portion lying between Colon and Gatum, a distance of nine kilometres. Work upon the other terminus between La Boca and Rio Grande is being done by the Franco-American Trading Company. The greater part of the remainder of the work is being done by the Canal Company, only a small portion of it being under contract. Work is progressing at the following points, the height of each of which above the level of the oceans is given:—Dos Hermanas, 20ft.; Vamos-Vamos, 25ft.; Buhio Soldado, between this and the next point the land rises to a height of 165ft.; Buena Vista, 56ft.; Frijole, 44ft.; Tabernilla, 53ft.; Barbacoas, 46ft.; San Pablo, 104ft.; Mamei, 79ft.; Gorgona, 66ft.; Matachin, 75ft. to 168ft.; Bas Obispo, 100ft. to 236ft.; Emperador, 228ft.; Culebra, 333ft.; Paraiso, 145ft.; Pedro Miguel, 20ft.; Miraflores, 36ft. The total amount of material to be dealt with is:

	Cubic metres.
Dredging	26,913,000
Rock, hard and soft	37,632,000
Earthwork	41,295,000

The amount of material removed up to March 1st last was:

	Cubic metres.
Dredging	452,000
Rock, hard and soft..	752,000
Earthwork	2,967,000

The severe climate has prevented the employment of as many men as could be worked advantageously, and has forced the company to substitute black for white labour. Although the sanitary regulations are enforced as rigorously as possible, it is not in the power of any company to make a negro—such as are found upon the isthmus—obey rules which he will not understand, and which interfere with his present comfort. The natural result of his disobedience is that he is soon placed on the sick list and sent to the hospital. During the dry season of the past year there were about 12,000 men employed on the excavations, but during the wet months, when operations in many parts of the line are suspended, only from 6000 to 8000 men are at work.

Machinery and supplies are delivered at Aspinwall and distributed along the line of the canal by the railroad, which is also used to remove the excavated material. The proper disposal of this material makes one of the large items of expense, since it must not only be taken away from the canal, but must be so placed that the heavy rains will not wash it back after the completion of the work.

The manner of carrying on the work and the appliances used will be readily understood from our engravings. Besides the excavator there is employed a "discharger," used in connection with a marine dredge, having a capacity of 6500 cubic yards per day, and a scow, which are now working in the bay at Aspinwall. Through a hole in the centre of the hull of the dredge extends a powerful frame, carrying an endless chain, to which iron buckets are attached. The excavated material is thrown into a shoot leading over the side of the dredge, and whose outer end can be raised and lowered. The scow is towed alongside, and secured, so as to receive the material falling from the shoot; after having been loaded, it is taken to the discharger—a name which well explains its duties. This is built upon the catamaran plan, and consists of two long hulls, secured together by overhead frames, and between which the loaded scow is placed. The material is elevated by buckets upon an endless chain carried upon a frame, the lower end of which can be raised and lowered by a chain passing through a block in the upper part of the cross frame. The material is emptied into a long iron tube, 3ft. in diameter, and supported by guys from a mast. Water is pumped into a tube in order to assist the discharge.

According to the *Scientific American*, for work of this kind, where it is impossible to ascertain the exact nature of the material to be excavated, and where obstructions in the form of boulders, stumps, &c., are being constantly and unexpectedly encountered, it is doubtful if this method of digging is as rapid and economical as that which uses the ordinary dipper and grapple. An obstacle of unusual size lying in the path of the buckets will obstruct operations, and there is no way of raising it. Besides, such obstacles, if raised, are apt to choke the delivery tube.

FOREIGN NOTES.

THE circumstance that the Anglo-Egyptian military authorities have applied to Herr Krupp for the supply of a number of six centimetre camel or mountain guns is being made the most of on the Continent, and is regarded as the first open acknowledgment on the part of Great Britain of her inability to supply, for the present, really efficient guns. That this opinion is rapidly gaining ground on the Continent is an undoubted fact, as is proved by the desertion—more or less recent—of the English system of artillery by the Governments of Turkey, Greece, Spain, Portugal, Austria, Holland, Denmark, &c. Leading foreign artillerists do not, however, deny that England moves in the van of artillery progress, but it is maintained that the experiences gained at Woolwich and Elswick are immediately turned to account by foreign manufacturers, whilst in England they are stored up to be embodied in the "best gun" of the future. The present unsettled state of the gun question in England has not been lost upon the Governments of China, Japan, the Argentine Republic, &c., who have recently placed considerable orders with French and German firms. The Roumanian Government, it is true, have lately procured a number of 15 centimetre guns from Elswick, which have given results far surpassing those obtained by any other gun of similar calibre at present in use.

Rumours have of late appeared in the German press, to the effect that the War Ministry contemplated a large increase of field batteries. Such reports have always been denied from official quarters, for obvious reasons, but they are nevertheless substantially correct, for though there is at present no intention to add to the number of batteries already in service, it has been determined to bring the strength of each up to six guns instead of four. Both Russia and France possess a far more powerful artillery force in commission than Germany, but the large reserve of guns and trained men at the command of the latter Power enable her at a short notice to place a force in the field which nearly equals that of the two former combined.

A series of artillery experiments took place at Havre, on the 4th of June, for the purpose of testing the efficiency of a new design of carriage for the 12-centimetre siege gun, which proved successful. Subsequently several shots were fired from a 24-centimetre steel gun mounted in Fort de l'Ppi, in the presence of General Ladvocat, Director of Artillery. At the fifth round the gun burst, hurling the breech portion into an earthwork in rear, whilst a mass of steel, weighing 4 tons, flew out to sea. The gun was manufactured in 1874, and the charge used weighed 55 kilos., with a projectile of 144 kilos. The accident is ascribed to the fact that some of the coils had become loosened.

The Hungarian Steam Shipping Company "Adria" has determined to profit by the present stagnation in the English shipping trade so as to increase its fleet of steamers. Herr von Peichl, nautical director of this company, is at present in England for the purpose of purchasing six or seven steamers of medium size, with which the company will open new lines between Fiume and Venice, &c., under a subsidy from the Austro-Hungarian Governments.

The Spanish Admiralty are having designs prepared for several powerful ironclads and unarmoured cruisers, which it is intended to build in accordance with the projected plan for increasing the strength of the navy. It is reported that the cruisers will be constructed on the system advocated by Mr. Mackrow, of the Thames Ironworks, as the vessels of the Gravina class have given great satisfaction, especially as regards the facility with which the entire armament can be used on either side. A large portion of the programme is devoted to torpedo boats, to which branch of marine warfare the Spanish naval authorities have devoted special attention. It is reported that a boat built by a continental firm, on designs supplied by builders at Poplar, was found to be so carelessly constructed that the same had to undergo a thorough overhaul on its arrival in Spain, and it is therefore not unlikely that these boats will in future be not only designed, but also built, on the Thames.

The Vulcan Company, of Stettin, have secured the contract for several fast paddle steamers, which are intended to run, under a subsidy from the German Government, as mail steamers to Sweden. They offer no special novelty of design, and resemble the boats built by Messrs. Burmeister and Wain for the Korsör and Kiel route.

It is reported that the authorieties at Whitehall have selected the old wooden two-decker Donegal, built at Devonport in 1858, to supersede the Vernon as torpedo school ship at Portsmouth. The German Admiralty employ a very different type of vessel for the same purpose, viz., the fine new corvette Blücher, of 2856 tons, which has been fitted with eight launching tubes for torpedoes, and is without doubt the most complete torpedo school ship afloat.

PUTNEY NEW BRIDGE.—To-morrow, the 12th inst., a memorial stone in the new bridge at Putney will be laid by the Prince and Princess of Wales, who will proceed from Marlborough House, *viâ* Knightsbridge and Fulham-road, over Putney Bridge to the entrance to the New Bridge at the northern end of High-street, Putney. They will there enter the works, and see models and plans of the bridge in a small pavilion close to the stone to be laid. After laying the stone they can, if disposed, proceed for a short distance over the temporary bridge to see the piers in course of construction within the dam.

THE JABLOCHKOFF LIGHT.—After a period of more than 5½ years, the pioneer of all the electric arc lights, has ceased to illuminate the Thames Embankment by reason of the termination of the contract with the Metropolitan Board of Works. The lights were put up in 1878 for a three months' trial, consequently the works were not of a permanent character, yet the lights, with the exception of a few occasional mishaps, have run well and given general satisfaction, although no more exposed position could have been selected for such a trial. It is an open secret that the price, 1½d. per hour, paid for the lights resulted in a considerable loss to the company. From the recent address of Sir Joseph Bazalgette at the opening meeting of the past session of the Institution of Civil Engineers, it appears that twice the illuminating power was obtained on the Embankment from the Jablochkoff lights which could have been obtained from gas if the same money had been expended—in other words, the price should have been 3d. per hour to have compared with gas.

RAILWAY MATTERS.

MUCH satisfaction is expressed at the withdrawal of the opposition to the Bill which is to come before the House of Lords, authorising the introduction of steam power upon the Dudley, Sedgley, and Wolverhampton tramways. The route is at present very expensive to work, on account of the heavy cost of horse-power, and it is hoped that the introduction of steam will considerably reduce the expenditure under this head.

IN Amsterdam the prospectus has been issued of a company for the construction of a railway between Delagoa Bay and Pretoria. The capital is fixed at 15,000,000fl. and the Transvaal Government guarantees 5 per cent. interest. The subscriptions will remain open until July 1st. The Transvaal Government will receive, as special compensation for the exemption from import and export duties which it has granted for goods transported by the railway, 85 per cent. of the net profits over and above 6 per cent. on the capital.

IT is rumoured that the Government of Bengal have it in contemplation to lay down 300 or 400 miles of light railways on the principal roads of the Province, in the belief that, whilst these will be the means of cheapening the cost of transport in Bengal, their cost will be not more than the outlay involved in the upkeep of the ordinary kunkur roads of the country, often so difficult of maintenance. Should this experiment prove successful, or only partially so, we may expect a new departure on a large scale in the direction of light railways for India.

WE believe, says the *Colonies and India*, that the next decade will witness an important advance in the demand for rails and rolling stock for India, and information which has recently reached us from Calcutta points to an entirely new departure in this direction—the direct outcome of the recent Exhibition there. A firm which had exhibited its light rails of 14 lb. for a gauge of 2ft. 6in., attracted so much attention from officials and non-officials—from natives as well as Europeans—that a number of orders for such for short tentative lines had been booked for up-country, and when we last heard from the capital of Bengal, the representative of that firm had left Calcutta for the North-West Provinces and the Punjab, in order to attend to the numerous inquiries made regarding their system of railways.

THE report of the East Indian Railway Company states that the total length of the East Indian Railway proper is 1509½ miles, of which 469½ miles are double and 1040 are single, while in addition to the above there are 159¼ miles, including sidings, of State lines worked by the company. The cost per mile of line per month for the second half of 1883 was £37 11s. 8⅔d., as against £35 15s. 4¼d. The cost of locomotive power for the half-year was 8·59d. per train mile, as compared with 10·02d. during the corresponding period of 1882. The total number of passengers, exclusive of periodical ticket holders, during the half-year was 5,108,303, against 4,713,881, some portion of the increase being due to the Calcutta Exhibition, but the greater part to the reduction in the third-class fares. The tonnage in goods and minerals for the half-year was 2,322,238 against 2,125,207 tons. The percentage of the working expenses upon the gross receipts was 38·70, as compared with 40·29 in the corresponding half of 1882.

AT the Master Car Builders' Convention on the 11th ult., Mr. M. N. Forney, secretary to the Association, read a very valuable paper on the "Relation of Railroad Wheels and Rails to each other." The paper was very exhaustive, and covers the ground very completely, and brings forward a large array of facts to bear upon the question of the proper form of tread and flange of wheels and head of rails. The real action of coned wheels, which has been a disputed point since the first days of railway working, was shown by a very simple and conclusive experiment, demonstrating that a vehicle with wheels of unequal diameter will run in a curve whose radius is proportionate, not to the difference in diameter of the surfaces of the tread bearing on the rails, but to the length of wheel base. A four-wheel truck of 5ft. wheel base, with wheels coned according to the prevailing practice, would tend to run in a curve of nearly a mile radius. This was demonstrated by a model which was exhibited in action to the meeting.

THE length of railway open in India is 10,832 miles, of which 549 were opened during the year 1883-4. A report recently quoted in the House of Commons, but not yet published, showed that the capital expenditure amounted to £142,606,900, including lines under construction; that the average cost per mile came to £11,300; that the net receipts from all the lines were £8,418,900, compared with £7,684,200 of the previous year, the return being £5 13s. 6d. per cent. compared with £5 7s. 3d. The proportion of working expenses to gross receipts was 48·39, as compared with 49·97 in 1882. On the East Indian Railway the proportion was only 36·91 per cent. Mr. Danvers, who quoted the report, considered these results satisfactory, as showing improved results and an expansion of traffic. He thought that a more rapid extension was desirable, if carried out judiciously and with a proper regard to financial exigencies, and so as to relieve instead of to increase taxation. While favourable to both State agency and private enterprise being employed, he preferred the latter, especially for working the railways. He was in favour of lowering rates, so as to make them suited to the capacity of the people and the claims of trade.

WITH regard to new railways in Greece, a recent official report gives some useful information. It mentions first the new line from the Pirœus to Patras, *viâ* Athens, Eleusis, Megara, Kalamaki, New Corinth, and thence along the shores of the gulf of that name to Vostizzia and Patras. This line, which is a single one on the narrow gauge system, is practically completed for a distance of twelve miles to Eleusis, and in the course of the present summer it will be finished to Megara. The same company has constructed a line across the Isthmus of Corinth, a distance of six miles, to be opened about the same time as that to Eleusis, and it is expected that the main line will be completed as far as Corinth before the beginning of next year. A new line is also being constructed from Ergasteria, Laurium, *viâ* Port Thoriko to Athens, with a branch line from the village of Colandri to Morouse and Kephissia. This is also a narrow gauge line, the width between the two rails being one metre, and its construction is being pushed forward with activity. It is expected that the main line of this railway will be opened to the public from Ergasteria to Markopoulo, half way to Athens, by September next. The construction of a new line from Volo to Larissa has been much retarded by the floods during the late severe winter, these floods having done considerable damage to the line, which, it appears, was constructed in a faulty manner.

IN their *Iron Trade Report*, Messrs. Bolling and Lowe say:—"The Association of Rail Manufacturers is now firmly established, a reduction of output agreed upon, and buyers are gradually acknowledgiug the rationality of this arrangement. Had matters continued on the old basis, the result would probably have been the stoppage of several mills, a number of skilled workmen as well as labourers thrown out of employment, the shareholders in limited companies called upon to pay up—in fact, losses all round, without even leaving to the survivors the stimulating prospect of immediate profit. Locomotive and wagon builders are more satisfactorily placed than the manufacturers of rails, in consequence of constant repairs and additions needed by rolling stock, in order to keep up with the requirements of the times; while a good steel rail lasts many years. We do not believe that since steel rails came into general use it has been found necessary to replace 50,000 tons—if so much—out of the millions laid down, while of old iron rails, English railway companies alone have sold, as worn out, more than a hundred thousand tons since 1879. Iron rails are now a thing of the past. Steel is cheaper to produce in the form of rails. The weight may be less to withstand the same traffic, and the cost of re-laying is reduced to a minimum. These facts are more encouraging to the investors in railways and tramways than to producers of the materials.'

NOTES AND MEMORANDA.

THE certificate issued under the Northumberland miners' sliding-scale for the three months ending May 31st shows the net average selling price of coal to have been 5s. 1·50d. per ton. The present rate of wages will remain unaltered.

THE two coal-fields of the North of France yielded 10,051,461 metric tons or tonnes in 1883, as contrasted with 9,594,942 tons in 1882, or an increase of 4·7 in 1883 over 1882. Nearly the whole of this increase is due to the output in the Pas-de-Calais, which was 423,625 tons more in 1883 than in 1882.

IN the *American Journal of Science* for last month is a paper on the tendency of rivers flowing to the north or to the south to encroach on their east or west banks respectively, by G. K. Gilbert, in which the author, after extended study, adopts the view that this tendency is sufficiently accounted for by terrestrial rotation.

IN a paper on the upper waters of the Mersey, recently read before the Warrington Literary Society, Mr. W. Spinks gave the Thostle Nest Weir flow as 26 million cubic feet per day, mean, in April, 1883; and 21 millions per day, mean, in May-June. The minimum flow over the weir at Warrington is given as 480 cubic feet per second.

THE following quantities—in tons—of zinc were produced in 1883, by the different countries named:—The Rhine district and Belgium, 123,891; Silesia, 70,405; Great Britain, 27,661; France and Spain, 14,671; Poland, 3783; Austria, 2879; United States, 32,790; totals, 276,080. These figures all show increase on previous years, except as relates to France and Spain and to Poland, which show a decrease.

DURING the week ending June 14th, 1884, in twenty-eight cities of the United States, having an aggregate population of 6,815,300, there were 2617 deaths, which is equivalent to an annual death rate of 20·0 per 1000. In the North Atlantic cities the rate was 17·0; in the Eastern, 20·5; in the Lake, 16·7; in the River, 14·7; and in the Southern cities for the whites 24·1, and for the coloured 44·3 per 1000. Of all deaths the American *Sanitary Engineer* gives 41·8 per cent. as under five years, the proportion being highest in the Lake cities, viz., 50·8 per cent.

DURING the week ending June 7th, 1884, in thirty-one cities of the United States, having an aggregate population of 7,070,800, there were 2785 deaths, which is equivalent to an annual death-rate of 20·5 per 1000, a slight increase over the rate of the preceding week. In the North Atlantic cities, the rate was 18·6; in the Eastern, 21·6; in the Lake, 16·6; in the River, 16·8; and in the Southern cities, for the whites, 21·3, and for the coloured, 40·2 per 1000. Of all the deaths, the *Sanitary Engineer* says, 39·2 per cent. were under five years of age, the proportion of this class of deaths being highest in the Lake cities, viz., 50·1.

AT a recent meeting of the Physical Society, Mr. Blaikley read a paper on the velocity of sound in small tubes—a continuation of experiments formerly brought before the society by the author. Mr. Blaikley showed experimentally how his measurements were made. He found that pipes in which the upper proper tones were in harmonic order, or, better still, those in which they were far removed from the harmonic order, and therefore dissonant, were best for the purpose. He had obtained velocities from fine tubes varying from 11·4 to 88·2 mm. in diameter, the former giving 324·38 and the latter 330·13 m. per second as the velocity of sound. In free air Mr. Blaikley thought the velocity would come out 331 m. per second. The differences of velocity for the different pipes were very regular.

AT the *conversazione* of the Society of Telegraph Engineers and Electricians, held at King's College, on the 3rd instant, an exhibit was made under the superintendence of Mr. Latimer Clark and Mr. John Muirhead, showing the effect of retardation; an artificial cable, equal to about 8000 miles of the Atlantic cable type at present being made by the Commercial Cable Company (Bennett-Mackay cables). His experiment was the more interesting as the aspect of retardation had never previously been known on so long a length of cable. The artificial cable was composed of a number of Muirhead's Patent Inductive Resistances and Condensers, which form part of the apparatus for working the new Atlantic cables on Muirhead's duplex system; this system is also working the Atlantic cables of the Western Union and Direct United States Cable Companies. The effect of retardation on this length of cable under the circumstances was very marked, the current taking about three seconds to traverse the entire line to show a signal at the distant end. The total electro-static capacity of the cable was about 2400 microfarads, and the total resistance about 19,200 ohms. Several instruments connected with the working of the duplex and Mance's new system of apparatus for fault-testing on cables were also exhibited as manufactured by Latimer, Clark, Muirhead and Co., of Westminster.

A CORRESPONDENT, who is one of the owners of the steamers mentioned below, sends us the following results of some trials of the Australian Bulli coal as compared with Welsh coal:—Steamer No. 1: Speed with Welsh coals, Nixon's navigation, 10 knots; consumption, 8 tons per day; steamed easily. With Bulli coal, 8·4 knots on 10 tons; could not keep steam. Registered horse-power, 120. Steamer No. 2: Engineer reports found Bulli coal always 15 per cent. worse steaming than Welsh; contains 10 per cent. more ashes; speed reduced considerably. Registered horse-power, 500. Steamer No. 3, on a twelve month's trial: Speed with Welsh coal, 10 knots; consumption, 17 tons; ashes per watch, 2½ to 4 cwt.; steamed easily. With Bulli coal, 8½ to rarely 9 knots on 22 tons; ashes per watch, 30 to 36 cwt.; very hard to steam; coal seemed to go on bars and right up funnel. Registered 220-horse power. Steamer No. 4: Speed with Welsh coals, 10·4 knots; consumption, 27 tons; ashes per day, 2·5 tons; indicated 1350-horse power; steam, 75 lb.; revolutions, 57·6 per minute; steamed easily. With Bulli coal, speed, 9 knots; consumption, could only burn 26 tons; ashes per day, 6·5 tons; indicated 1000-horse power only; steam, 68 lb.; revolutions, 53 per minute; could not steam at all satisfactorily, though the weather was very favourable. Registered 350-horse power.

IN a paper on the manufacture of maize-starch as a new agricultural industry, L. von Wagner—*Dingl. Polyt. Journ.*—says nitrogenous matters are the most important, both for food and for manure. The manufacture of maize starch satisfies both these requirements. In this manufacture, the 8 to 15 per cent. of nitrogenous matter contained in the maize is obtained as a bye-product in a fresh and unchanged condition. This, when mixed with chopped straw, maize roots, husks, and shoots, makes an excellent and easily digestible food for cattle. Maize yields 52 to 60 per cent. of starch as a main product, and, as a bye-product, 8 to 15 per cent. of nitrogenous matters; and, as residue in husks and shoots, 12 to 18 per cent. At the present time agricultural starch manufactories obtain their product from potatoes. A comparison between the potato starch and maize starch industries is very significant. Good potatoes yield 25 per cent. of their weight of dry substance, and contain 1·1 per cent. of nitrogenous matter. Therefore 100 kilogrammes of dry substance give 4·4 kilogrammes of nitrogenous matter. Maize yields 77·6 per cent. of dry substance, and contains 10·6 per cent. of nitrogenous matter, so that 100 kilogrammes of the dry substance give 13·6 of nitrogenous matter, or three times as much as potatoes. The potato bye-product yields 11 per cent. of dry substance, and 0·5 per cent. of nitrogenous matter, so that the dry substance contains 4·5 per cent. On the other hand, the bye-product of maize manufacture contains 25 to 33 per cent. of dry substance, which almost entirely consists of digestible nitrogenous matters, whilst the residue of husks and shoots contains the greater quantity of the fat of the maize. The author goes on to consider the yield of starch, the exhaustion of the land, and the use of nitrogenous matters as food bye-products. The bye-products repay the cost of working, so that the difference between the price of the maize and that at which the starch is sold is clear profit.

MISCELLANEA.

THE death-rate of Edinburgh last week was 18 per 1000.

THE Carr House Ironworks at West Hartlepool were offered for sale at the Middlesbrough Exchange on Tuesday last, but not a single bid was made for them.

THE partnerships in the firm of Miller and Co. have been dissolved, and the business, under the same name, will henceforth be in the hands of Mr. Thos. Miller.

MR. GEORGE KEARSLEY, of Ripon, has been awarded the first prize gold medal for his No. 4 grass-mowing machine at the field trials of grass mowers at Condom, France.

A NEW up-river dock was opened at Battersea on Wednesday, through the enterprise of Mr. A. Ransome. At the same time and place new flour mills, on the roller mill system, recently built by Messrs. Marriage, Neave and Co., were opened.

THE annual dinner of the Inventors' Institute took place on Wednesday at the Health Exhibition. Admiral Selwyn presided, and about eighty sat down to dine. Mr. Mackie conducted the members and visitors over the parts of the Exhibition most interesting to them.

PLANS have been prepared for the construction of a large hall, to be called the Salle du Travail, in Paris, close to the Hotel de Ville, where men can meet employers and arrange their terms. There will be, besides the central hall, eighty rooms for the syndicates of different trades. The cost of construction is borne by the city.

THE deaths registered in twenty-eight great towns of England and Wales for the week ending Saturday, July 5th, corresponded to an annual rate of 19·5 per 1000. In London 2458 births and 1508 deaths were registered. The annual death rate, which had been 17·8 and 19·1 per 1000 in the two previous weeks, rose last week to 19·6.

THE Cleveland ironmasters' returns for June show that ninety-nine blast furnaces were in blast during that month, and that the total make of pig iron of all kinds was 197,994 tons, being 12,998 tons less than during May. Stocks which for some months previously had been decreasing, showed an increase of 3,747 tons. This is no doubt owing to the stoppage of the forges for Whitsuntide holidays. The total quantity of pig iron held in stock at the end of June was 269,899 tons.

THE annual statement of the Mersey Docks and Harbour Board shows that the total tonnage of vessels using the port to the 30th ult. was 8,800,362 tons, against 8,527,521 tons in the previous year, showing an increase on the year of 271,831 tons. The receipts showed a falling off of £17,206, the amount for the year just concluded being £1,056,864, against £1,074,071 in the previous year. The reductions made in regard to dock and town dues more than account for this small falling off.

THE Postal Telegraph Company and the Bankers' and Merchants' Telegraph Company, of the United States, have agreed upon a contract for the joint operation of their lines. The union of these two companies brings under one control about 9000 miles of pole lines, with about 55,000 miles of wire now completed and in operation; and there will soon be completed 3000 miles more of pole line, and 21,000 miles additional wire, making a total of 12,000 miles of pole line and 76,000 miles of wire. The whole forms a complete system of land lines, which will be operated in connection with the Bennett-Mackay ocean cables.

SOME sample axes cast of Hadfield's manganese steel were recently ground by Messrs. Hubbard, Bakewell, and Co., Pittsburgh; and writing of the steel, Mr. Chas. W. Hubbard observes:—"The steel axe and adze we ground for you were extremely hard. There seems to be a peculiar, close, greasy nature about the material that resists the action of the grindstone and emery wheel, which has less effect on them than anything we have ever seen in steel or iron. I would say the material has the very essence of anti-friction. A journal made of such material would run to an extreme number of revolutions in a sand-box without friction or heat."

THE manufacture in Wolverhampton of electric light appliances is to be extended. So satisfied is the Wolverhampton Electric Light, Storage, and Engineering Company with the number of orders which it has received, our Birmingham correspondent says, that the proprietors have determined to throw over the branches of the hardware trade in which they were engaged, and devote themselves exclusively to the electric light business. With this object they have this week sold off their old plant and stock, and will fit up their premises wholly for the new industry. The blast furnaces at Spring Vale, near Wolverhampton, of Mr. Alfred Hickman, are having the electric light laid on by the company.

THE practical result of the recent application to Parliament for new powers by the Stockton and Middlesbrough Water Board is as follows, viz.:—The Board is to be allowed to pump an additional six million gallons from the Tees per week for ten years, but not more and not longer. By that time they must have their gravitation scheme completed, so as to be able to return again to their previous statutory quantity. When the chairman of the water board was being cross-questioned, he was asked by the opposing counsel if he had seen the white elephant? It is to be hoped, our North of England correspondent writes, that this enterprise, when further loaded with the necessary additional capital, will not perpetuate the memory of the above smart witticism, nor clothe the allusion with melancholy reality for the Clevelanders of the future.

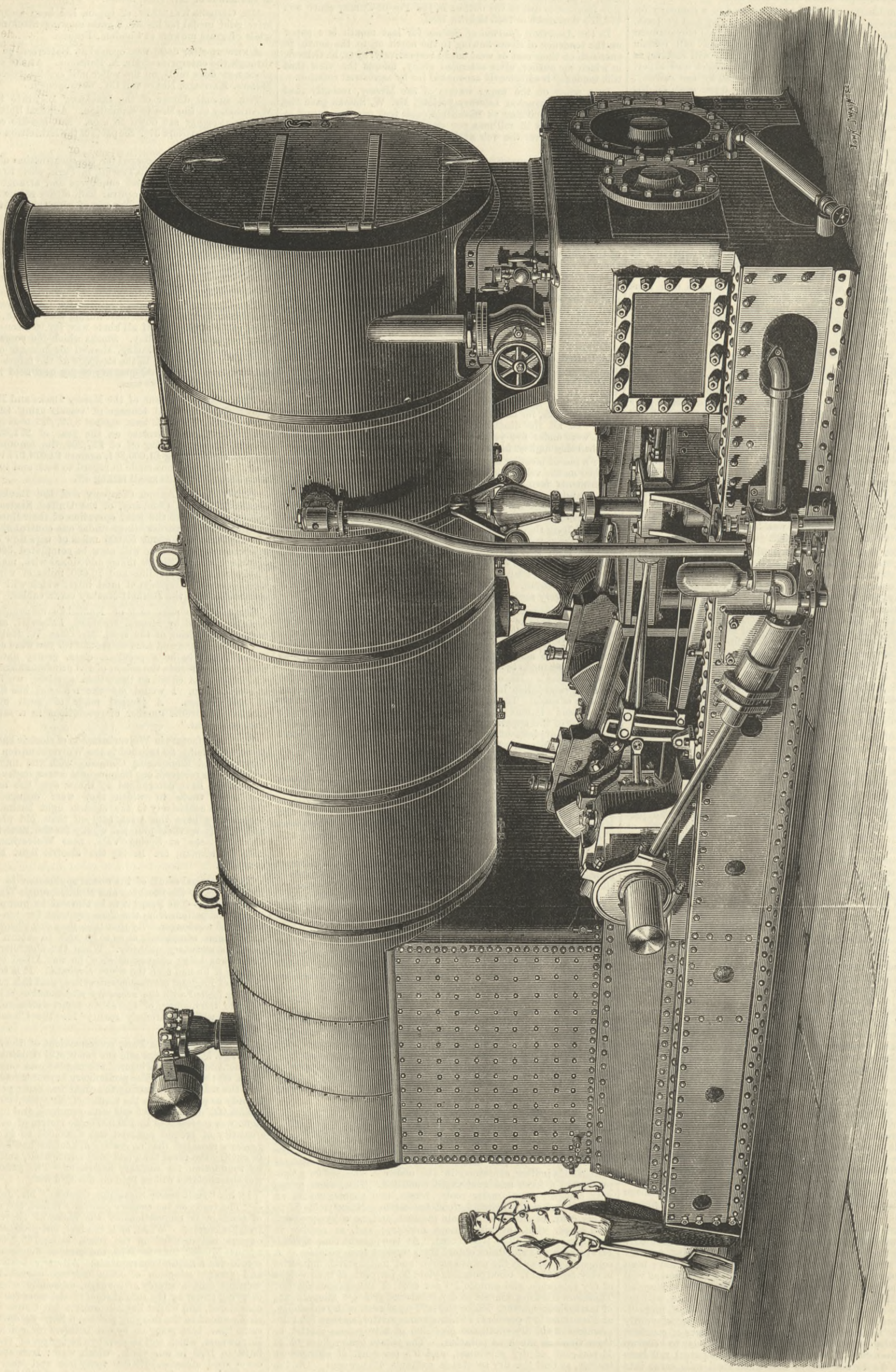
IN speaking to the Paris correspondent of the *Standard* a few days ago, M. de Lesseps said the funds still remaining in the hands of the Administration insured the regular and uninterrupted progress of the works. The preliminary expenses had been incurred, and the real work of cutting the canal was being proceeded with as rapidly as possible. In the month of May 660,000 cubic metres—23,298,000 cubic feet—of soil were removed, and in June the work done was represented by 700,000 cubic metres of earth. The total quantity of ground removed was 6,565,534 cubic metres. M. de Lesseps repeated that no greater difficulties had been encountered in cutting the canal than had been anticipated, and that there was no foundation for contrary assertions. The general meeting of the shareholders will be held on the 23rd inst.

IN his "Half-yearly Steamship Circular," Mr. John White says:—"The trade of the country generally is bad, but over-production of tonnage is unquestionably the cause of the exceedingly low freights current. When, as is the fact, the production for English owners has doubled in ten years, being 768,576 tons in 1883, against 370,668 tons in 1873, the present depression can only be considered a natural consequence. All our extension of commerce and greater adoption of ocean carriage cannot be expected to warrant such a supply of tonnage, especially when the effective carrying power by the substitution of steamers for sailing ships is considered, and whilst English owners have thus been so extensively added to the carrying powers, a large production has, at the same time, been going on by our builders for colonial and foreign shipowners, which will be seen by the figures of the total tonnage built in 1883 in our yards, which were: Iron steamers, 676,338 tons; steel steamers, 113,389 tons; iron and steel sailing vessels, 129,398 tons; making a total production of 919,125 tons. Another example of the rapid building that has taken place will be seen from the year's production twenty-five years since on the Clyde of 35,709 tons, compared with the tonnage constructed on the same river in 1883 of 415,694 tons. . . . . The engineers' strike at Sunderland, which arose through the men considering that the employers utilised too many apprentices, continues, and has entered on the second year of its existence—not a very profitable life."

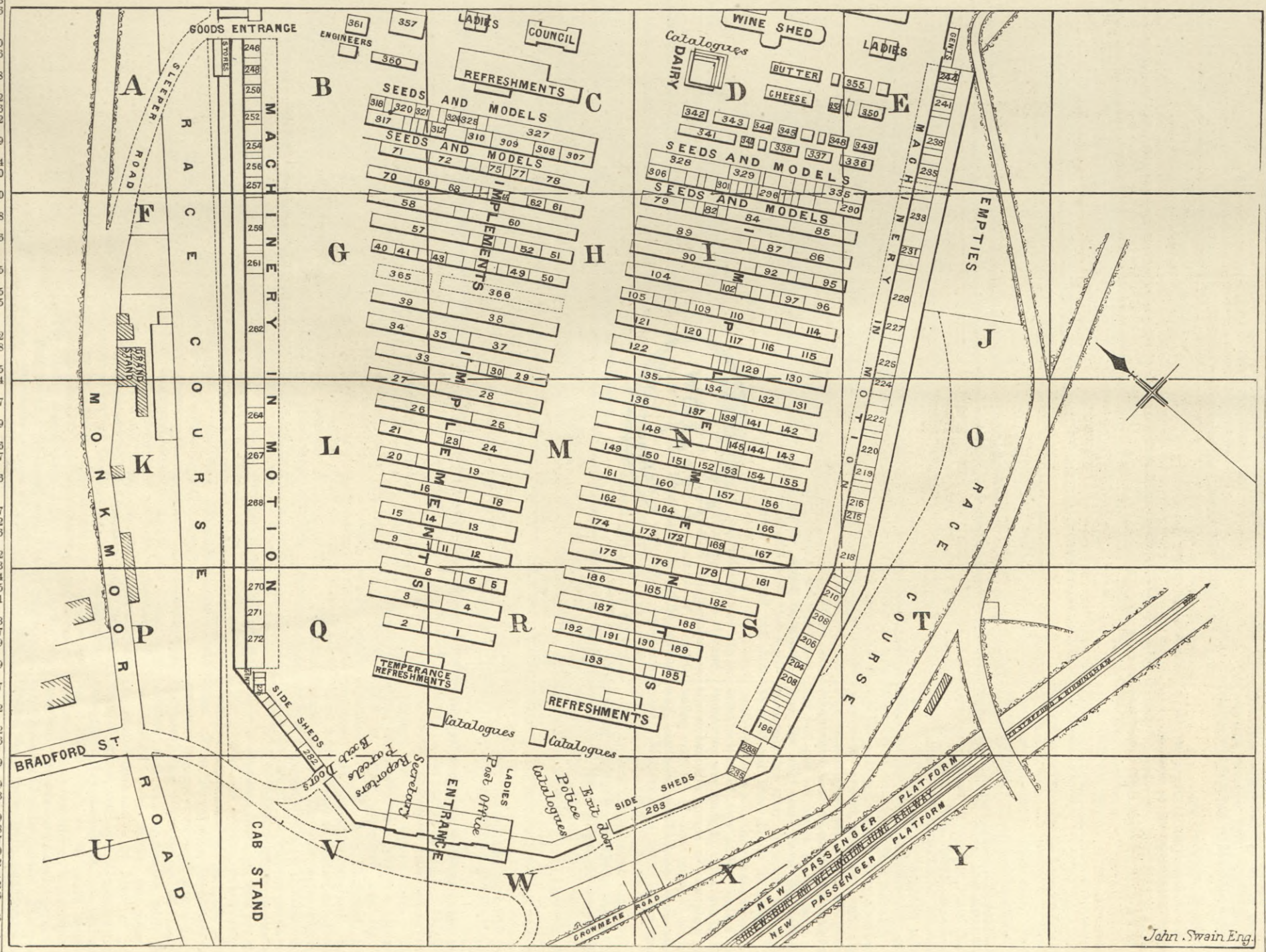
FIFTY-HORSE POWER SEMI-FIXED COMPOUND ENGINE.

MESSRS. RUSTON, PROCTOR, AND CO., LINCOLN, ENGINEERS.

(*For description see page 29.*)



MAP OF MACHINERY DEPARTMENT, ROYAL AGRICULTURAL SOCIETY'S SHOWYARD, SHREWSBURY.



Exhibitor.	Block	No
Ayre Bros.	I	298
Arnold and Sons	C	322
Aveling & Porter	R	1
Allen, William	B	358
Avery, W. and T.	N	130
Affleck, William	S	180
Andrew, J. E. H., and Co.	S	200
Agricultural and Horticultural Association	D	306
Albion Iron-works	S	182
	S	208
Alexanders and Loveridge	—	157
	—	218
Allchin, F., Linnell, and Co.	S	206
Aylesbury Dairy Co.	I	79
Allen, Richard	I	99
Begg, Alexander	Q	281
Bamford, H., and Sons	M	28
Bigg, Thomas	I	124
Barrows & Stewart	G	261
Bohler, Bros., and Co.	Q	279
Baker, John	N	145
Bradford, Thos., and Co.	C	72
Barnard and Lake	N	171
Braby, James	S	194
Bristol Wagon Works Co.	H	38
Baxter, W. H., and Co.	B	247
Bentall, E. H., and Co.	I	86
Bligh, Bros.	G	42
Boby, Robert	M	161
Brown and May	S	190
Burlingham, Innes, and Paternoster	I	87
	J	232
Bruce, Alex. K.	E	235
Burney and Co.	I	97
Baker, Thomas	I	116
Ball, William, and Son	G	58
Bamlett, A. C.	M	12
Barford and Perkins	N	167
	O	213
Beach, J., and Co.	D	333
Benison, Bros.	H	45
Bradley & Craven	B	254
Brenton, William	M	23
Baker, W. B.	H	30
Bust, F. and J. S.	J	229
Blower, J. and B.	X	285
Bagnall, W. G.	T	209
Briggs, Thomas	H	36
Bailey, W. H., and Co.	S	202
Bracewell, Humphrey	G	34
Barker, T. B., and Co.	S	198
Braggins, G. F., and Co.	I	103
Bayliss, Jones, and Bayliss	I	104
Burrell, Charles, and Sons	G	259
Bellamy, John	I	115
Clay, Charles	H	29
Clayton & Shuttleworth	R	187
Coleman & Moreton	R	186
Carter, James, and Co.	D	328
Cradock, George, and Co.	S	183
Cooke, John	M	162
Casewell, William	M	22
Clarke's Crank Co.	O	216
Cooch, Henry	N	140
Crampton Bros.	H	31
Crosskill, William, and Sons	H	33
Coalbrookdale Co.	C	68
Constantine, T. J.	E	237
Clements, Jeackes, and Co.	B	250
Cadle, Cornelius	I	108
Clift and Son	G	41
Coultas, James	N	168
	O	214
Crowley, John, & Co.	I	84
Crump, Henry S.	N	141
Carson & Toone	I	121
	E	351
Carter, J. Harrison	J	225
Corbett, S., & Son	J	233
Cowley, John, and Son	S	201
Corbett, Thomas	N	148
Christy, Thos., and Co.	H	105
	E	234
Cæsar, Henry	G	365
Cottrell and Co.	E	242
Corcoran, Bryan	I	113
Crossley Bros.	S	196
Driffield and East Riding Pure Linseed Cake Co.	D	310
Darkin, Walter	X	286
Dell, W. R., and Son	J	228
Dennis, W. F., and Co.	I	92
Dening and Co.	N	176
Day and Sons	C	312
Day, Son, and Hewitt	B	319
Davis, Joseph, and Co.	X	284
Decauville Aîné	B	70
Dickson, James, and Sons	D	330
Down, Henry, and Co.	B	318
Dawson, W. B., and Son	H	46
Durham and North Yorkshire Steam Cultivation Co.	S	205
Davey, Sleep, and Co.	S	185
Denton, Henry	M	25
Dominion of Canada, Government of the	V	282
Doulton and Co.	I	118
Dickson, F. A., and Sons	C	325
Evans and Co.	D	334
Edgington, Benjamin	B	357
Entwistle and Kenyon	H	59
Edlington, J. B. and T.	R	6
Errington, Roger	I	297
Eldred, Mottram, and Co.	H	66
East Yorkshire Cart and Wagon Co.	H	37
Foster and Pearson	D	342
Foster, W., and Co.	B	256
Farmer, Robey, Brown, and Co.	S	212
Fawcett, Thos. C.	B	253
Fison and Lack	E	244
Foden, Edwin	L	265
Follows and Bate	N	131
Fowler, John, and Co.	R	193
Fison, C. O.	I	127
Forder and Co.	H	49
Goulding, W. and H. M.	C	309
Gibbons & Robinson	B	257
Garrett, Richard, and Sons	R	192
Gilkes, Gilbert, and Co.	O	222
Gillings, William	C	76
Greenall, Guest, and Co.	B	249
Glover, Wm., and Sons	G	39
Guy and Stevens	N	143
Gower, A. W., and Son	M	149
Gilbert, William	N	158
Gardner, William	J	227
Helliwell, T. W.	D	340
Hunt and Tawell	N	132
Howes and Ewell	O	221
Howarth, James	D	352
Hooke, D. B.	Q	276
Henri's Patent Cattle Feed Co.	D	296
Hayes, Henry, & Son	G	57
Handyside, Andrew, and Co.	L	15
Hillerns, O., & Co.	I	126
Hathaway, George	I	80
Hepburn and Gale	Q	274
Hill and Smith	I	89
	B	362
Hornsby, Richard, and Sons	G	262
Hancock, F., & Co.	C	73
Henshaw, Reuben	S	184
Hind and Lund	J	226
Humphries, E.	Q	271
Hart, David, & Co.	J	129
Harrison, McGregor, and Co.	M	19
Hindley, E. S.	E	239
Holyoak, Thomas, and Sons	N	152
Hopkinson, Chas.	O	224
Howard, James	X	287
Howes and Sons	H	48
Hunter, James	C	326
Hughes, Thomas	D	339
Hunter, Thomas	N	153
Hatton, Joseph	E	243
Haynes, R. T., and Co.	N	151
Hensen and Co.	B	363
Hetley, Alfred	N	165
Holmes and Sons	S	195
Howard, J. and F.	Q	8
		270
Hathorn, Davey, and Co.	S	203
Horse Nail Co.	Q	280
Hall, J. and F.	I	100
Hassall and Singleton	S	288
Holmes, Pearson, and Midgley	N	133
Hope, W. A., and Sons	D	332
Hull Wagon Works Co.	H	60
Inman, Henry, Exors. of the late	H	366
Jones, John Milton	C	323
Jenkins, Robert, and Co.	I	88
Jack, Alex., and Sons	N	154
Jeyes' Sanitary Compound Co.	B	313
Johnston Harvester Co.	L	9
Jenkin, F.	C	324
	B	360
Jeffery & Blackstone	L	26
	L	264
Johnson, R., Clapham, and Morris	I	102
Johnson, Bros., and Co.	I	94
Keyworth, J. and H., and Co.	R	5
Kingsford, Fairless, and Co.	M	11
Kell, Meats, & Co.	M	175
King, H. J. H.	M	14
Kearsley, George	L	21
King, William	H	51
Kirkstall Forge Co	E	238
Kaye, Joseph, and Sons	I	98
Keay, E. C. & & J.	I	107
	D	343
Langley, Thomas, and Son	I	91
Lawes' Chemical Manure Co.	C	310
Lyon, Arthur	I	83
Larkworthy, J. L., and Co.	M	174
Llewellin, George, and Son	C	75
Lawton, Joseph	G	40
Lloyd, Thomas, & Sons	I	111
Lankester and Co.	M	13
Lascelles, W. H., and Co.	D	344
Lawrence and Co.	H	67
Lightfoot, Wm.	N	138
Lister, R. A., & Co.	J	230
Lampitt and Son	O	219
Lilwall, Bros., and Co.	B	316
Lloyd, Lawrence, and Co.	C	77
Mackinder, Edwin	I	299
Morris, Little, and Son	B	317
McLaren, J. & H.	S	204
Marshall, Sons, and Co.	S	218
	S	207
Matthews, F. C., Son, and Co.	D	331
Murton, Henry Angus	H	61
Main, A. & J., & Co.	B	364
Matthews, John	D	348
Maynard, Robert	J	231
Mays, Jonathan Aldous	B	69
Miller, John, & Co.	D	301
Morton, Francis, and Co.	I	90
	C	356
Morgan and Co.	H	52
McMullen, H., and Son	H	54
Maldon Ironworks Co.	I	135
Müller, H. L.	S	197
Marshall and Co.	H	64
Marston, J., & Co.	S	53
Morris, J. and M.	S	177
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TO CORRESPONDENTS.

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J. T. P.—*Your question cannot be answered unless the temperature inside and outside the chimney is known. See Box's treatise "On Heat," or Wilson's treatise "On Chimneys."*

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STEEL TUBES.

(*To the Editor of The Engineer.*)

SIR,—Will any reader kindly give me the name of a good maker of steel tubes for hydraulic pressure gauges? W. F. M.

Stalybridge, July 8th.

COFFEE AND RICE PREPARING MACHINERY.

(*To the Editor of The Engineer.*)

SIR,—I shall be pleased if any of your readers can put me in communication with makers of machines for preparing rice for market; also machinery for preparing coffee for market. COLONIST.

Birmingham, July 8th.

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THE ENGINEER.

JULY 11, 1884.

AN ELECTRICAL TESTING ESTABLISHMENT.

EVERY one admits that nothing like finality has been reached in electrical science. Progress can only be made by the man who investigates, discovers, and invents; but the work of investigation at all events becomes daily more difficult as the science with which we have to deal becomes more precise. To discover phenomena is one thing, to attach numerical value to them is quite another. The simple apparatus with which Faraday made not a few of his discoveries would be useless to the man who attempted to deduce facts of pecuniary value from them. The difference between old and modern dealings with electricity is similar to that which obtains between qualitative and quantitative analysis. It is an easy matter to ascertain whether water does or does not contain lime; it is quite another to ascertain how much. Anyone can tell whether a sample of iron does or does not contain carbon; only a practised chemist can say in what quantity. In electrical science, nothing is easier than to determine whether a given combination does or does not generate a current. It requires refined instruments to measure the energy and quantity of that current in volts and ampères. Pushing on a step farther, we may point out that inventions in electricity are being made every day. New dynamos, new lamps, new measuring instruments, and many other things whose name is legion, are being turned out by prolific brains. Some of these inventions are valueless, some of them valuable. In enlightened scientific Great Britain there does not exist any means by which their value or worthlessness can be ascertained at a moderate expense. A new battery is invented by a man who is a good electrician but an indifferent chemist; he has practically no ready means of finding out whether the idea is good or bad. He can ask the opinion of electricians no wiser in chemistry than himself; or he can apply to chemists who know so little of electricity that they are not really qualified to pronounce a useful opinion. In either case, the result must be unsatisfactory; and the only course left to the inventor is to apply to one of the few experts who really combine information on both subjects. He pays fifty guineas, and gets an opinion. In nine cases out of ten this is simply an opinion. It may be very valuable; in any case it will possess some value; but, after all, it is not quite what is wanted, and the cost of it is a serious obstacle in the path of an inventor, who must have a great deal of faith and a good deal of spare money before he will invest £50 in this way. The functions discharged at present by the skilled electrical expert are very much the same as those of a practical iron or steel maker called in to say whether a piece of metal is bad, good, or indifferent. Our metallurgical progress would have been very small had we been left to regard the value of new processes as purely matters of opinion.

The most prominent want of electricians at the present moment is a testing establishment which will do for them what Mr. Kirkaldy has done for the iron and steel makers, the engineers, and the shipbuilders. Such an establishment as we suggest need not—to begin with, at least—be of very colossal dimensions. An engine, the best that can be procured, and capable of running with extreme regularity up to 50 or 60-horse power, would be needed; also one, or perhaps two, much smaller engines—say, of 5 to 10-horse power. Also two or three dynamos of various sizes, and capable of giving either low pressure or high pressure currents. These would occupy the basement of the building. On the next floor would be space devoted to the construction and testing of batteries of all kinds. On the floor above, telegraph apparatus of all descriptions, telephones, &c., would be dealt with; and on the third floor, lamps, arc and incandescent, could be tested in suitable rooms by the aid of the photometer and such other appliances as might be found necessary. A small chemical laboratory would also be needed. A workshop, containing a proper supply of tools, ought to be available, and two or three highly skilled workmen ought always to be at hand. It is needless to say that a competent staff of experimenters would also be needed, under the control of a single authority, whose skill and impartiality would be beyond question. The staff need not be very costly, because it might be mainly composed of pupils willing to pay a good fee in return for obtaining almost unlimited facilities for obtaining instruction.

The way in which the establishment would be worked may be easily imagined. Let us suppose that an inventor has produced, let us say, a new arc lamp. On payment of a moderate fee he would be assigned a dark room, and two terminals, giving him whatever current and potential he might require. He might then test his invention in privacy. If he found that small changes were necessary, the workshop would be available; and he would be saved the loss of time which might be incurred in removing his lamp and bringing it back again. If he was not himself a competent mechanic, then one of the resident workmen would be at his service, at a fixed rate per hour. Having got his lamp into shape, and perhaps patented it, he would require a certificate of its quality. The lamp would then pass out of his hands and be tested by the head of the establishment in quite another department of the building, and a report setting forth the nature of the tests, and the results obtained, would be supplied to the inventor on payment of a proper fee. The same course could be pursued with secondary batteries—let us suppose—current for charging being supplied at so much an hour. All manner of measuring instruments might be sent and officially tested, to ascertain their qualities; and apparatus already in the market could be dealt with in much the same way, a report or guarantee being given with each, just as the Kew certificate is given with thermometers and meteorological instruments.

We can of course, in the compass of an article like this, only indicate in general terms the nature and character of such a testing establishment as we have suggested. The main features of it would be that two distinct departments would exist, in one of which the inventor would be left to a large extent to his own devices to work out to perfection or failure his inventions; while in the other department entirely independent and competent testing could be carried on, and the thing tested would stand or fall on its own merits. This testing department would in all respects go on the same principles as those adopted by Mr. Kirkaldy, in whose words we may say that "facts, not opinions," would form the basis of every report drawn up.

We do not at present know of the existence anywhere of any establishment of the kind we indicate. The ably conducted School of Telegraphy in Princes-street, Hanover-square, supplies some facilities for making tests. The same may be said of technical schools in the City of London, under Messrs. Ayrton and Perry; but we cannot call to mind at the present moment any other places where tests can be carried out. It may be urged that the opinions of experts, such, for example, as Sir W. Thomson or Professor Forbes, may be regarded as all sufficient; but they are nothing of the kind. In the first place, such reports are few in number, and refer to isolated inventions. They give the capitalist and the public no means of comparison. Mr. John Noakes has a report this year on an insulator, let us say; two years ago Mr. Robert Styles had *his* report on an insulator. The users of insulators have no means of comparing the two, and the relative value of the respective inventions cannot be got at in this way. But besides this, it is evident that nothing which can be done by professors can supply the facilities for effecting improvements that would be conferred by the establishment we suggest. A chemist may invent a secondary battery, but have no means of charging it. He cannot afford the money or the space that would be absorbed by an engine and dynamo. At a public testing establishment he might for a few pounds have what he wants—current, not dynamos. Again, a man invents a dynamo. It will not be difficult to get one of moderate size made, nor will it be costly; but to find power to drive it, and facilities for really first-class testing, is quite another thing.

We are strongly of opinion that a public testing establishment such as we have sketched would supply a want and could easily be made to yield a profit. We commend the idea to our readers. We may add that in part the scheme has been suggested to us by one of the most eminent practical electric light engineers in England, a circumstance which is not without its weight in our estimation.

GOVERNMENT ENGINEERS (?)

WE use a note of interrogation with set purpose, because it is doubtful if the gentlemen concerning whom we are about to write are engineers at all in the proper sense of the word. That they are not is not of necessity their fault. Their incompetence is frequently the result of the operation of a defective system which pervades every Government department which has to do with constructive engineering in any shape or form. Its origin dates very far back. Its prolonged existence is due to the enforcement of conditions which are unsuitable to the present age, however well they may have been adapted to times past. There has always been an antagonism between the routine of military or Government systems and the practice of engineering. Attempts have been made to tie down and limit the forces of nature, and the forces of nature have had the best of it, and they have been hated accordingly. Let us take, for example, the introduction of steam power into our fleets. Nothing can be imagined more distasteful to the seamen of the time. Captains did not understand it. To them it was an unmitigated nuisance. Although the wind and the sea might not be very obedient, the sails of a ship were, at all events, entirely under the captain's control. The steam engine was not. We have heard of a captain who wanted to court-martial his chief engineer, because he did not get up steam in one hour. As the captain told him, the ship could have been covered with canvas in three minutes after his order was given to make sail, yet he must wait three hours for steam. The introduction of machinery into war ships was followed very tardily by the introduction of new sailing orders and new tactics. An endeavour was made to carry out in the engine room and the stokehold a system of discipline that only applied to sailing vessels. If some men in authority had had their way, engineers would have worn swords in the engine-room. Matters are a little better managed now, but not quite so well as they might be.

The modern Government engineer must be a man of unusual merit if he can shake himself free from the fetters which bind him. A case came recently within our knowledge in which a man of this stamp carried on the business of his department with the greatest skill and success, in his own way. It came to the knowledge of those in authority over him that he was not working in the old routine groove. The result was that he was called before them, sharply reprimanded, and told that the work must be done (?) as it always had been done. It was nothing to the point that he urged that he had no arrears, as his predecessors always had had; that there were no complaints on the part of the public; that his way was cheaper and better and more satisfactory in all respects than anything that had gone before. The reply was that doing the work was purely a secondary consideration. That to follow precedent was the first point to be attended to. He had, disgusted, to give way; what the result will be may be imagined. Routine, carried out in the most ridiculous fashion, is a blight on the Government engineer. The able letter which will be found on another page, supplies an admirable example of its operation in the case of Government contracts for rolling stock; but it is by no means confined to one department. It is not to be supposed, however, that the defects in specifications pointed out by our correspondent are traceable to absolute incompetence on the part of those who prepare them. Take, for example, the absurd stipulation that the plummer blocks for an earth wagon are to be machined on the faces bolted to the timber side frames. It is not to be assumed that this originated with the drawer of the specification. No doubt on some former occasion plummer blocks had to be fitted to iron plates, and they were, of course, machined to make a good fit. In Government eyes a plummer block is a plummer block, whether for a crank shaft or an earth wagon, and if one is machined, that constitutes a precedent, and all must be machined. It was once found useful to send out a good many tracings of rolling stock. The precedent thus established, the fiat went forth, and hundreds, nay thousands, of square yards of tracing cloth are yearly sent to India, covered with detailed drawings of locomotives and rolling stock. The tracing cloth alone for one order of this kind cost £45. It is perfectly well understood that these drawings are left to rot when they reach India, or supply food for white ants. We could, were it necessary, multiply instances wherein a blind adhesion to routine and precedent brings about the most absurd results. In our dockyards, our arsenals, our gun factory, in every possible direction, we find the same influence blighting the engineer, and incapacitating him from doing the things of which he is capable. The Government civil engineer hardly ever gets a chance of showing what manner of man he really is.

Nor is this by any means confined to those who have to do with railways and weapons. If we turn to the marine department of the Board of Trade, we shall find plenty of examples of the automatic manner in which work is performed without any elasticity of practice or of action. Everything is put on an official bed of Procrustes, and cut to fit official ideas. If the Board of Trade rules for marine boilers,

applied to locomotives, and were enforced, it is questionable if a speed of thirty miles an hour could ever be exceeded. Fire-boxes an inch thick would be demanded. Boilers now carrying, day after day, for years, pressures of 140 lb., would not be passed by a Government inspector for 60 lb. The wooden-jointed way in which the Board acts is admirably set forth in the reports on boiler explosions now published periodically. Every casualty is an "explosion." The blowing out of a lead plug is an "explosion;" the bursting of a mineral oil still by the application of a light to the gas it contained when empty of oil, is a "boiler explosion." The comments made on true explosions are often ludicrous in their simplicity. Thus, not long since the whole class of vertical boilers was condemned in sweeping terms, because it happened that one exploded. That Government engineers are capable of better things when they succeed in shaking off the shackles of routine, and placing themselves in touch with the civil engineer, is shown by the action of the Railway Department of the Board of Trade. Its officers are not faultless, but on the whole there is very little to complain of, very much that is praiseworthy, in their mode of investigating railway accidents, in the recommendations that follow these investigations, and in their inspection of lines.

To what the imperfections of the system are ultimately due it is not easy to explain within the space at our disposal. They are in part traceable to the action of heads of departments, too old for their work or too timid or indolent to do what is right. By the application of rules of considerable or even great antiquity to modern practice these gentlemen save themselves from responsibility. If by any remote chance a plummer block not planed where it bears on the wood gets loose, the man who drew the specification may be blamed—he had departed from the rules of the office. If a hundred planed plummer blocks got loose he would go scot free. The blocks were made as they always had been made. Common iron will answer very well for common work. The Government engineer is bound to insist on iron with an elongation of 18 per cent. with the grain and 9 per cent. across it. The Government engineer is supposed to receive a very expensive education, and to be highly competent in every way; but it seems that he can only follow precedent, however antiquated. It may be urged that the younger Government engineers are all highly trained men, who have had very costly technical instruction, and passed a very difficult examination. This is perfectly true, but it has but little to do with the matter. Competitive examinations do not teach an engineer where and how he is to buy things to the best advantage. It is just possible that the training of a Cooper's Hill man might prevent him from securing important parts of a structure with coach screws put into the timber with the grain. It could not tell him that he would have to pay an extra price for using plates of iron 8ft. by 6ft. in one piece. The competent civil engineer knows how to get the best value for his money. The most highly trained Government engineer is, as a rule, the most densely ignorant on this subject. Nor is it to be supposed that English Government engineers stand alone in this respect. Much the same story reaches us from all parts of the world. In point of fact nations, that is to say taxpayers, are perhaps worse served and get less for their money than anyone else. Private shipyards, for example, can always make a profit out of Government contracts. The ships so built really cost less than the ships built in our Government dockyards, but no one ever heard of a profit being made out of a Government dockyard yet.

In certain departments either the new system has been so entirely novel that it sets official red-tape at defiance, or the engineers employed have taken such a standpoint that they have been pretty well left to themselves, and with the happiest results. The Post-office and Telegraph Departments may be cited in proof of this. Our telegraph engineers are, indeed, among the ablest men of the day. It is possible that sheer force of circumstances, and death or superannuation may yet effect salutary changes in other departments. Meanwhile the engineer who is under Government control can hardly help doing absurd things. Excuses must be made for him; and we are sorry that this has to be said of any member of our profession.

THE DRACHENFELS RAILWAY.

ANOTHER favourite sight has been placed within the reach of tourists by that so-called spoiler or vulgariser of natural scenery, the engineer. The railway up the Drachenfels has been completed. The line is 1522 metres in length, the upper end being 222 metres above the starting point. The mean gradient is 1 in 16·8, and it reaches 1 in 5 in several places. The rails are of steel, one metre apart, the rack, which is central between them, being also of steel. The sleepers are of iron one metre apart. The cost of the line has been about £10,000. It will make a visit much more easy and attractive to many, but it will, no doubt, raise the ire of those of that school of philanthropists who are ever ready to preach of the elevation of the masses, but who have an objection to their being raised by rail to such of nature's quiet beauties as they are fond of visiting. Rack railways, though the first was constructed but a few years ago up the Righi by M. Riggenbach, have now become numerous. They now comprise (*a*) those worked wholly by engines gearing in the rack, and (*b*) those worked either by locomotives which have rack as well as common gear, or by two kinds of locomotives. The first class includes (1) the Vitznau-Righi, built in 1870, and having a maximum gradient of 25 in 100; (2) the Kahlenberg-Vienna, built in 1872, with maximum gradient of 10 in 100; (3) the Schwabenberg-Pesth line, also built in 1872, and having the same maximum gradient as the Kahlenberg; (4) the Arth-Rigi, built in 1874, and having a maximum gradient of 21 in 100; (5) the Rio-de-Janeiro, built in 1882, with maximum gradient of 15 in 100; and (6) the Drachenfels, on the Rhine, with a maximum gradient of 22 in 100. All these lines are purely tourist or sight-seers' lines. The lines of the class *b* are of a commercial character, part of their length having the ordinary rails only. No. 7 is the Ostermundingen-Berne line, built in 1870, with a maximum gradient of 10 per 100; 8 is the Rorschbach-Heiden, built in 1874, and has a gradient of 9 per 100; 9 is the Wasseralfingen, built in 1876, with maximum gradient of 8 per cent.; 10 is the Rueti-Zurich, built 1877, gradient 10 per cent.; 11, Laufen-Berne line, built 1878, gradient 6 per 100; and 12, the Oberlahnstein, built in 1880, with gradient 10 per 100. The locomotives already constructed for these lines are, according to Herr Riggenbach, forty-two, weighing from 9 to 18 tons each. Besides these lines, Riggenbach has constructed four funicular lines, where the rack is used, only as a means of securing a really trustworthy brake, and where water is taken into a suitable holder at the top of the line, the weight taken being enough to balance the locomotive and the train, and thus to reduce the locomotive work nearly to a minimum. These lines are the Giessbach, on the Lake of Brienz, gradient 28 per 100; the Dom Jesus de Braga, Portugal, with a gradient of 45 per 100; Lisbon, gradient 25 per 100; and of Montreux-Geyon, on the Lake of Geneva, with a fall of 57 per 100. The two last were completed only last year. In the course of thirteen years there has thus been a much unexpected development of little railways of this class, and there is much to be done yet in this way, even at home.

CLEVELAND IRON MINERS' WAGES.

UNDER the sliding scale that prevails in Cleveland, there has been another reduction in the rate of wages in the Cleveland iron mines. It is, however, a proof that, under a deep depression of trade, the system of sliding scales gives relief to the employers, just as in periods of prosperity it gives increased wages to the workmen. The realised price for pig iron during the last quarter in the Cleveland district is shown to have been 36s. 4·65d. per ton. The amount of the reduction is a fractional one; but whilst it will only very slightly affect the wages of the miners—to the extent of a few pence weekly—it will give, in the total, a very great relief to the employer. The falling off in the trade is shown rather by the volume of the production than by the value, for the price is within 8d. of the price that has been for some time quoted in the market by the associated makers of Cleveland. It is worth notice, too, that that price is still very much higher than that which was known five years ago in the extremity of depression in the trade in the north-east. There may be differences of opinion as to the cause of the decline in price, and as to the probability of the recovery being early; but, whether tested by the price or by the demand for labour, the fall in the rate of wages may be fairly said to be one that is due to the employers. That it should be brought about in the peaceful manner that it has been is a fact that is creditable to both sides of the bargain—for the method is cheaper and quicker than that of a special arbitration, and much more gradual in its operation.

THE RECENT DANISH ARMOUR PLATE TRIALS.

RARELY have experimental tests of armour plates been more closely watched, or followed with greater interest, than those which have lately been concluded at Amager, near Copenhagen. The principal reason for the attention thus exhibited will, no doubt, be found in the circumstance that, whereas most naval powers have definitely settled the question as to the system of armour to be adopted, the Danish Admiralty decided not to be governed by foreign official reports, but rather to judge for themselves respecting the merits of the only principles of armour plate manufacture at present in use, viz., the French steel plates and the English compound plates. The question has now been decided in favour of Wilson's compound armour, and the order for the armour plates for the Ivar Hvitfeldt has been placed with Messrs. Cammell and Co., of Sheffield. This solution of the question will not surprise those who have followed the various stages of the trials as reported in these columns. Yet it must be acknowledged that the Danish Naval Commission have had to contend with unusual difficulties in arriving at a conclusion, for it was known from the first that the Amager trials, instituted, as they were, on an independent basis, would have important results. It is a source of gratification to us to know that the order has been placed with an English firm.

CONTINUOUS BRAKES.

AN accident occurred near Chicago not long ago which must have been attended by most disastrous results, but for the prompt action of the Westinghouse brake with which the train was fitted. Mr. Joseph Wood, superintendent of the Pittsburgh, Fort Wayne, and Chicago Railway, supplies the following information concerning the accident in question:—"The train consisted of an engine, one baggage and three sleeping cars, weighing about 190 tons. At the time of the accident the train was on a descending gradient of 1 in 125, and was going at a speed of from 40 to 45 miles per hour. After leaving the rails, the engine went partly down an embankment, taking with it the baggage and first sleeping car, and stopping at a point 240ft. from the point of derailment. The other two sleeping cars remained on the road bed, the rear end of the rear car being 75ft. ahead of the point of derailment, showing that from the time of the application of the brakes—when the engine was derailed and broken loose from the tender—to the point of stopping of these cars, they had gone a distance of 370ft. These facts so strongly emphasise the efficiency of the brake that further words seem unnecessary. I may add, however, that none of the passengers were injured sufficiently to delay their journey."

TRACTION ENGINES IN SHEFFIELD.

THE Sheffield Town Council, on the 9th inst., confirmed the decision of the Watch Committee, by which all traction or other locomotive engines are to be prohibited from passing over any thoroughfare within the borough between the hours of 9 a.m. and 5 p.m. There was a strong opposition, and an amendment against the resolution was voted upon as follows: For ths amendment, 20; against, 27; neuter, 5. A bye-law carrying out the resolution of the Council was passed. Alderman Gainsford spoke vigorously against what he condemned as the retrograde policy of the Corporation, comparing it to the short-sighted opposition to railways, and declaring that it could not and would not stand. It does seem absurd to pass such a resolution. The borough of Sheffield extends all the way to Stanedge Pole, a solitary place on the moors, and to Dore and Totley—the one seven and the other five miles from the parish church. Are these to be considered thoroughfares within the new bye-law? No little hardship will be caused to coal and other companies who have invested heavily in traction engines, and Derbyshire people, who depend upon them for their service of coals and heavy goods, will be injuriously affected.

COMPOUND LOCOMOTIVES IN THE UNITED STATES.

THE compound locomotive is not a success in the United States. Uneconomical as the normal American engine is as compared with the English engine, the difference between its performance and the best possible seems to be too small to be touched by compounding. The *American Railroad Gazette* says that the Boston and Albany compound locomotive has been finally voted a failure as an economiser of fuel, and is to be changed into the ordinary form, which, from its construction, is a simple matter to do. This engine has four cylinders—two high and two low-pressure—one in front of the other with the same piston-rod. The rear—low-pressure—cylinder is of about the usual size. The engine proved a failure simply because it was more expensive to maintain than the simple engine without showing any corresponding economy. It seems not to be easy to obtain any definite information as to the performance of Mr. Webb's engine, but it is a suggestive fact that every one else who has tried the compound locomotive has failed to accomplish anything with it.

LITERATURE.

Reminiscences of Travel in Australia, America, and Egypt. By RICHARD TANGYE, with illustrations by E. C. Mountford. Second Edition. London: Sampson, Low, and Co. 1884. 290 pp.

TREVELYAN states that when Lord Macaulay was returning from India, that statesman set himself the task of learning German on the voyage, but Mr. Tangye says he set himself the less ambitious task of writing this book while travelling. In many cases, or with most people, the advantage of the world would be best consulted by those travellers who followed Lord Macaulay's method of preventing monotony. Not so, however, with Mr. Tangye, for his book may be read with very great pleasure, and not without edification. The volume is descriptive of voyages, journeys, places, people, and manners, and anecdotic of all these. His notes on his Australian visit give an interesting and useful insight into colonial progress and affairs which is not to be gained from other sources; and the feeling that impresses a reader is that the author must have been thinking more about his notes than the enjoyment of his rambles when out there. His remarks on the different results of the policy of New South Wales as compared with those of the policy of Victoria should be read by all who are in any way concerned with the effects of Free Trade and protection in new countries. In view of the correspondence now being published in our columns on lifts, it is noteworthy that the author, in his account of the enormous thousand-roomed Palace Hotel in San Francisco, mentions that "all the gas and water fittings, the hydraulic lifts, and the pumps, were supplied by English makers."

In his notes on America is a note encouraging to travellers. He says:—"The Pacific Railroad is a single track, and, although a wonderful engineering work, is not by any means a substantial or confidence-inspiring line if judged by English standards. The rails are old and worn, the bridges and viaducts very lightly constructed, and almost always of wood. I observed in several cases that the carriages were actually wider than the viaducts, many of which are open between the rails. . . . The train in which we were travelling narrowly escaped falling into a ravine 120ft. deep. One dark night after we had all retired to rest we were awakened by continued whistling and ringing of bells. . . . We found we were being taken across a viaduct one carriage at a time, and as we crossed we could see lights moving about at a great depth below. . . . The viaduct had been discovered to be in an unsafe condition, some of its timbers having been partially burnt, and it was a matter of discussion whether we should be allowed to cross at all. . . . Ours was the last train that went over it, for before daylight the whole structure had fallen with a tremendous crash." Speaking of the descent of 8000ft., from the summit to the eastern plains in the Salt Lake district, in about four hours, the author says: "Steam is turned off, the brakes turned on, and down we go. As we were preparing to descend I remarked to the negro attendant that I supposed we must trust the engineer now? 'No sah,' said Sambo, 'I guess we must trust de ole man up above,' pointing to the skies." As to the cost of things generally in America the author says: "I have travelled in many countries, but in almost every thing have found America twice as dear as any other country. The charges are simply monstrous." He then speaks of the extortion by which a couple of dollars must be paid for luggage taken to the hotel, which could easily go with the cab taken by the passenger, and for which a shilling would be paid in England. On the other hand, he says "the charges made by the steamboat companies and most of the railways are exceedingly moderate, and their arrangements in connection with baggage most convenient," the through booking of luggage being here referred to.

The author's visit to Egypt was since the Kasassin and Fort Meks affairs, but the events of that time have not prevented him from paying an extended visit and giving accounts of some entertaining incidents. There is a good sprinkling of fun throughout the book, and it will not disappoint those who take it up. It is well got up, and is provided with a good index.

BOOKS RECEIVED.

The Blow-pipe in Chemistry, Mineralogy, and Geology. By Lieut-Col. W. A. Ross, R.A., F.G.S. London: Lockwood and Co. 1884.

Mineral Resources of the United States; United States Geological Survey. Albert Williams, jun., chief of Mining Statistics and Technology Division. Washington: Government Printing Office. 1883.

Minutes of Proceedings of the Institution of Civil Engineers, Vol. lxxv. and Vol. lxxvi. Edited by James Forrest. London: The Institution. 1884.

Treatise on the Application of Wire to the Construction of Ordnance. By James A. Longridge. London: E. and F. N. Spon. 1884.

Strains in Ironwork: A Course of Elementary Lectures. By H. Adams, M.I.C.E. London: E. and F. N. Spon. 1884.

PRIVATE BILLS IN PARLIAMENT.

AFTER a thirty-four days' inquiry, a Select Committee of the House of Commons have given their sanction to the Barry Docks and Railways Bill, a scheme which, if carried out, will effect the most important changes in the carrying and shipping of coal in South Wales. The promoters of the Bill are freighters and others who complain of the lack of accommodation and the unjust rates to which they are subjected by the

Taff Vale Railway Company, by the Marquis of Bute as owner of the Cardiff Docks, and by the Taff Vale Company as the proprietors of Penarth Docks, and of the system of railways connecting the mineral districts with the sea. Finding that they could not obtain redress of their grievances, the freighters determined themselves to provide a remedy, and with this object they consulted Mr. John Wolfe Barry, the eminent engineer. Mr. Barry applied himself to the task of finding a suitable site for his docks; and finally, after consultation with Sir John Coode, Mr. Lister, Captain Moriarty, and others, it was decided that Barry Island should be adopted. This spot, situated as it is in one of the most sheltered parts of the Bristol Channel, and forming at present a harbour of refuge, seemed, in Mr. Barry's eyes, to have been designed by nature for the purpose to which he now intends to apply it. Mr. Barry summed up the advantages of the site as follows:—The depth of water, the ease of constructing and maintaining the outer channel, the short length of channel, and last, but not least, the facility of obtaining the materials for construction of works. The first and most important work authorised under the Bill is the construction of a dock forty acres in extent, and a basin of eight acres. The entrance to the dock will be at the eastern end, in order to preserve as far as possible the character of the place as a harbour of refuge, and the approach will be by a lock 500ft. long by 80ft. broad. From the entrance gates to low-water mark, the distance is 460 yards. The level of the dock sill will be 18ft. The promoters estimate the cost of carrying out the dock portion of their scheme at £521,953, including the usual 10 per cent. for contingencies. For the expenditure of this sum of somewhat more than half a-million, the promoters of the Bill expect to accommodate, without inconvenience, 2½ million tons of coal, or 330,000 tons more than can be provided for at the utmost pressure by the new Cardiff Dock, of which the estimated cost is considerably over a million. Leaving this portion of the scheme, we come to the railways which are to be made from Barry into the gathering ground of the Rhondda Valley. The estimated cost of these lines is £752,123, or an average of over £22,000 per mile. An important objection to this part of the Bill seems to lie in the fact that railway No. 3 approaches the docks on a gradient of 1 in 88. Evidence was given in support of the engineering features of the Bill by Mr. Rendel, Mr. Szlumper, Sir Frederick Bramwell, and Mr. Deas. The principal opponents of the Bill were naturally the Marquis of Bute and the Taff Vale Railway Company, opposing the dock and railway projects respectively. Their case was based generally on the unfair nature of the competition which would be set up by the promoters, rather than upon the impracticability of the works proposed in the Bill, though this point was taken. Amongst the witnesses called for the petitioners were Mr. Giles, M.P., Mr. Abernethy, Sir John Hawkshaw, and Mr. Percy Westmacott, manager for Sir Wm. Armstrong and Co. At the conclusion of the case the Committee passed the Bill, limiting the running powers of the promoters over the Taff Vale to that portion of the company's system lying above Treforest, but providing for the exercise of running powers between Treforest and Cardiff in the event of the Taff Vale Company not giving due facilities for the interchange and forwarding of traffic.

Since the Whitsuntide recess, though business in the Committee Corridors has not been slack, the matters under discussion have not generally been of interest from an engineering point of view. Mr. Forbes and Sir Edward Watkin have been arraigning each other before several Committees, and each has been very successful in obtaining the rejection of schemes introduced by the other. The Various Powers Bill of the London, Chatham, and Dover Railway Company was for a considerable time before a Select Committee on the application of the promoters for leave to extend their line from Dover, the present terminus, to Folkestone. The line was promoted with the view of increasing the railway facilities to Folkestone, and so developing existing and new traffic. The old question of the agreement between the Chatham and Dover and the South-Eastern was gone into at great length. It appears that in 1863 the two companies determined to divide all receipts for the carriage of traffic between London and Folkestone, and this agreement has doubtless been an advantageous one for the Chatham Company, though they now carry a larger share of the traffic than formerly. Charges of evasion were mutually indulged in, and finally the Committee determined to throw out the scheme. The Chatham Company had no better success with their Shortlands to Nunhead scheme, the best surviving project of the many introduced this year for the accommodation of South London. The Bill authorised the construction of a line 4½ miles in length from Shortlands, a station on the Chatham and Dover main line, to Brockley, where a junction was formed with one of the suburban lines of the company. By curves to be constructed at Peckham Rye, and running powers over a piece of the Brighton line, access was to have been obtained to the East London, and traffic might have been carried by through trains, as Mr. Forbes proposed, from the Chatham Company's main line to Whitechapel. The scheme was naturally very vigorously opposed on its merits by the South-Eastern Company, which represented that its service was sufficient to meet all the requirements of the locality. The Brighton Company also petitioned against the Bill; but their opposition was confined to the inconvenience and possible danger apprehended as a result of the proposed junction. Ultimately the Committee agreed not to allow the Bill to proceed. The same Committee also passed the Taff Vale Railway Bill, the main feature of which is the improvement of the company's access to the Bute Docks. For this purpose a piece of line 52 chains long will have to be constructed. The Bill also contained powers as to the acquisition of land, and enabled the company to raise £133,000 in the usual proportions of share and borrowed capital. The Treferig Valley Railway Bill has undergone considerable modifications since it was introduced into Parliament. It was originally proposed to construct several small lines of a total length of six miles, but these additional powers are now abandoned, and the scheme has become one for the transfer of the undertaking to the Taff Vale Company. The Great Western Railway (No. 1) Bill was also in the same group as the three last-mentioned Bills. Amongst other things, the Bill authorises a junction line, twenty-seven chains in length, at Didcot, for the purpose of avoiding the inconvenience of a back shunt; a branch railway from Kemble to Long Newton; a junction with the Montgomeryshire Railway in St. Woolds; a substituted line for a portion of the Nantyglo branch; a branch to the Bristol Channel; and a deviation, forty chains in length, of the Rhmyney Railway. The total length of new line contemplated under these powers is 12 miles 55 chains. The remainder of the Bill relates to the commercial and financial arrangements between the Great Western and other railway companies. The capital powers contained in the Bill provide for the raising of £600,000, of which £150,000 is to be borrowed. Another South Wales Bill was that of the Milford Docks Company, which, owing to the unfortunate complications which have attended its undertaking, feels it necessary to ask Parliament to extend the time for the completion of the works. The discussion before Committee related principally to the financial position of the company. The Bill authorised a short railway of 32 chains, for the purpose of connecting the docks of the promoters with the railways of the Milford Haven Dock and Railway Company.

A Commons' Committee passed the Liskeard and Caradon Railway Bill, which extends the company's lines to Launceston, at which point a junction is formed with the North Cornwall. Over the lines of the latter company traffic may be carried on to the South-Western at Ludford. The traffic consists principally in agricultural produce.

In the House of Lords there is naturally an increase of business, as Bills come up from the House of Commons; and lately their Lordships have had as many as five Committees sitting in one day. As nearly all the schemes have been previously described, it is only necessary to touch upon the various matters. One of the first Bills to be dealt with was the Stockton Barrs Bill, which authorised a short line for the purpose of developing a piece of land the property of the promoters. Some technical objections taken on behalf of the petitioners were overruled; and the main question turned on the expediency of authorising the crossing on the level of a public road. The district is impregnated with level crossings, and there is a crossing even at the entrance to the North-Eastern Company's terminal station at Middlesbrough, where the traffic, both goods and passenger, is very large. This fact was proved in evidence by the promoters, but their Lordships held that it was undesirable to allow the Bill to proceed. The cost of the construction of the line was estimated at about £1000.

The most important Bill which has yet passed the Committee stage of the House of Lords is the Manchester, Sheffield, and Lincolnshire Railway (Chester to Connah's Quay) Bill. This project—of which we gave a full description on the occasion of the passing of the Bill by Admiral Egerton's Committee of the House of Commons—includes the construction of a six-span low-level swing bridge across the river Dee. The company intends to commence its line at the termination of the Cheshire Lines Committee's undertaking at Chester, and to construct a railway about seven miles in length to Connah's Quay, a port in the estuary of the Dee. The Bill is promoted with the view of improving the access to Connah's Quay from the colliery district of North Wales and the salt works of Cheshire. The estimated cost of carrying out the works authorised under the Bill is £161,000, £60,000 being the probable cost of the bridge. Since the Bill has been in the Commons the promoters have introduced modifications and improvements in the details of the structure in order to meet the objections brought by opponents. The Bill is now beyond all danger, and will in due course receive the Royal Assent.

Lord Romney presided over a Committee engaged in considering the Omnibus Bills of the Metropolitan and Metropolitan District Railway Companies. The Bills related principally to the rights of the companies in parts of the Inner Circle line; but the Bill of the District Company sanctions the construction of a passenger subway from the South Kensington Station to the entrance of the Royal Horticultural Gardens. This work is estimated by Mr. J. W. Barry at about £30,000. Entrance to the subway will be obtained by means of a flight of steps, and in the subway there will be gradients of 1 in 17, 1 in 29, 1 in 50, and 1 in 150. It may be remembered that in the House of Commons a subway from South Kensington to the Royal Albert Hall, promoted by the Metropolitan Company, was considered as an alternative scheme, but was rejected by the Committee. The Blackpool Railway Bill, also before Lord Romney's Committee, authorises an extension from the West Lancashire lines at Preston to Blackpool, a watering-place on the Lancashire coast. The length of line to be constructed under the powers of the Bill is about twenty miles, and the estimated cost of carrying out the works is £504,748. The Bill gives extensive running powers over the West Lancashire Railway.

The Earl of Milltown's Committee have given their assent to an important Midland scheme, viz., the Dore and Chinley Railway Bill. This Bill authorises the construction of a line from Dore to Chinley, both places being situate on the Midland line; and the connection thus afforded between two branches of the Midland system will have the important result of providing a new route from Manchester to Sheffield, and an alternate line between London and Manchester. In the event of a block on the Midland, on that exposed piece of line between Derby and Stockport—and experience has shown that this is not an impossible contingency—the now authorised Dore and Chinley line would be of great importance, as it would enable the Midland Company to conduct its traffic with but little inconvenience. The cost of constructing the twenty miles of line authorised under the Bill will be nearly one million pounds, or an average of £50,000 per mile. When it is remembered that something like four miles will be in tunnel, it will be seen that these figures, which look somewhat alarming at first, are not unusually high. The Midland Company will work the line, and has engaged to give the Dore and Chinley Company a guarantee of 3 per cent.

The District Railway Ventilators Bill of the Metropolitan Board of Works has passed through Committee of the second House without opposition. The Bill orders the removal of the air shaft in the carriage way opposite Montague House. The West Lancashire Railway Company has satisfied Lord Redesdale of the expediency of authorising its extension to the Preston Docks. This is one of the Bills which have been denuded of their principal features. The Bill, as presented to Parliament in February, sanctioned an extension to Blackpool, but this scheme was withdrawn, as its object was covered by the Blackpool Railway Bill.

50-H.P. SEMI-FIXED ENGINE.

WE illustrate on page 26 a semi-fixed engine of unusually large size made by Messrs. Ruston and Proctor, of Lincoln, to the following specification:—

Cylinders.—To be respectively 14in. diameter for the high-pressure, and 22½in. diameter for the low-pressure, the steam passing from the first to the second, and thus expanding to the most economical extent; both to be 24in. stroke The working barrel of each to be cast separately of specially selected hard metal and forced into the main casting, the space between forming the steam jacket, which completely surrounds each cylinder. The slide valves of the same kind of iron scraped up fairly with the valve faces. The steam chests to be placed on each side and the stop valve chamber centrally in front, all the valves being at once accessible on the removal of their respective covers. The cylinders to be planed to receive the channel iron frame and strongly bolted to it; at the top to be secured by a flange to the boiler. The cylinder covers to be polished, the glands all brass of extra strong pattern, suitable drain and tallow cocks to be provided, and a special arrangement for draining the steam jackets. The barrels to be covered with felt and wood lagging, and finished with neat sheet iron casing fastened by screws.

Pistons.—Of improved pattern, with two metallic packing rings and internal spring ring, to be bored taper and secured by nuts to steel piston-rods.

Crossheads.—Of hammered scrap iron, forged solid, tool finished all over, and cottered firmly to piston-rods.

Slide bars.—To be quadruple, of rectangular section, bolted respectively to the cylinder covers and neat guide stands. Slide blocks of cast iron with large wearing surfaces. Gudgeons of steel, firmly keyed to crossheads.

Connecting rods.—Of best scrap iron finished bright, fitted at both ends with extra long gun-metal bushes secured by straps and cotters.

Excentric straps.—Of gun-metal polished, with bright wrought iron rods and case-hardened joints and pins. Valve spindles of steel, to work in suitable brass guides.

Automatic gear.—The admission of steam to the high-pressure cylinder to be automatically varied by the governor from 1 per cent. up to 50 per cent. of the stroke, according to the power required, by an improved arrangement of gear consisting of a double-ported expansion valve connected by a radius rod to a rocking slot link driven by a separate excentric.

Governor.—Of improved cross-arm type, very sensitive in action, connected directly to the expansion gear, and furnished with an oil cylinder to steady it.

Feed pump.—Of ample size worked by separate excentric, with gun-metal plunger, valve box and valves and copper delivery pipe; to work continuously, water not required by the boiler being returned through a regulating cock to the feed tank.

Water heater.—Of improved construction, to consist of a branch from the exhaust pipe connected by a copper tube, furnished with brass cock, to the "return" pipe of the pump. The overflow water, thus highly heated by the exhaust steam condensing and uniting with it, passes down and raises the temperature of all the water in the feed tank to nearly boiling point.

Crank shaft.—Of steel bent from a single bar, and truly turned, to be long enough to carry a pulley at both ends.

Crank shaft carriages.—To be strongly attached to the frame, and very substantial, with extra long gun-metal bearings adjustable both vertically and horizontally, and caps made to fit over projections on the horn blocks.

Fly-wheel.—10ft. diameter by 16in. face, of heavy pattern, turned to carry belt; revolutions per minute, 90.

Bed-plate.—To be formed of two strong channel-iron bars firmly braced together at the ends by the cylinder and ashpan castings, and stayed between by the wrought iron plate carrying the guide stands.

Boiler.—Placed over the engine; to be of the loco-multitubular type, very strong, of ample capacity and extra heating surface, suitable for burning wood. The barrel plates to be of best Staffordshire quality; double rivetted in longitudinal seams, and arch plate of same quality. The tube plate and other plates of flanging quality.

Fire-box.—To have large grate area. All the plates—front cover and tube plate—to be exclusively of Lowmoor or of Bowling iron, and to be well strengthened by deep girders and screw stays at top and sides respectively.

Tubes.—To be of best wrought iron lap welded, 2in. extreme diameter, 144 in number; expanded by patent tool at smoke-box ends, and secured in the fire-box by steel ferrules.

Manhole.—To be formed in a stout wrought iron plate, flanged and rivetted round the opening, with a strong cover, crossbars and bolts. Mudholes, suitably furnished, to be made at each corner of fire-box, in the smoke-box, and in a mud collector placed under the barrel.

Seatings.—Strong cast iron seatings, truly faced, to be rivetted on the shell to carry the safety valves and check valve.

Workmanship.—The plate edges to be planed and fullered, rivet holes to be accurately punched fair with each other, and plates be rivetted up by patent hydraulic machinery. The stayholes in the fire-box to be drilled through both plates at once, so as to be perfectly true.

Pressure.—To be strongly stayed for a working pressure of 120 lb. per square inch, and tested by water to 200 lb. per square inch.

Mountings.—To be furnished as follows:—Strong wrought iron smoke-box with door and fittings. Chimney base, and wrought iron chimney finished with bell top and damper plate. Fire-door with baffle-plate, set of fire-bars, and cast iron ashpan with regulating damper. Brass safety plug screwed into crown of fire-box. Balanced steam stop valve with starting handle, placed in the cylinder casting, and connected by a copper bend with an anti-priming pipe fixed inside the boiler. Combined spring balance lever safety valve, and improved lock-up spring safety valve. Steam pressure gauge and brass syphon, glass water gauge of strong pattern, two brass gauge cocks, and signal whistle. Steam jet pipe and cock for forcing the draught. Brass blow-off cock and water plug.

Sundries.—The boiler barrel to be felted, lagged with wood, and neatly covered with sheet iron. The engine to have good lubricators to all bearings; tool-box and set of case-hardened spanners; firing tools and shovel; suction and return pipes; tube brush and rod; water funnel; oil tin and spare gauge glass; also suitable holding-down bolts.

Generally.—To be capable of working up to three times its nominal power, and to be tested under steam by a friction brake; to be made throughout of the very best material and workmanship, every part being finished accurately to gauge by the most modern appliances.

THE SOCIETY OF ARTS CONVERSAZIONE.

THE Society of Arts and the Executive Council of the International Health Exhibition combining gave a *conversazione* of the most satisfactory kind on Wednesday night at the Health Exhibition. Although it was stated that the number of invitations was limited to 3000, at least double the number must have been present. The guests were received by the Duke of Buckingham. The building and the gardens were brilliantly lighted, and the weather was everything that could be desired. Among the numerous bands, that of the French Engineers—heard, we believe, for the first time in London—attracted a good deal of attention, and fully deserved the applause which it obtained. Chinese musicians discoursed, not sweet music, but to English ears hideous discords, on the pagoda bridge which spans the eastern pond. The fountains, illuminated under the direction of Colonel Sir Francis Bolton by the electric light, developed effects which must be seen to be appreciated; the horizontal rainbow in the central column, produced by the rays from the clock tower, is curious and interesting. In spite of the enormous crowd leaving the building just before midnight there was no confusion, the police arrangements being in all respects admirable. The refreshment bars in every direction were open, and nothing could exceed the hospitality of hosts and exhibitors. In all respects the results were satisfactory, and those who had the good fortune to be present will remember it as the most enjoyable *fête* of the season. The success of the Exhibition may be regarded as settled, as already over 1,100,000 persons hav passed the turnstiles.

THE CHICAGO RAILWAY EXPOSITION.

No. XIII.

ANDREW WARREN, of St. Louis, Mo., exhibited some permanent way tools of convenient design and light construction. Among these were the rail gauge illustrated in Fig. 56. It is somewhat similar to the well-known Huntingdon track gauge, but the lugs bearing against the inside of the head of the rail are struck to a radius from the centre of the track, and the gauge therefore measures correctly, even if it be not laid exactly at right angles to the rails. The same maker exhibited a wrought iron jack for lifting rails in the track—see Fig. 57. It is light, simple, and easily handled, but cannot be left in position during the passage of a train or vehicle over the road in course of repair. The Beland track drill, illustrated in Fig. 58, is a machine for drilling rails in position. It is not in the way of passing trains, and all the holes for a fish-plate can be drilled without shifting the cramp.

Another useful permanent way tool—Prout's patent spike extractor—was exhibited by Messrs. Lalance and Grosjean, of New York, and is illustrated by Fig. 63. The working parts are made of steel, and the principle on which it acts can be readily understood from our illustration. It will pull out a spike from between two closely adjacent rails, or extract a spike from any position in which it can be driven. The top of the rail may be used as a fulcrum, as in our illustration, or the foot, connected to the extractor proper by links working in slots, may rest on the sleeper, and serve as a fulcrum. It can thus be used either inside or outside the four-foot, which is convenient when platforms are near the rails, or on viaducts, or in tunnels, &c. It will pull out the longest spike at one operation, the hand lever assuming a nearly horizontal position, when the spike is completely extracted.

The Morden Switch and Frog Company exhibit a form of guard rail which is intended to restore an already derailed vehicle to the rails—see Fig. 59. Many accidents have occurred through vehicles becoming derailed some distance before they reach a bridge or curve, where simple expedient of bringing the guard rails together to a point in the middle of the track is calculated to replace the vehicle on the rail, and thus prevent a serious accident. The guard rails are considered necessary. The ordinary method of applying guard rails permits such a vehicle, which may have travelled safely for some distance, to continue off the rails when it reaches a dangerous spot. The

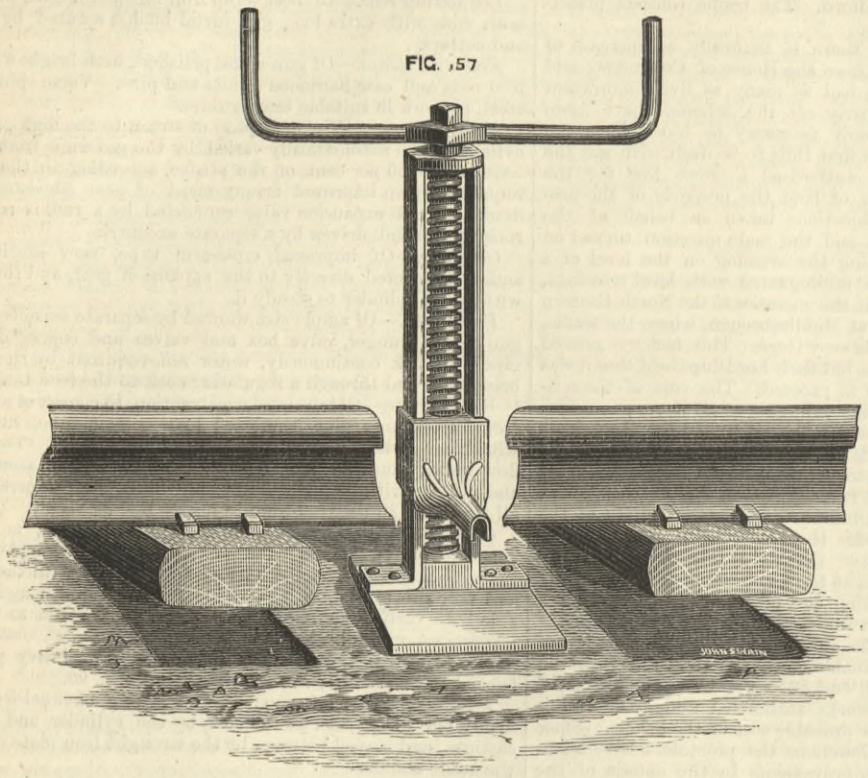


FIG. 57

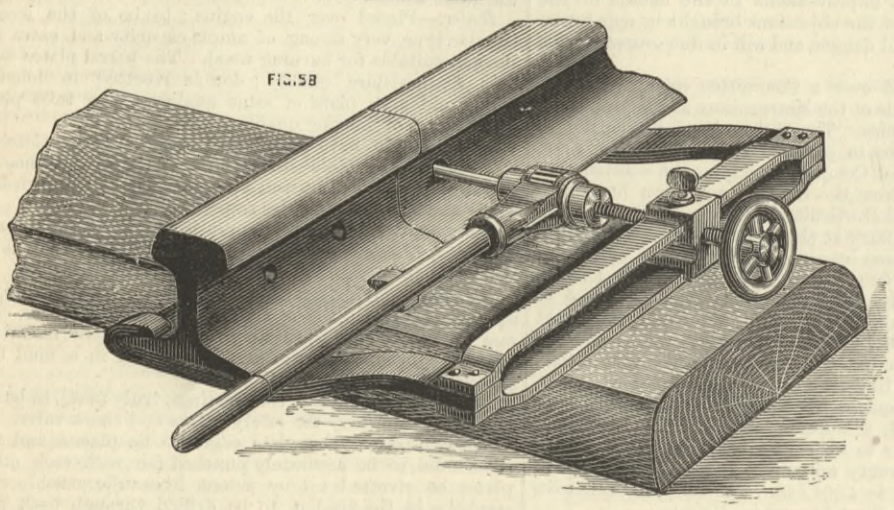


FIG. 58

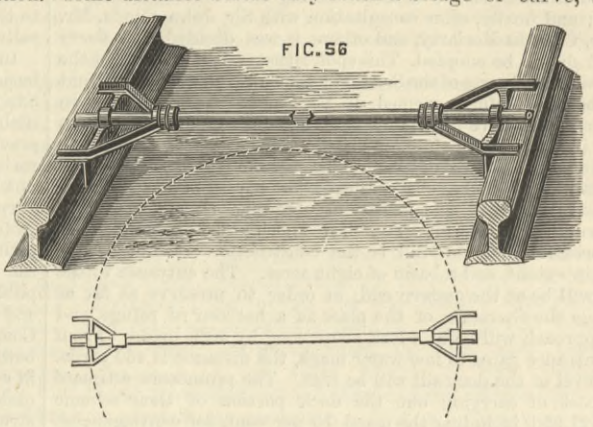


FIG. 56

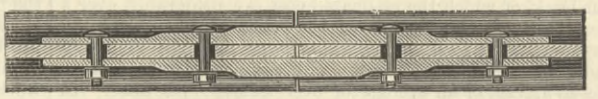


FIG. 60

PLAN IN SECTION THROUGH WEB OF RAIL

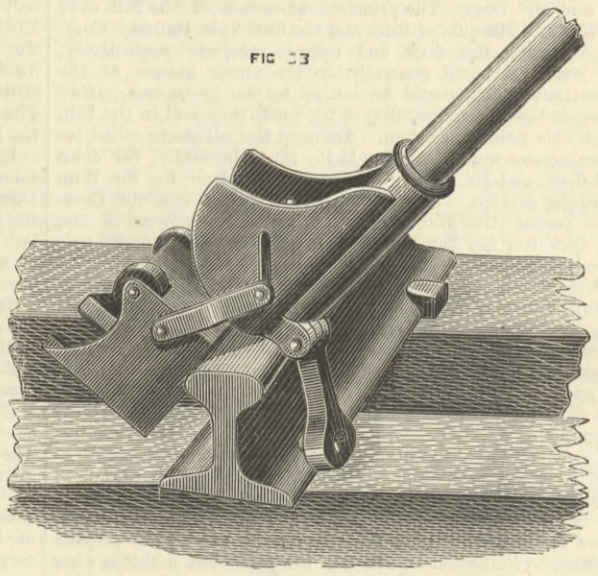


FIG. 63

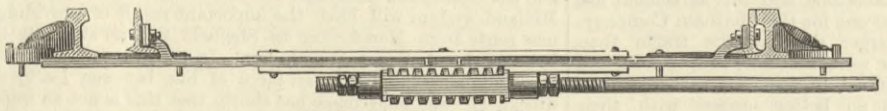
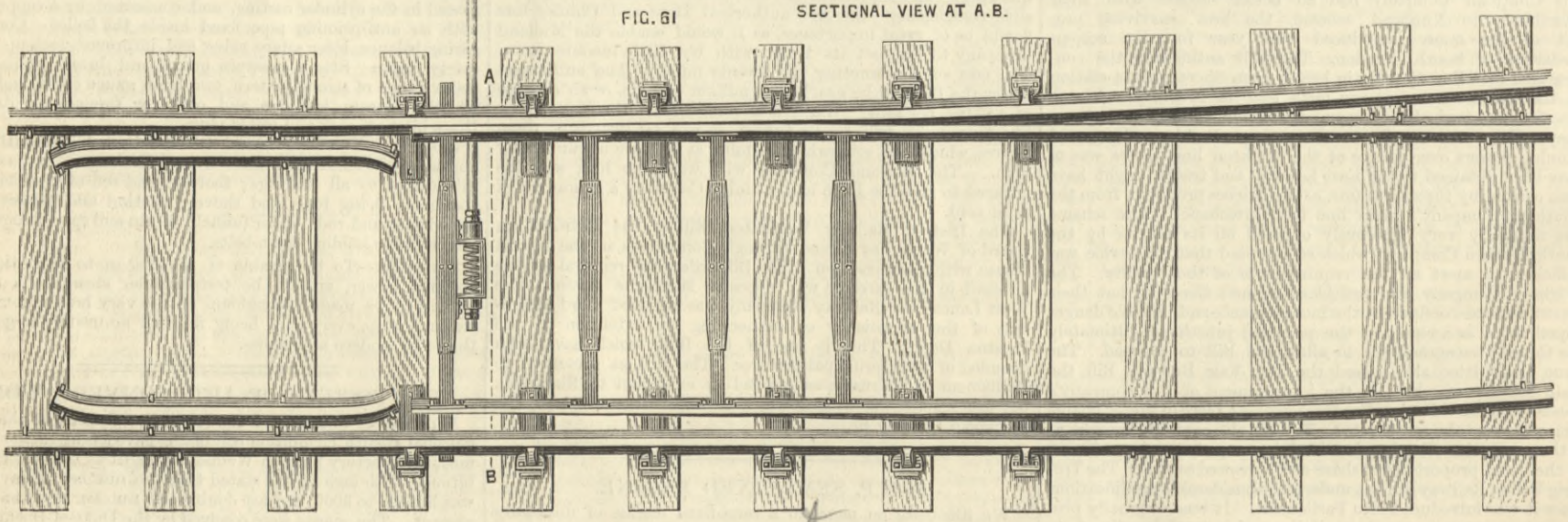


FIG. 61

SECTIONAL VIEW AT A.B.



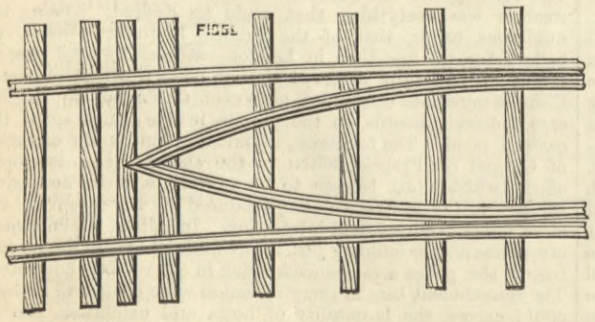


FIG. 59

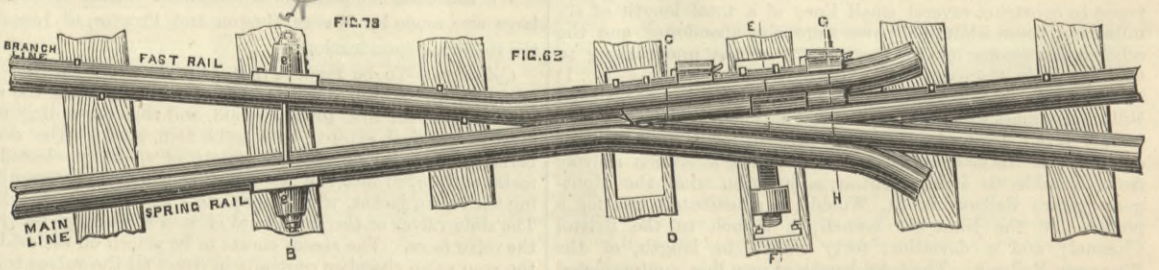


FIG. 78

FIG. 62


SECTION ON A.B


SECTION ON C.D


SECTION ON E.F


SECTION ON G.H

Messrs. Sellars, Fowler, and Co., of Chicago, exhibited some of their so-called flexible fish-plates, a longitudinal section of which is shown by Fig. 60, representing a plan in section through the web of the rail. The object of the inventor is to obtain a joint which will make the rails of equal strength at all points. With the present system of stiff angle section fish-plates the joint near the end of the fish-plates is stiffer than a plain rail, the rail and fish-plates together making a short and rigid girder, which refuses to transmit the wave of flexure that has passed along the plain part of the rail. At the actual joint between the two rails the strength again varies, the rails being divided; the whole work of resisting flexure falls on the fish-plate at that point, and the rail is concentrated in a short distance. The remaining portion of the fish-plate being, with the rail to which it is bolted, stronger than the solid rail, the alternate rigidity and slackness of the way gives rise to concussions, which damage both rolling stock and permanent way. The flexible fish-plate is made strongest in the centre, where strength is required, by rolling it of greater thickness there, and it decreases in strength towards the ends by successive diminutions in thickness, thus making the track, as a whole, of equal strength throughout. This joint is largely used in the United States.

The Pennsylvania Steel Company exhibited several different patterns of points and crossings, amongst them the Lorenz safety switch, which presents some points of novelty, and is illustrated by Fig. 61. The point rails are shaped to fit snugly to the stock rail, and to the extent of the tapered surface they take bearings on the flange of the fixed rail, which supports the point rails under vertical strains. The point rails slide on wrought iron plates, which extend under the fixed rails, and preserve the relative elevation of both, and are combined with a lug on the outside of the fixed rails, which effectually prevents any spreading or canting. The bars connecting the point rails are made with joints, which give vertical stiffness, and laterally permit the variation in length due to the parallel rule motion of the point rails. The middle portion of each connecting bar is composed of two bars rivetted together on a centre of the same thickness as the end portions that work between the two bars. These end portions are pivotted inside the middle portions, and secured to the point rails as shown. A spiral spring holds the point rails against the fixed rails, making the road secure for all vehicles moving in a direction facing the points; and at the same time, the wheel flanges of vehicles coming out of the siding will force the point rail away from the fixed rail, sliding the opposite point rail so that the treads of the tires run partly on the fixed rail, thus enabling a vehicle to come out of a siding safely when the points are set for the main line. This switch has been lately introduced, but is already in extensive use, especially upon the Pennsylvania Railway. The same firm also exhibit a spring crossing, illustrated in Fig. 62, which gives the tread of a wheel passing on the main line a bearing at least equal at all points to the width of the head of the rail. It is a built crossing, the parts being secured together by bars and keys. The main line wing rail lies close to the side of the point of the crossing, being held there by an india-rubber spring, which is protected from injury by a cylindrical casing or shield. An ordinary guard rail for the other main line rail preserves the spring wing rail from any side-long blows from the wheel flanges running on the main line. The flanges of a wheel coming in or out of the branch push the spring rail aside, compressing the spring which returns the wing rail to its normal position when the vehicle has passed. It will be observed that no accident can occur if the spring fails, as it then becomes an ordinary crossing, the large bolt shown in our illustration limiting the movement of the wing rail. This crossing is used on the New York elevated and other railways, and as may readily be perceived, forms a remarkably smooth track for the fast trains.

In America much attention is paid to the importance of rails being perfectly straight before they leave the cooling plates in the rolling mill, and as the rails emerge finally from the rolls they are passed between three vertical rollers, which give them a somewhat decided curve, which so balances the effects of contraction that when cold the great majority of the rails are almost perfectly straight. It is found that when rails are straightened cold they invariably return under traffic to the original curvature due to contraction, and form a very rough riding road. It is said by Americans that imported English rails are defective in this respect. On the other hand, many American steel rails made a few years back have given way near the ends, where they receive a constant succession of blows as the wheels pass over the low joints. An insufficient length of cross end cut off probably permits some slight flaw in the end of the rail, which speedily developes and renders it necessary to take up the rail after three or four years' use, while English rails, under similar conditions, are wearing well after ten years' work, owing to the greater hardness of the steel and a less hurried and more careful system of manufacture. These defects are now fully recognised, and American steel works now obtain an enormous output from a comparatively small plant by a careful adaptation of every detail to produce work with regularity and efficiency.

The Pennsylvania Steel Company was recently reported to have rolled 2952 rails in 164 heats in twenty-four hours. As each rail is 30ft. or ten yards long, this represents about 70ft. length of rails rolled per minute, or enough rails for a single line railway 8⅜ miles long, turned out in twenty-four hours. The works which perform this feat are surpassed both in size and number of men employed by many English steel works, and to those who have not visited America, the enormous fecundity of American mills and workshops appears inexplicable, if not incredible. Speaking generally, in America a given plant and number of men will produce about double the amount of work turned out by similar works in England. It is stated on good authority that, notwithstanding the difference in the rate of wages, that steel rail making costs slightly more per ton for labour in England than in America.

One factor in the greater output of American works is the sobriety of the great bulk of the people, especially in the Western States, and the strong feeling that exists not only against drinking in excess, but against drinking intoxicants at all, and this is well illustrated by the following authentic instance:—The Pennsylvania Steel Company recently paid their men a month's pay, £24,000, on a Saturday, and on the following Monday not only was no man absent through drink, but not a single employé was reported as having been seen drunk in the town on the previous Saturday night and Sunday. Of what English steel works could the same thing be said? It was recently stated by a leading English colliery owner that an examination of the books of several well-known collieries showed that, taking a period of several years, each man employed had, on the average, worked only 4·16 days per week. The consequent diminished output of the collieries per man employed is obvious, and these typical instances illustrate forcibly one, perhaps the principal, cause of the greater output of American works. It may be mentioned that it is a common practice in America for employers to take cognisance of their men's behaviour and sobriety whilst off duty, and this fact alone would show the comparative sobriety of American workmen. Any large employer of labour in Great Britain who thus attempted to interfere with "the liberty of the subject" would find he had undertaken a somewhat extensive contract.

The North Chicago Rolling Mill Company exhibited a steel rail 120ft. in length, and showed rails twisted into quick pitch screws, &c. All the coke used by the various large steel works near Chicago is brought by rail from the Connellsville coke district, 500 miles off. The freight, however, is low, as the coke is loaded in cattle cars, which otherwise return empty from the east. Few iron or steel works in the United States can find a supply of all the needed raw materials near at hand, though new discoveries of ganister, fireclay, natural gas—which forms an excellent fuel—coal, &c., are continually being made.

A large proportion of the pig iron and iron ore used for steel making come from England and Spain respectively, and the cost of the raw material per ton of steel rails is considerably higher than in England, and this grave disadvantage is only partially balanced by the lower railway rates, and the increased output of a given plant.

LEGAL INTELLIGENCE.

JUDICIAL COMMITTEE OF THE PRIVY COUNCIL.

Present—SIR BARNES PEACOCK, SIR ROBERT COLLIER, *and* SIR ARTHUR HOBHOUSE.

July 8th.

NEWTON'S PATENTS.

THESE were applications for the prolongation of letters patent granted on the 1st of August, 1870, and the 3rd of November, 1870, for a term of fourteen years each, to Mr. A. V. Newton, of No. 66, Chancery-lane, for the invention of "Improvements in cutting, boring, grinding, and pulverising stone and other hard substances." The petitioners were Tilghman's Patent Sand Blast Company, of Bellefield Works, Sheffield.

Mr. ASTON, Q.C., (Mr. WAGGETT and Mr. BOUSFIELD were with him) opened the case for the petitioners; the ATTORNEY-GENERAL, Mr. R. S. WRIGHT, and Mr. DANCKWERTS appeared for the Crown; Mr. WEBSTER, Q.C., and Mr. MOULTON appeared for Messrs. Siemens; Mr. MACRORY for Messrs. Lotz, licensees; Mr. CHADWYCK HEALEY for Messrs. Pilkington, licensees; and Mr. W. N. LAWSON for other licensees.

The invention consisted in cutting and grinding stone and other hard substances by means of a stream of sand driven rapidly against such substances by a jet of steam, air, water, or other suitable gas or liquid, the requisite velocity, in certain cases, being imparted to the sand by means of a direct impact of revolving blades or paddles, or the centrifugal force of hollow tubes arranged as the spokes of a wheel.

In the course of the case an objection was taken by the ATTORNEY-GENERAL, upon the subject of the remuneration received, by the petitioners, that while the profits arising from the French and Belgian patents appeared in the accounts, no reference was made to the Australian, United States, and Italian patents.

Mr. ASTON contended that under the new Patent Act it was not compulsory upon the petitioners to make reference to the foreign patents; but he applied for an adjournment in order that the accounts might be amended so that the particulars might be added.

Mr. WEBSTER, Q.C., argued that their lordships should not allow an adjournment in order that the accounts should be amended until they had gone into the accounts themselves. He contended that upon the accounts, as they stood, the petitioners had received a much greater amount than their lordships had ever recognised as or allowed to be insufficient remuneration. He suggested that their lordships ought not to allow an adjournment until they saw what the accounts really were.

After some discussion, in which the other counsel for the opposing parties took objections similar to that raised by Mr. Webster,

Their lordships conferred together upon the subject; and

Sir ARTHUR HOBHOUSE, in giving the judgment of their lordships, referred to the objections which had been made as to no sufficient information having been given with reference to the profits arising from foreign patents, and that, in point of fact, the petition was silent as to any profits from the foreign patents; and observed that the accounts, as drawn up, did disclose what had been received with regard to the French and Belgian patents, but no reference was made to the profits arising from the Australian, United States, or Italian patents. The reason alleged for that was that by the new Patent Act of last year the practice of that committee had been altered, and that, as was argued, it was not necessary any longer for a petitioner to produce accounts relative to foreign patents. The section which was relied upon was as follows:—"The Judicial Committee shall, in considering their decision, have regard to the nature and merits of the invention in relation to the public and to the profits made by the patentee as such, and to all the circumstances of the case." It was difficult to suppose, however, that the Legislature could have intended to alter the rules adopted by that Committee based upon what, by experience, was found to conduce to the justice of the case and to the public convenience. Their lordships were of opinion that no such alteration was made, and that, looking now to the case before the committee, and to all its circumstances, they found it to be a very material circumstance that they should know what had been received by way of profit upon the same invention in foreign countries; it might be the determining point in the case, and it was for the petitioners to supply them with materials for that purpose. That being so, the only question then was whether there should be any adjournment of the case for the purpose of allowing the petitioners to amend their accounts. The petition was to have been heard on the 10th of last month, but at the petitioners' desire it was postponed until that day. The petitioners now, however, applied for another adjournment for some period in order that they might furnish their opponents with the accounts which they had neglected to produce up to the present time. It was obvious, however, that as the patent expired in August, the opposing parties would have a very short space of time to go into the accounts. Moreover, in the objections lodged at the office, clear intimation was given that a point would be raised on that subject. Their lordships, therefore, thought that in a cumbrous case of that kind, with many opponents, who must be there at considerable trouble and expense, the petitioners must bear the consequences of their refusal to produce the accounts, and their lordships declined to allow any adjournment. The petition must, therefore, be dismissed, with such costs as might be apportioned by the Registrar.

July 9th.

BISCHOF'S PATENT.

This was a petition for the prolongation of letters-patent granted on the 19th of September, 1870, for a term of fourteen years, to Mr. Gustav Bischof, jun., for the invention of "improvements in the means employed for the purification of water."

Mr. WEBSTER, Q.C., and Mr. W. NORTON LAWSON were counsel for the petitioners; the ATTORNEY-GENERAL, Mr. R. S. WRIGHT, and Mr. DANCKWERTS appeared for the Crown.

The invention related to the use of spongy iron for purifying water for domestic purposes, and depriving sewage of its obnoxious and dangerous properties. Spongy iron has been proved to possess a strong and lasting action in separating or destroying and rendering innocuous by chemical agency various objectionable matters occurring in water and sewage; and of still greater importance is the physiological purification effected by the material—that is to say, the destruction by it of low forms of organic life occurring in water and sewage. It has been proved that no degree of dilution and no natural filtration or ordinary artificial filtration, such as through sand, however efficient it may be, affords any such guarantee; and it had been applied with very great and most marked practical success at the military stations of Fort George, in Scotland, Shoeburyness, and elsewhere. The petitioners, Mr. Bischof, and others, had expended large sums of money and devoted great pains and trouble in endeavouring to introduce the invention to the public and bring it to use. They had endeavoured to obtain its employment by water companies in London, but owing to the uncertainty which had prevailed since 1878 as to the position of the water companies in regard to proposed legislation on their rights, the companies had been unwilling to embark new capital in adopting the invention. The only town in which the invention had been applied to waterworks was Antwerp, and it had been perfectly successful. In these circumstances, the chief application of the invention had been for the purpose of the manufacture of domestic filters. The utility of the invention had been generally acknowledged, and domestic spongy iron filters had been introduced into the various Government departments, and was beginning to be generally used. In these circumstances, the petitioners asked to have the patent extended in order that they might receive a fair reimbursement and remuneration commensurate with the great public value and importance of the invention.

Mr. WEBSTER, in opening the case, referred to the meritorious nature of the invention, and mentioned incidentally that one of its chief advantages was that by it the *bacilli*, which had recently been discovered by Dr. Koch and others to be the germs of cholera, were detected and prevented from filtration into the water.

Dr. Frankland, F.R.S., a member of the Rivers Pollution Commission, was called, and gave evidence in support of the petition, testifying to the great merit and novelty of the invention as destroying the germs of the disease.

Mr. Bischof, the patentee, detailed the experiments made by him which led to the invention the subject of the patent.

Mr. WEBSTER said there were other scientific witnesses in attendance, who would speak to the great merit of the invention; but

Their LORDSHIPS said that after the evidence which had been given, they did not think it necessary to hear any further proof as to its utility.

The ATTORNEY-GENERAL did not dispute the merit of the invention, and accepted the accounts as put in.

After considering the matter for a short time in private,

Sir BARNES PEACOCK said that after the evidence which had been given, their lordships entertained no doubt that the invention which was the subject matter of the patent was a very useful and meritorious one, and they thought that as far as that went it should be renewed, unless the patentee had received adequate remuneration. As to that point, the accounts had been proved, and the Attorney-General did not object to them. Their lordships were of opinion, upon those accounts, that so far from the patentee having made any profit, he had sustained a loss, and they thought they ought to advise her Majesty to renew the patent. In the case of Spencer's patent, it was extended for seven years, and, following that precedent, their lordships would advise her Majesty to extend the patent for seven years.

NEW ORLEANS EXPOSITION BUILDING.—The Boston *Herald* says that the main building of the New Orleans Exhibition is in some respects the most remarkable edifice ever built in this country. It is much the largest exposition building ever erected in the world. The architect has succeeded, at a moderate cost, in producing the largest single room, every part of which can be seen from any point, of which there is any knowledge. The building is 1378ft. long by 905ft. wide, and covers 33 acres, or 11 acres more than the Philadelphia Centennial Exposition, 1876. There are 1,656,300 square feet of floor space, including gallery. The reader may form a better impression of the vast dimensions of the structure by imagining three ordinary city blocks one way and five the other covered by a solid roof. And, if he chooses to allow his fancy carry him still farther, he can picture a monster panorama of the world's industry, extending before his vision uninterrupted by a single object except the supports. The active commercial rivalry of the different sections is aptly shown by the distribution of contracts for the materials. The roof, which will cover 1,000,000 square feet, is being made in Cincinnati. The window sashes come from Milwaukee, Wis. The glazing will be done by St. Louis parties. Four thousand kegs of nails are being shipped from Wheeling, W. Va. Nine million feet of Mississippi lumber will be consumed. A massive group in bronze, typical of America, to be placed over the main entrance, is being made at Canton, O., as are also a statue of Washington and Columbus, and coats of arms of all the States, which will appear in medallion form as part of the exterior ornamentation. Finely modelled cornices are being made at New Orleans. The building will be 60ft. high, with a tower 115ft. high, and the architect has been fortunate in rendering the exterior unique and attractive. A platform will be erected on the tower, reached by elevators, from which visitors may have an exceptionally fine view of the city of New Orleans, the Exposition grounds, the Mississippi River, and the surrounding country. There will be one line of gallery extending around the entire circumference of the building, to which visitors will be carried by 20 steam and hydraulic elevators, representing all the manufacturers of these conveyances in this country. The music hall, situated in the centre of the building, will be 364ft. wide, and will comfortably seat 11,000 persons. A platform is being built for 600 musicians. To light the building with incandescent lamps, will require 15,000 lights and 1800-horse power. To light with the arc system will require 700 lamps and 700-horse power to operate the dynamos. The total steam required for lighting and for the machinery hall will be at least 3000-horse power. In this estimate is included the power for five arc lights of 36,000 candle power each, which will light the grounds. These are among the largest single lamps ever constructed. The cost of this great structure, lacking no single desirable feature for the purpose intended, will only be about 400,000 dols. and the other buildings will be proportionately inexpensive.

THE ROYAL AGRICULTURAL SOCIETY'S SHOW AT SHREWSBURY.

THE trials of machinery this year apply to sheaf-binding and ensilage mechanism. The particulars of the entries are as follows:—

SECTION I.—SHEAF-BINDING MACHINERY.

In Class 1.—Sheaf-binding reaper, the binding material to be other than wire. First prize is £100; the second prize, £50.

Stand No. 3.—James and Frederick Howard, of the Britannia Ironworks, Bedford. Article 45: Sheaf-binding reaper, "Simplex," for manilla or hemp twine; manufactured by the exhibitors; price £60; transport attachments, £2; a most complete and efficient string sheaf binder; it is a most reliable and easily managed machine. Article 46: Withdrawn. Article 47: Reaper, sheaf-binding "Simplex," for manilla or hemp twine; manufactured by the exhibitors; price £60; fitted with J. and F. Howard's recently patented knotting mechanism; width of cut, 5ft. Article 48: Withdrawn. Article 49 (new implement): Sheaf-binding reaper, "Low Down;" manufactured by the exhibitors; price £50; fitted with improved binding devices. This newly-designed machine has the canvas elevators of reduced height, and whilst the same width of cut is maintained, the machine is about 1ft. narrower. The gear work and other appliances are simplified in construction, whereby the weight and cost are reduced.

Stand No. 9.—The Johnston Harvester Company, of 70 and 71, Chiswell-street, London. Article 189: Harvester and string sheaf binder; manufactured by the exhibitors; price £60; perfectly automatic, yet entirely under the control of the driver from his seat; interchangeable speed to the reel; perfectly balanced; no side draught.

Stand No. 13.—Lankester and Co., of 44, Sumner-street, Southwark, London, S.E. Article 215: Harvester and twine binder; manufactured by the McCormick Harvesting Machine Company, of Chicago, U.S.A.; price £60, with two knives and usual extras; awarded first prize gold medal at the late R.A.S.E. trials, Derby, 1881; low cut, extra wide, with improved reel and simple binding mechanism; sheaves of uniform size packed, bound, and delivered automatically; position of band around sheaf easily varied at will. Article 216 (new implement): Harvester and twine binder; manufactured by the McCormick Harvesting Machine Company; price £65; with two knives and usual extras; this machine cuts a width of 6ft.; main and grain wheels of steel; improved knotting frame with new feeding device for cord holding disc. Article 217 (new implement): Harvester and twine binder; manufactured by the McCormick Harvesting Machine Company; price £60, with two knives and usual extras; this machine cuts a width of 5ft., and is fitted with improved elevator rollers adapted for heavy and tangled crops; also new device for tightening aprons; main and grain wheels of steel. Article 218 (new implement): Harvester and twine binder; manufactured by the McCormick Harvesting Machine Company; price £60, with two knives and usual extras; new pattern harvester and binder known as the McCormick Harvester and Binder No. 4. Article 219 (new implement): Harvester and twine binder; manufactured by the McCormick Harvesting Machine Company; price £60, with two knives and usual extras; new and entirely re-modelled machine, constructed almost entirely of steel and iron, known as the McCormick light harvester and binder; McCormick's binders have gained the only two gold medals awarded by the Royal Agricultural Society to binders.

Stand No. 14.—H. J. H. King, Newmarket, Stroud, Gloucestershire. Article 228: Reaper and binder combined; manufactured by the exhibitor; price £55; a combined sheaf-binding and reaping machine, to tie with string—King and Evans' patent; made narrow enough to pass through an ordinary gateway without alteration. Article 229: Reaper and binder combined; manufactured by the exhibitor; price £60; a combined sheaf-binding and reaping machine, to tie with string—King and Evans' patent; specially designed to deal with unusually heavy and tangled crops. Article 230: Reaper and binder combined; manufactured by the exhibitor; price £55; a combined sheaf-binding and reaping machine, to tie with string—Evans and King's patent; with the binder opposite the cutter bar.

Stand No. 16.—Samuelson and Co., of the Britannia Works, Banbury, Oxfordshire. Article 255: Reaper, prize string sheaf binding; manufactured by the exhibitors; price £60, with two sickles; with elevated binding table and with canvas elevating aprons, binding with string; this machine was awarded the silver medal of the R.A.S. of England at the Derby trials, 1881; cutting 5ft. wide. Article 256 (new implement): Reaper, automatic sheaf binding; manufactured by the exhibitors; price £50, with two sickles; with low-level binding and delivery platform for the sheaf, and binding with string.

Stand No. 21.—George Kearsley, of the British Iron and Implement Works, Ripon, Yorkshire. Article 381: Harvester, sheaf-binding; manufactured by the exhibitor; price £60. Article 382: Harvester, sheaf-binding; manufactured by the exhibitor; price £60. Article 383: Harvester, sheaf-binding; manufactured by the exhibitor; price £50.

Stand No. 24.—Walter A. Wood, of 36, Worship-street, London, E.C. Article 407: Sheaf-binding harvester; manufactured by the exhibitor; price £60, with two knives and extras; entirely automatic in its operation; grain cut, elevated and bound with regularity and certainty; the driving wheel is 3ft. 4in. in diameter, with 7in. face; the frame of the binder is of iron; the knife is driven by a rocking shaft from the rear; the reel is also driven from the rear; width of cut 5ft. Article 408: Sheaf-binding harvester; manufactured by the exhibitor; price £62 10s., including two knives and extras; similar to Article No. 407, but cutting a width of 6ft. Article 409: Sheaf-binding harvester; manufactured by the exhibitor; price £60, including two knives and exttras; built on the low down principle; elevation greatly reduced; driver wheel 2ft. 9in. in diameter, 10in. face; new arrangement of gearing, knife driven from the front; new device for driving reel; also an expeditious and novel plan of raising the harvester; sheaf carrier attached; width of cut 5ft.

Stand No. 262.—Richard Hornsby and Sons, Limited, of the Spittlegate Ironworks, Grantham, Lincolnshire. Article 4568 (new implement): Harvester, new string sheaf-binding; manufactured by the exhibitors; price £60; transport arrangement, £2 5s. extra. Article 4569 (new implement): Harvester, new string sheaf binding; manufactured by the exhibitors; price £60; transport arrangement, £2 5s. extra. Article 4570 (new implement): Harvester, new string sheaf binding; manufactured by the exhibitors; price £60; transport arrangement, £2 5s. extra.

In Class 2 for separate sheaf-binders the binding material to be other than wire; the prize is £25.

Stand No. 10.—The Notts Fork and Implement Company, Ranskill, Bawtry, Nottinghamshire. Article 195: Binder, separate; manufactured by the exhibitors; price £38; separate sheaf binder, for binding any kind of corn after the same has been cut down by a self-raking reaper.

Stand No. 11.—Kingsford, Fairless, and Co., of Acre-road, Kingston-on-Thames, Surrey. Article 198: Sheaf binder, Independent; manufactured by the exhibitors; price £35; to gather up and bind with string any corn or other crops cut by a side delivery reaper; Woolnough and Kingsford's patent. Article 199: Sheaf binder, Independent; manufactured by the exhibitors; price £35; to gather up and bind with string any corn or other crops cut by a reaper or scythe; Woolnough and Kingsford's patent.

SECTION II.—ENSILAGE.

In Class 3.—Efficient machine for cutting and elevating materials to be preserved in silos; the prize £25.

Stand No. 84.—John Crowley and Co., of Meadow Hall Ironworks, near Sheffield, Yorkshire. Article 1575 (new implement): Cutter and elevator, No. 13, with safety lever (Samuel Edwards' patent); manufactured by the exhibitors; price £35; arranged to cut and elevate green material for ensilage, and having the fly-wheel constructed so that the material can be cut from $\frac{3}{8}$in. to 3in. lengths; fitted with feed web and two pulleys.

Stand No. 85.—Richmond and Chandler, of Southall-street, by the Assize Courts, Manchester, Lancashire. Article 1630 (new implement): Ensilage cutter, portable; manufactured by the exhibitors; price, fitted with one pulley complete, £45; extra fly-wheel, fitted with three knives, £4 extra; for cutting and elevating wet or green fodder into silos.

Stand No. 86.—Edward Hammond Bentall and Co., of Heybridge, near Maldon, Essex. Article 1668 (new implement): Ensilage cutter and elevator, marked E C A; manufactured by the exhibitors; price £30.

Stand No. 87.—Burlingham, Innes, and Paternoster, of Exchange Ironworks, Hitchin, Herts. Article 1708 (new implement): Ensilage machine; manufactured by the exhibitors; price £60; duplicate knife-wheel with five knives, £3 10s.; portable, for cutting and elevating clover, peas, or any other materials to be preserved in silos. Article 1709 (new implement): Chaff and ensilage cutter, combined portable; manufactured by the exhibitors; price £75; duplicate knife-wheel with five knives, £3 10s.; with new patent self-feeding motion, sifting and bagging apparatus, and fitted with patent elevator for silos.

Stand No. 105.—Thomas Christy and Co., of 155, Fenchurch-street, London, E.C. Article 2193: Cutter and elevator for forage; manufactured by A. Albaret, of Liancourt, Rantigny, Oise, France; price £100; Albaret's patent combined forage-cutter and elevator, for cutting and storing in silos, maize, and all forage crops.

Stand No. 121.—Carson and Toone, of the Wiltshire Foundry, Warminster, Wilts. Article 2593 (new implement): Ensilage cutter; manufactured by the exhibitors; price £37 10s.; on travelling wheels, with 13in. mouth, two pairs patent annular feed rollers, travelling web, four knives; will elevate into silo 10ft. from ground; or can be used for chaff-cutting, for sacking 4ft. 6in. from the ground.

Stand No. 229.—F. and J. S. Bust, of Winterton, Brigg, Lincolnshire. Article 4331: Ensilage cutter, portable; manufactured by the exhibitors; price £40, with two knife wheels; very powerful, with five knives and safety lever; is driven direct from fly-wheel of portable engine, will not choke with wet or green fodder; either bags or throws cut product into silo; if fitted with elevator to deliver up to 20ft. high, £10 10s. extra. Article 4332: Chaff-cutting and preparing machine, portable; manufactured by the exhibitors; price £52 12s., with two knife wheels; for using in connection with thrashing machine or otherwise; will cut, riddle, sift, salt, and bag chaff as fast as straw is thrashed; fitted with safety lever and feed rollers that will not choke; adapted for cutting ensilage; elevator to deliver up to 20ft. high, £9 extra.

Stand No. 230.—R. A. Lister and Co., of the Victoria Ironworks, Dursley, Gloucester. Article 4342: Ensilage and chaff-cutter; manufactured by the exhibitors; price £22; this machine can be fitted with an elevator when required for elevating the ensilage into the silo, price £5 15s. for 12ft. length.

Stand No. 231.—Robert Maynard, of Whittlesford Works, near Cambridge. Article 4347 (new implement): Ensilage cutter and elevator, portable; manufactured by the exhibitor; price £42; for cutting green materials, and elevating into silos, up to 20ft. high.

LETTERS TO THE EDITOR.

(*Continued from page* 21.)

MODERN ORDNANCE.

SIR,—Having lately read several papers on the above subject, more especially the report in your paper of the lecture delivered by Colonel E. Maitland, R.A., at the United Service Institution, on June 20th last; also another by Mr. J. A. Longridge, and several letters on modern ordnance in your columns, it seems to me that the very important question of air spacing, and best method of arranging the powder in the cartridges for modern heavy ordnance, have been somewhat lost sight of in the various and conflicting considerations which govern the manufacture and use of artillery designed to give the highest practicable velocity to heavy projectiles. The method by which increased velocity has been obtained both in England and abroad consists, as most of your readers must doubtless be aware, in enlarging the chamber containing the powder charge, and is commonly known as "chambering;" but the method of making the cartridge contain its own chamber seems to have been overlooked by every artillerist except Colonel Hope, who appears to have urged this method of utilising increased charges for many years past.

It will not, I suppose, be denied by any practical artillerist that the pressure gauges used for ascertaining the highest pressures in the chamber or bore of any given gun, and also the maximum pressure exerted in the base of the projectile, do really give accurately and exactly such results on the blocks of copper used in them, and that these pressures can be ascertained within the limits of a ton at least; and further, I think it will be generally admitted that the maximum pressures are exerted in the chamber of a gun at some period of combustion of the charge between the moments when the inertia of the projectile is being overcome—and when the projectile has moved forward a few inches up the bore—from its seat. Now, if the charge when fired in a chamber exerts a certain maximum pressure, say, of 20 tons per square inch throughout the chamber, it is evident that more work will be done in a longitudinal direction on the interior face of the breech block than on the base of the projectile by exactly the difference in areas of these two surfaces. Take, for instance, the 16·25in. breech-loading gun of 110 tons. The area of the base of the projectile on which the force generated by the explosion or combustion of the charge is exerted is about 207·5 square inches; and the area of the face of the breech block is somewhere about 380 square inches, as far as I can ascertain from rough scale measurements; and let us suppose that such a powder and charge are used as will limit the maximum pressure in the bore to 20 tons to the square inch. It is evident that the force acting on the base of the projectile at the moment the pressure reaches this point will be about 4150 tons, whilst that acting on the breech block would be about 7600 tons.

Now can this be considered a scientific method of imparting velocity to a projectile? to do more than 3000 tons more work on the gun than on the projectile. To me it seems that Mr. Longridge has hit the nail on the head, when he speaks of chambering, in his letter, pp. 577 of *Engineering*, of June 27th, 1884, as being a source of weakness in the gun, which probably caused the failure of the 100-ton Armstrong gun on board the Duilio, and the tearing asunder, longitudinally, of the 8in. gun, by the same maker, on board the Chilian frigate Angamos.

Let us now examine that portion of Colonel Maitland's lecture delivered on 20th June, 1884, where he speaks of the lengths and diameters of the chambers of modern guns. Taking the dimensions of the chambers mentioned by Colonel Maitland, we shall find—First, that the volume of a cylindrical chamber, 3·15in. in diameter and 18·6in. long, will be 144·95 cubic inches; second, that the volume of a chamber, 7in. diameter, and of the same length, will be 715·81 cubic inches. Let us call the smaller chamber A, and the 7in. chamber B; and let us assume what, I believe, is not very far from the truth, that the actual specific weight of the powder of which the R L G_2 powder composing the charge is 1·0416 ounces to the cubic inch, or, in other words, its density is about 1·8.

To be precise on this point, I would state that, supposing a cubic inch of solid R L G_2 powder to be made direct from the press cake in manufacture, such cubic inch would weigh 1·0416 ounces. We should find, therefore, that these chambers would contain the following weights of granular powder in ounces:—Capacity of A for R L G_2 = 64·172 oz.; capacity of B for R L G_2 = 323 oz.; number of cubic inches of air space left in chamber when filled with cartridge = 82·40 cubic inches; do. B = 405·71. And yet, though these are very nearly constant ratios of air spacing to the charges employed, Colonel Maitland shows that the pressures in chamber A are from 4 to 15½ tons per square inch greater than they are in chamber B, and he frankly states he does not know why. Now it is a well known fact that any fluid passing through a small pipe meets with more resistance than the same fluid passsing through one of a larger diameter, and it seems almost certain that more time and force would be expended in driving gas forward through an area of 7·8 square inches for a certain length than would be required to drive it forward through an area of 38·5 square inches nearly through the same length, and I think that this, irrespective of the probable caking and crushing of that part of the charge nearest the base of the projectile, will account for the increased pressures referred to by Colonel Maitland.

Now, would it not be possible to burn the same weights of powder in their respective chambers in such a manner that the powder would be almost instantaneously ignited in the interior throughout its whole length, and burn gradually outwards to the walls of the chambers? Suppose, for instance, a compressed cylindrical cartridge were to be formed of powder having a density of 1·8 exactly to fill chamber A, and weigh as much as the granular cartridge, say 64·1472 ounces. It would be found, of course, that the dimensions of this cartridge—suppose we call it A^1—B^1 would be as follows:—External diameter, 3·15in.; length, 18·6in.; diameter of cylindrical hollow in centre of cartridge extending throughout its length, 2·455in.; thickness of wall of powder cake, ·3475. In cartridge B^1 the dimensions would be:—External diameter = 7in.; length, 18·6in.; diameter of hollow, 5·2718in.; thickness of wall, ·8641in. Now, suppose these two cartridges to be so enveloped in a suitable substance on the outside that they could not crack, and no flame could reach their exterior surfaces, except by burning steadily through the walls of powder, and, further, that they were ignited centrally throughout the whole of their length almost instantaneously, what should be expected to happen?

I think it is evident that a certain volume of gas would be given off which would vary in amount with the amount of surface first ignited in the interior of each cartridge, or in other words, that the volume of gas first evolved would vary directly as the square of the diameter of the interior of the hollow, and that a constantly increasing volume of gas would be evolved whilst there was any powder remaining in the walls to be burnt. I believe this method has been adopted in the manufacture of ammunition for the Nordenfelt guns with success, resulting in increased velocity to the projectile and less work done in the gun. And Colonel Hope seems to have adopted something of this kind in his experiments, which must have been wonderfully successful if he has succeeded in burning cartridges of 15 calibres in length with a projectile in front without giving wave or local pressures.

Finally, as an Englishman, and in the interest of maintaining our country's position in the world, I would strenuously urge the carrying out of careful and exhaustive experiments on these lines even with old or obsolete guns; and it might perhaps prevent the country being committed to a weak and unscientific method of construction, which might fail our sailors and gunners in the hour of need, and perhaps may prove that the large number of muzzle-loading guns at present in the service may have capabilities at present unknown and undeveloped. It may also prove that Colonel Hope is as much in advance of the artillerists of the present as Major Palliser was when he advocated the method devised by him for utilising our existing stock of smooth bore ordnance, which has given us a serviceable, accurate, and cheap, if not very powerful, gun. WILLIAM MARTIN, late Captain R.A.

Milford Haven, July 2nd.

WATER POWER.

SIR,—I read with interest your article on the above in your last issue, and as I have had some little experience with water-wheels and turbines, will you allow me space to say a few words thereon? I agree with your premise, that as a sufficient head of water is not often to be had in England in a suitable position, its value as a motor, except for small powers, may be readily over-estimated. In countries, however, where fuel is dear and where there is a large and equable supply of water, I think it can hardly be denied that water is the most economical of all powers. Much, however, depends on the amount of water available, the site, the machinery to be driven, and the wheel selected. It need hardly be said that an equal supply of water is of the highest importance; too much being in many cases as bad as too little, the back water in any case having a considerable retarding effect, and undershot wheels may be entirely "drowned." I take it that many of the mistakes and disappointments that have occurred in the erection of water-wheels have been brought about by the insufficient attention given to the construction or selection of a wheel of a type, shape, height, and width, well adapted for the work required, bearing in mind the especial exigencies of the site, the velocity and flow of the water, and the power and speed required. In fact, in many cases one pattern of wheel is made to do duty for all kinds of requirements. The following may perhaps illustrate my meaning. Sometime back I supplied wood-working machinery to a firm on the Continent, and had several complaints as to its inefficiency. On examination I found that it was running much under speed, and the wheel used unsuited to the site and work, being a large slow-running wheel, whilst a quicker running wheel with much wider floats and less diameter would have been in every way preferable. To get over this difficulty and increase the speed of the machines, I had to use intermediate gearing, with a corresponding reduction in the effective power of the wheel. After the first outlay for dams, races, wheels, &c., an advantage most decidedly in favour of water-wheels in countries where fuel is scarce and skilled labour expensive, is the low cost of maintenance.

As in the case of vertical water-wheels, in the economical use of turbines much depends on their exact adaptation to the stream and site where they are employed. I think there can be little doubt that the introduction into general use of the turbine has been considerably retarded by these points not being borne in mind, and by the construction of a great number of wheels of exactly the same pattern, whether they meet the requirements of the case or not, when a few simple modifications might have secured a far higher practical result. For instance, the curvature of the fixed partitions and floats that may in one case be suitable, may in another be increased or diminished with a decided gain in effect, the number and size of them also should be varied according to the water supply. Again, the proper construction of the races and the fixing of the wheel to secure ample space both in depth and width for the easy discharge of the water from the wheel is important. For very large powers doubtless steam will, as asserted by you, compare favourably with water power, at any rate in countries where fuel is cheap; but had the development of water power received at the hands of engineers as much attention as that of steam, I feel sure it would be used in preference in many cases and be more popular than it now is.

If this letter will provoke a discussion as to the merits of water *v.* steam power, I think it would be of considerable interest to the profession generally. M. POWIS BALE.

20, Budge-row, E.C., July 1st.

THE FUTURE PROSPECTS OF YOUNG ENGINEERS.

SIR,—I hope the above question will permit of a few extra and perhaps really practical remarks. As one who has fought the battle through the shops without the aid of premium or friends, except those made by perseverance and industry, I may be allowed to express my opinion. What is the cause of the dearth of employment to those who may be able and willing to work? Firstly, what constitutes an engineer? I have always understood that he should be a man in possession of really practical ideas, and supported by a consistent theoretical knowledge to enable him to carry out his ideas in an intelligent, economical manner. If this is so, how is it that such men lack employment to the extent that your correspondent, Mr. Audain, states?

All men who may have passed through an apprenticeship know that all are not alike. Some are naturally capable, others incapable; some require teaching, others teach themselves; some enter the business possessed of a good, and even finished education, others with a possible knowledge of the three R's. The latter learn their trade, and go into the world as workmen, and in the majority of cases turn out to be fair average workmen, and some of them, by patient, persevering industry, coupled with an innate desire to be something better than a workman, spend all their available spare time in learning drawing and in obtaining an acquaintance with theory; these men very often become our most trustworthy and reliable engineers — for they understand the practical routine of detail manipulation, its difficulties, and the best way out of them. And after bringing the self-taught knowledge of theory to bear upon their practice, they are enabled to consummate work generally to the satisfaction and credit of all concerned. With the former class this is different: usually they are premium pupils, with no immediate incentive to stick to their work, as they are too often allowed to do pretty much as they like: their superior education seems to destroy the desire for work. First, they come into the works, and seldom get more efficient than able to take the skin off their knuckles, or make rattling good hands at cylindrical filing; this is not always their fault, but the fault of the officials under whom they work. They are spoilt in the initial stages of their career, and after passing through the drawing-office are turned out into the world not knowing enough, and too proud to become workmen, they fall back upon their knowledge of drawing and the smattering of theory they possess, and desire to pose in some official capacity; they are assisted in this either by funds of their own or by the influence of friends. Failing to obtain what they consider to be a suitable situation, they commence as consulting engineers, or otherwise, and glut the already overstocked market. I do not mean overstocked with efficient men, but by putting their influences at work they too often crowd out the really able man, who may be capable, energetic, but possibly not so highly polished as themselves. I do not blame them for this, but I do blame the system that makes a crowd when there should be but a few. These remarks, I think, answer the question of our young engineers, as their future should be a close, earnest attention to the duties they have to perform. It is impossible for an engineer, if left to himself, to become a master of his business unless he makes himself practically efficient, for without it he can hardly be more than a mere copiest draughtsman instead of a capable leader. I know of many really efficient men who are capable engineers, with a sound, healthy knowledge of their business, who are unable to obtain that employment suited to their capacity, and judge the reason to be a too close attention by employers to the actual wage paid, instead of paying a fair price for good workable people. The future of our young engineers will be safe if they strive to be engineers in truth and not in name only; and if employers would but consider it their duty to fulfil their engagements to their pupils, this question would soon be found at rest.

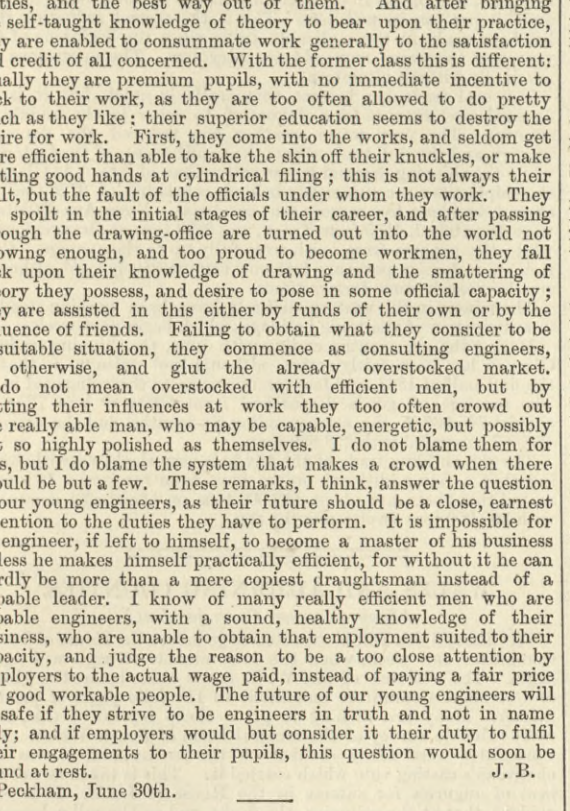
J. B.

Peckham, June 30th.

GRAPHIC AND ANALYTIC STATICS.

SIR,—In No. 1486 of THE ENGINEER appears an article on stresses in framework, by Mr. R. H. Graham, C.E., and in the example given (a roof truss) the author assumes the wind pressure to be vertical, adds it to the dead load on the roof, and with the total load thus found he, by one diagram, determines the maximum stresses in the different members of the frame, defending the practice on the score of simplicity and on the assumption that any error will be trivial in practice. Such a method of procedure cannot, however, be defended, being radically wrong in principle, and the error resulting from it—whether in excess or deficiency—although unimportant in very small trusses—where practical considerations necessitate the use of scantlings in excess of theoretical requirements—may be in the case of large roofs so serious that a more rational method of dealing with wind pressure becomes indispensable.

Wind, it must be conceded, is usually observed to blow horizontally, and can hardly be conceived as blowing vertically downwards. Mr. Graham has not overlooked this, for he says, "If, as some suppose, the wind blows in a perfectly horizontal line, then the direction of gravity and wind pressure are strictly at right angles." Now I dispute the truth of this inference; it does not follow that because wind blows horizontally the direction of its pressure on a surface inclined to its direction is also horizontal, for:—Wind being simply current air follows the laws of fluids in motion, *i.e.*, of hydrodynamics; its pressure therefore is normal to a surface pressed and reduced in the following ratio derived from the experiment of Hutton. Let w = intensity of horizontal wind pressure in pounds per square foot of vertical surface. w_n = intensity of wind pressure on any surface inclined at an angle i to the wind's direction, *i.e.* of slope $i = w\ (\sin.\ i)\,(1{\cdot}84 \cos.\ i - 1)$; the quantity w_n when required in calculation would be difficult of reduction, but is given in "Molesworth's Pocket-book," 19th edition,



p. 98, in terms of w for ten different angles. The pressure w is a hydrodynamical pressure, whereas the pressure Wn is equivalent to a simple statical pressure, and admits therefore of being resolved in any direction by the rules of statics.

To determine the maximum stresses on a roof truss, it is necessary therefore to draw two stress diagrams, one for the total vertical load and one for the normal load pressing on one side only of roof—for wind cannot be conceived as pressing on both sides of a roof at the same time. This latter diagram, it will be seen, will give one value for the stress on any particular bar in the truss, and another value for the stress in the corresponding bar on the opposite side of truss. The greater of these must of course be taken—as the wind may press on either side—and added to the stress developed by the vertical load, the sum of the two will give the maximum stress in the bar in question. Should the roof truss be unsymmetrical, it will then be necessary to draw two diagrams of normal load, one for each side, to determine which pressure developes the greater stress.

The following example is elementary in the extreme, but will suffice to illustrate the foregoing remarks, for which purpose only it is appended:—

Span = 36ft.; distance apart of trusses = 10ft.; angle of inclination of rafters to horizon = i = 30 deg.; $\therefore$ length of rafter = 20·8ft.; w = say 40 lb. per square foot—this may safely be assumed as the greatest possible horizontal pressure; w_n = 26·4 lb. per square foot of roof surface. $\therefore$ W = 26·4 × 20·8 × 10 = 5491 lb. = total pressure on side of roof acting in a direction normal to its surface. To determine the reactions:—Through the centre of rafter, and perpendicular to it, draw the straight line WZ, this is obviously the resultant of the uniform load on one side of roof; then

$$R^1 : R^{11} : W = A^{11}Z : A^1Z : A^1A^{11}$$

$$\therefore R^1 = \frac{A^{11}Z}{A^{11}A^1} W;\ R^{11} = \frac{A^1Z}{A^{11}A^1} W;\ R^1 + R^{11} = W$$

On any straight line $a\ a$ parallel to the wind direction, and therefore perpendicular to the rafter, take $a\ a$ = W the whole load. Set off downwards the loads $\frac{W}{4}$, $\frac{W}{2}$, $\frac{W}{4}$. Set off upwards the reactions R^1, R^{11}. Then draw the polygons of forces for every joint in succession in the usual manner. Large roofs of more complex type take more time, but present no special difficulties.

June 30th, 1884. A. EDMONDS.

[We have handed Mr. Edmonds' letter to Mr. Graham, who replies:—"Your correspondent is scarcely serious when he imputes to me the idea that the wind blows "vertically downwards;" or again, when he ascribes to me the notion that the wind can blow simultaneously in two opposite directions. Taking your correspondent's opinions in the order given, I have first to remark that wind pressure cannot be strictly called a "hydrodynamic," any more than a thermodynamic force; still the fact of its being a function of the velocity lifts it out of the region of static into that of dynamic forces. But in this sense the normal pressure is just as truly a dynamic force as the horizontal pressure from which it is derived. The reason why we can treat it as a static force lies altogether outside of itself, and rests simply on the fact that the roof is rigid and its resistance therefore passive. Even when adopting the rigorous method of dealing with wind pressures, which is not called for in roofs, it is not at all necessary "to construct two diagrams, one for the total vertical load and the other for the normal load." It is far easier and more correct to do the whole thing in one operation—for an example of which please refer to my "Graphic and Analytic Statics," Ch. viii., Sec. 5, Figs. 188-89, Plate 3. I am not at all convinced that the wind ever presses upon flat surfaces—and least of all upon roofs—with so great an intensity as 40 lb. per square foot. The case in illustration selected by your correspondent is extremely simple; nevertheless his construction is far from perfect. In the first place the end reactions are much more easily and far more elegantly determined by the aid of graphic than analytic statics. Secondly, the roof must be considered as subject to a permanent uniform dead load, as well as a variable wind load, one diagram serving for both cases. Working out roughly the example set by your correspondent, first on the assumption that the roof is loaded uniformly with a load of 45 lb. per square foot; then under similar conditions for a load of 50 lb. per square foot; and lastly, drawing the diagram according to strictly theoretical conditions, I find that the results of theory agree very closely with those derived on the first hypothesis. In fact, taking a bar of each type, the stresses for the tie-rod s^1 are identical, that for part-rafter T^1 slightly in excess, and that for the strut S^1 slightly deficient. The differences are not worth noting, the maximum in bar S^1 leading to a difference in sectional area of only 0·11 of a square inch. Had the wind load been made a less proportional part of the total load—as it should have been—the results would have agreed still more closely."—ED. E.]

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

(From our own Correspondent.)

THIS week the quarterly meetings have been held. The amount of business transacted has not been large in any department, but in a few branches some fair sales have taken place. More will probably be done in a week or two's time, when the market has settled down.

In Wolverhampton yesterday—Wednesday—the all-mine pig makers of Shropshire and Staffordshire declared quotations without change upon last quarter's basis, thus cold blast all-mines stood nominally at 80s. and hot blast at 60s. In reality, however, business was done at 2s. 6d. and, in some cases, even 5s. per ton under these prices. Sales were restricted, and stocks of all-mines in makers' hands were reported heavy. Competition from vendors of hematites made in outside districts was severe. The Tredegar Company quoted 56s., Ulverstone hematites were also 56s., and the Barrow Company quoted 57s. 6d. for No. 3 and 56s. for No. 4. Hematites generally were down on the quarter by from 2s. to 2s. 6d. per ton, and on the half year by 4s. per ton.

Part-mine pigs were a little brisker than all-mines, yet even here sales were not active. Native part-mines were generally 45s. to 42s. 6d. Bradley's Darlaston Green pigs were: No. 1, 45s.; Nos. 2 and 3, 43s. 9d.; forge, 42s. Staffordshire cinder pigs were 40s. to 37s. 6d. Derbyshire and Northampton pigs were down on the quarter 2s., and on the half-year 4s., and were quoted an average of 42s. 6d. to 42s. for best sorts.

In the manufactured iron branch, buyers at Wolverhampton concluded, in the absence of any announcement to the contrary, that marked bars were to remain at £8 2s. 6d. for Earl Dudley's brand, and £7 10s. to £7 for the bars of the other leading houses; and business was transacted upon this understanding. Excellent bars were, however, to be had at £6 15s., and even £6 10s.; while an inferior sample was £6 5s., and common bars were £6 to £5 15s., a drop on the quarter of 2s. 6d., and on the half-year of, in a few cases, 5s.

Branded hoops were £8, while common, for export purposes, were £6 5s. upwards, a reduction on the April meetings of about 2s. 6d. Gas tube strip varied from £6 down to £5 15s., and in some instances even £5 12s. 6d. per ton, the last-named figure being a fall on three months back of about 5s.

Sheet makers were unable to report a large business, and less proportionately was done in these than in hoops and bars. Prices of sheets were more varied than ever before, and though open market quotations were without change upon the quarter, they were lower upon the half year by 5s. per ton on singles, and by 2s. 6d. to 5s. per ton on doubles. Merchant singles were quoted an average of £7 upwards, doubles, £7 10s. to £7 15s.; and lattens, £8 10s. Galvanised sheet makers were reticent as to prices, but £12 to £12 5s. delivered Liverpool was the general figure. Boiler plates were dull at £8 10s. for ordinary sorts, and £9 to £9 10s. for superior qualities.

On all hands this afternoon there was much complaining of the severity of the competition in manufactured iron from the North of England, South Wales, Lancashire, North Staffordshire, and other outside districts. Manufacturers for these centres were numerous upon 'Change, and were busy seeking orders. A fair amount of success attended their efforts in some directions, especially when, as in certain instances, the North of England people underquoted local makers to the extent of 20s. per ton.

At Birmingham this—Thursday afternoon—the prices declared at Wolverhampton were confirmed in every particular. Mr. Fisher Smith announced his lordship's bars as £8 2s. 6d., and the other best houses announced them as £7 10s. Simultaneously all-mine pigs were quoted 80s. for cold, and 60s. for hot blast. The demand for best [illegible] whether rolled or raw, was reported very quiet. Even Australian orders which some time since were arriving freely for good bars have fallen off. Thin sheet makers are not so active as formerly. The leading Welsh steel-masters met and advanced steel bars for tin-plates 2s. 6d., making them £5 12s. 6d. at Welsh mills. Welsh tin-plate makers met and decided to maintain prices at 15s. for coke sorts and 18s. for charcoals. American demand reported quiet. Stocks at Liverpool decreasing.

The Earl of Dudley's list for the new quarter stands at:—Bars, either flat, round, or square, £8 2s. 6d. nominal for the lowest quality, £9 10s. for single best, £11 for double best, and £13 for treble best; rivet and T-iron, single best, £10 10s.; double best, £12; and treble best, £14. His lordship's ordinary T-iron, not exceeding 8 united inches, is £9 2s. 6d.; angles to 8in., and strips and hoops of 14 to 19 b.g., £8 12s. 6d. for lowest quality; £10 for single best; £11 10s. for double best; and £13 10s. for treble best. His lordship's strips and hoops of ¾in., not thinner than 20 b.g., are £9 12s. 6d. for ordinary; £11 for single best; £12 10s. for double best; and £14 10s. for treble best. ¾in. sizes are £1 per ton additional as to all the qualities.

William Barrows and Sons' list is:—Ordinary bars, £7 10s.; plating, £8; best crown, best scrap, and best chain bars, £9; best plating bars, and best angle, T, and rivet iron, £9 10s.; double best scrap and double best chain bars, £10; double best angle and rivet iron, £10 10s.; and double best charcoal bars, £16.

Messrs. Barrows' hoops from 14 to 18 b.g. are £8; single best matched slit rods, £8 15s.; best hoops and best slit rods, £9 10s.; double best charcoal horse-nail rods, £16 10s.; and rolled ditto, £18. Sheets to 20 b.g. are £9; 21 to 24 b.g., £10 10s.; and 25 to 27 b.g., £12; best sheets are £1 10s. per ton extra, and double best £2 10s. per ton extra. Boiler plates are £9; best, £10; double best, £11; treble best, £12; extra best, £15s.; and best charcoal, £19 5s. nominal.

Messrs. Noah Hingley and Sons quote best crown and best crown horseshoe bars, £7 10s.; best rivet iron, £8; double best crown bars, £8 10s.; double best plating iron, £9; and treble best bars, £9 10s. These prices apply to rounds and squares of ½in. to 3in. not exceeding 25ft. long, and to flat bars of 1in. to 6in. wide, not exceeding 25ft. in length. Angles up to 8 united inches and not exceeding 25ft., are 10s. per ton extra, and tees £1 per ton extra.

Vendors of steel of almost every description made outside this district and in it were pushing business on 'Change in Birmingham to-day, and numbers of them reported encouraging sales, particularly of Bessemer and other cheap steel in a partially finished state, for rolling down and working up purposes. The Lilleshall Iron Company hopes next week to be making steel ingots in quantities, but the cogging mill is not yet complete. At the Snedshill Works they have already rolled rivet steel, and tested it with every success.

The colliers are still on strike and appear hopeful of success. They have decreed a levy of 4d. per day per man, and 2d. per day per boy, to be paid by all those at work, and the funds thus raised and those collected from the public are distributed among union and non-union men alike. The action which the masters are taking appears mainly in the result of a meeting of the Committee of the Coal Trade which was held at Dudley on Tuesday. It was called to investigate reports that had been circulated by the men that a number of owners who were members of the Association had re-started their pits at the old rate. It was reported that these statements, with one or two exceptions, were unfounded, and the Committee confirmed the former decision to uphold the award of the arbitrator. It was also resolved that in the event of the strike being prolonged a meeting should be convened a week hence to carry out the resolutions previously arrived at for subsidising firms who are compelled to pump water.

The call for cultivating tools is quieter since the second half-year has been entered upon. Still the principal makers have enough to do; indeed, some of them are quite busy. India is buying fairly of hoes, picks, hammers, spades, and shovels. Some of the markets on the east and west coasts of South America are also sending good lines. Rio de Janeiro is, however, prejudiced by the prevailing rate of exchange, and the North and South Brazils are not buying with their usual vigour. The Australian demand is under the average, but South Africa gives evidence of revival.

The Town Council of Warwick have determined to erect additional works at their pumping station, and have instructed their surveyors to prepare the necessary specifications.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—To some extent transactions of any importance have during the past week been held in abeyance pending the result of the quarterly meetings, and this has had a tendency to still further restrict the limited amount of business doing in the iron market here. This, however, is so small a contributing item to the general depression which prevails in all branches of the iron trade, that it cannot be taken into very much account, the real cause of the depressed state of the market being the long continued absence of buying and the discouraging future prospects, which offer no indication of any source likely to develope the much wanted activity in trade. In pig iron there is a continued weak tone, and buyers are evidently making a strong effort to force down prices still lower by holding back orders as long as they possibly can. Forge proprietors have bought comparatively very little iron for months past; in many cases they have not taken the deliveries of iron they have bought, and although the manufactured iron trade has been extremely quiet, the quantity of pig iron bought or held in stock by finished iron makers must be very small. With many of the works on short time, it is not probable that they will for the present be coming largely into the market as buyers; there does, however, appear to be a slight improvement in the finished iron trade, so far as the number of inquiries in the market is concerned, and although no very hopeful view is entertained of any large amount of work being given out or of any better prices being obtainable, if the inquiries afloat should result in a sufficient acquisition of new work to keep the forges going, it will tend towards doing something to remove what has been the really weak spot in the iron trade.

There was only a very dull market at Manchester on Tuesday. For pig iron local makers were holding for 42s. 6d. less 2½ as their minimum for forge and foundry qualities delivered equal to Manchester, but in district brands there are some very low sellers in the market, Lincolnshire iron being obtainable at about 41s. 6d. to 42s. 6d. less 2½ delivered; Derbyshire iron is also coming into this market at very low prices, ranging from about 1s. to 2s. per ton above Lincolnshire. North-country irons, although they have recently been easing down in prices, are still too high to compete with the local and district brands in this market. Scotch iron remains without material change so far as this market in concerned.

In the finished iron market merchants have been showing rather more disposition to place out contracts, but the actual business doing continues small, and except that there is, perhaps, more firmness in adhering to £5 15s. as the minimum for good local and North Staffordshire bars delivered into this district, no better prices are being obtained. There are still sellers who are open to book good specifications at as low as £5 12s. 6d.; and common bars are offered at very low prices, orders having recently been taken at about £5 10s. delivered into this district.

Reports as to the condition of the general engineering branches of trade in this district continue in the direction of decreasing activity, and even in those branches which have been specially well employed, such as railway rolling stock and locomotive building, competition is beginning to quicken, showing that orders are running out without being replaced.

There are, however, some special branches of engineering that apparently are not affected by the general depression in trade, and visiting the works of Sir Joseph Whitworth and Co. during the

past week, I found that not only are they being kept fully employed with the orders they have in hand, but there is an increasing amount of new business coming forward which necessitates an almost continual enlargement of the works. This applies chiefly to their steel department, in which they have orders in hand for almost every country in Europe, for the United States, China, and the Colonies. To meet the requirements of their growing steel trade, Sir Joseph Whitworth and Co. are increasing the size of their furnaces so as to enable them to turn out 90-ton castings. Amongst some of the special steel work they had in hand when I visited the works was a large cylinder 8ft. 6in. long, 3ft. 4in. internal diameter, and about 60in. external diameter. This cylinder, which is constructed to work up to a pressure of 7 tons to the square inch, is built up on the same method adopted by the firm in constructing their gun tubes, and it has a screw block on each end. The firm have also in hand a gun tube 43ft. in length, forged hollow, with a 15in. hole. This tube, which is made from a casting weighing 45 tons, and finished weighs 24 tons, is to form part of a gun with a greater length than any that have yet been made, the total length over all being about 50ft., and the total weight of the gun when finished being 110 tons, and the weight of the shot to be fired being about one ton. In other steel work I noticed a number of cylinder liners of large diameter, some of them being 7ft. 6in., crank and propeller shafts, and amongst these a couple of hollow shafts nearly 60ft. in length, 12½in. diameter, with a hole through 4½in. diameter. When I add that the hole has been bored perfectly true through each shaft, a very fair indication is afforded of the perfectly homogeneous character of the metal in the fluid-pressed steel which Messrs. Whitworth produce for this class of work. In their tool department Messrs. Whitworth are chiefly busy on new plant they are laying down for the extension of their own works, and amongst the new tools they are constructing are a powerful slide lathe, to take in 60ft. propeller shafting, with about 30in. centres; others of lighter construction, including a 42in. brake lathe, to take in 36ft., for gun tubes and cranks, and I may add that some of these lathes are arranged to work with eight tools, four on each side.

In the machine making branch of industry the large local firms are still tolerably busy, but the orders chiefly run on foreign work, and with regard to this class of work, it may not be out of place to point out that the orders which have kept Lancashire machinists busy have been to so large an extent to fill competing mills abroad, that the Lancashire trade is now suffering proportionately in consequence, and millowners in India who have been supplied with machinery from this district are now entering into competition in neutral markets with the Lancashire manufacturers. It may be interesting to notice further that pretty much the same thing is now going on in the lace trade. The machinists in the Nottingham district are busy, but with the exception of orders from Scotland, where lace-making is being introduced, the bulk of the work they have in hand is for abroad. Formerly the exportation of lace-making machinery was confined to France, but now it is going almost equally to Germany, Spain, and almost all the civilised centres on the Continent, which must necessarily mean the curtailing of the foreign requirements for the finished article hitherto supplied by the Nottingham warehouses.

All through the coal trade of this district an extremely quiet tone prevails, and a large proportion of the collieries are not working more than six to seven days a fortnight, except where a good deal of the output is going into stock. All classes of round coal are very bad to sell, the better sorts, for house fire purposes, being quite a drug in the market. As regards prices, there are really no fixed rates where anything like sales in bulk are concerned. Colliery proprietors, where they have stocks to clear away, take practically what prices they can get to effect sales. Best coal at the pit mouth averages about 8s. 6d. to 9s.; seconds, 6s. 6d. to 7s.; and common round coals, 5s. to 5s. 6d. per ton. For engine classes of fuel there is a moderate demand, but with the exception of some of the better qualities of slack supplies are plentiful. At the pit mouth burgy averages 4s. 6d. to 4s. 9d.; best slack, 4s. to 4s. 3d.; and good ordinary qualities, 3s. 6d. to 3s. 9d. per ton.

For shipment there is a fairly active demand, but such low prices have to be taken that sales are effected more to clear away stocks than for any really remunerative business. Delivered at the high-level, Liverpool, or the Garston docks, good Lancashire steam coal is not fetching more than 7s. to 7s. 3d. per ton.

The wages question in the West Lancashire district is naturally a prominent question in the coal trade just at present, but it has really very little effect upon the market, and buyers show no anxiety to give out orders in anticipation of a possible stoppage of the pits. Supplies, in fact, are so generally plentiful, that if a number of the Lancashire collieries were, in the place of only running about half time as at present, to be stopped altogether for a few weeks, the reduction of the get would not be seriously felt.

Barrow.—The tone of the hematite pig iron trade of this district I have to report is still very flat, and no change hat occurred in the condition of the trade during the week. Business is quiet, and the number of orders coming to hand is inextensive. Makers in some parts of the district find a great scarcity of orders, and have a difficulty in keeping works going, but at Barrow makers are well supplied with orders for execution this month. Makers are firm with prices, and any attempt to force them down is firmly met. Quotations are practically unchanged. Mixed Bessemer samples change hands at about 47s. 6d. per ton net. Stocks are considerable, and are not diminishing. Of the steel industry of the district I have to report a flat state of affairs. The orders being booked from all quarters are inextensive. Some firms have booked one or two good contracts, which are keeping them fairly, though not busily, employed, but makers as a rule regard prospects as anything but good. Rails are quoted at 90s. per ton net at works for ordinary parcels. The shipments have slightly improved. Shipbuilders are dull, and no orders of importance are being booked. Iron ore quiet at last week's rates. Stocks are heavy.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

REGRET has been generally expressed concerning the serious hitch in the construction of the Hull and Barnsley Railway. It was rumoured in Hull on Saturday that the failure of the attempt to raise additional capital to complete the undertaking sufficiently to enable the line and the dock to be opened early next year would lead to the stoppage, in whole or in part, of the works. This turns out to be correct, 2000 of the workmen having already been discharged; and unless some arrangement is come to, it is feared that the whole of the works will have to be temporarily suspended at the end of next week. The directors are stated to contemplate keeping the works substantially in their present position, and await a more favourable time. It is not intended, however, to discontinue pumping at the dock, or the dredging of the entrance channel to the dock, nor to delay the works at the dock entrance, which latter step would involve serious loss. The Ouse and Hull swing bridges will also be continued. The present position of the undertaking stands thus:—Twenty-five miles of railway could be opened in six weeks, thirty-seven miles in two months, and the whole sixty-six miles in three months. The whole extent of the railway and the dock could, it is said, be opened in six months, but the entire undertaking must remain at a standstill for a time, owing to want of the necessary capital. This is a great change from the condition of affairs when the company was promoted. Then the capital was subscribed for three times over. Pity they did not ask for more!

The Calcutta Exhibition has a droll side to it, so far as competitors are concerned. Those who won gold medals naturally expected to get them. They can get them, it seems, at £10 10s. each, with the alternative that if they do not wish to pay for a gold medal they can claim a silver one instead. It is rather disappointing to win a gold medal, and then be asked to pay for it. One firm who were awarded a gold medal for their exhibit have not unreasonably intimated that they "did not expect to be asked to pay" for their prize.

The decision in the hoop L trade mark, to which I have already referred, is a distinct triumph for Messrs. Thomas Frith and Sons, Norfolk Works, Sheffield, who are the purchasers of the whole of Baron de Geers' output of iron under an agreement which has several years yet to run. While, however, the Brades Company has been defeated in its application to register the mark, the question remains—is the mark common property? Several firms in this quarter believe that it is, and are contemplating action to settle the point. I suspect that when they come into court with that contention they will find the Baron still to the front.

A recent order in regard to the assumption of the Royal Arms by manufacturers, merchants, &c., caused some uneasiness in regard to the common custom of sticking the insignia of royalty on Sheffield goods. A local gentleman writes to the Lord Chamberlain, asking if the prohibition applied to articles of Sheffield production such as cutlery, electro-plate, &c. The Lord Chamberlain, in reply, forwarded an extract from 46 and 47 Victoria, cap. 57, which, he said, would give all the information sought for. The section, which is really 106 of the Patents, Designs, and Trade Marks' Act of 1883, runs thus:—"Any person who, without the authority of her Majesty or any of the Royal Family, or of any Government Department, assumes or uses in connection with any trade, business, calling, or profession, the royal arms, or arms so nearly resembling the same as to be calculated to deceive, in such a manner as to be calculated to lead other persons to believe that he is carrying on his trade, business, calling, or profession, by or under such authority as aforesaid, shall be liable on summary conviction to a fine not exceeding £20." The English of this seems to be that no person in connection with his business, be it of any kind whatever, can assume the royal arms without obtaining permission, except under the constant fear of being mulcted in a penalty of £20.

I notice that the information I communicated to you a fortnight ago regarding a confederation of steel rail manufacturers—in other words, "a steel rail ring"—has been exciting much interest and some doubt in certain quarters. There need be no doubt on the subject. The statement was confirmed by Mr. Coward, the chairman of the Ebbw Vale Steel, Iron, and Coal Company, at the annual meeting of shareholders at Manchester, and he added that the effect of the combination had already been felt in an improved price for rails produced by this company. The official report of the meeting is before me while I write, and it substantiates, in every particular, what originally appeared in THE ENGINEER.

The outcome of the great competitive tests between the compound system of armour-plates—Sheffield—and the all-steel—Le Creusôt—plates is a complete victory for the compound system; and I understand that the contract for the whole of the armour required for the Danish war vessel Iver Hortfeldt, has been placed with Messrs. Chas. Cammell and Co., Cyclops Works, Sheffield. The tests took place at Copenhagen.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

THE quarterly meeting of the Cleveland iron market, held at Middlesbrough on Tuesday last, was but thinly attended. Owing to the returns for June being of an unfavourable nature from a smelter's point of view, the tone was somewhat flat, and but little business was done. Merchants endeavoured to beat down prices, but as they do not hold much iron, and as most of the makers are well sold, quotations are maintained in spite of them. For prompt delivery of No. 3 g.m.b. 37s. per ton must be paid, and some makers still quote 37s. 6d. Local mills and forges are working a little more regularly than last month, consequently there is an improved demand for forged iron, and the price remains steady at 35s. 6d. per ton.

Warrants are offered at 37s., but buyers are not forthcoming.

The stock of Cleveland pig iron in Messrs. Connal's Middlesbrough store continues to decrease steadily. On Monday the quantity held was 57,726 tons, being a reduction of 200 tons for the week.

Pig iron exports have been at a satisfactory rate since the beginning of July. About 3000 tons is the average daily quantity.

The finished iron trade remains in a quiet and dull condition. Inquiries are perhaps a little more numerous, but prices do not improve. Quotations have been stationary for some weeks, and are as follows:—Ship plates, £5 to £5 2s. 6d. per ton; angles, £4 15s. to to £4 17s. 6d.; and common bar iron, £5 2s. 6d. to £5 5s., all free on trucks at makers' works, cash 10th less 2½ per cent.

The accountant's certificate just issued under the Cleveland iron smelter's sliding-scale shows that the net average selling price of No. 3 G.M.B. for the quarter ending June 30th was 36s. 4·65d. per ton. Blast furnacemen's wages will remain unaltered, but miners' rates will be reduced one-twentieth of a penny per ton; underground men half per cent., and surface men at the mines four-tenths of one per cent.

Messrs. T. Turnbull and Son's shipyard at Whitby, which has been closed for about two months, is about to be reopened to the extent that an iron vessel which was commenced some time ago may be completed.

The value of the goods shipped from the Tees during June, exclusive of coal and coke, is £209,790, being an increase of £39,596 compared with June, 1883.

A portion of the work undertaken by the Hull and Barnsley Railway and Dock Company, and hitherto in progress, has been brought to a standstill until additional capital can be obtained. This seems rather strange when it is remembered what a rush there was for the shares when first the venture was introduced to the public, and how at that time far more capital was offered than could be accepted by the directors. Possibly Sir J. W. Pease's successful opposition in the House of Commons to the proposal to pay interest during construction may have had something to do with the present dead-lock. If so, the North-Eastern Railway Company, which has done its best to prevent poaching in its preserves, will now be able to chuckle. At all events, should they pass a vote of thanks to Sir Joseph at its next directors' meeting, the public will understand what it is for.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

IN the Glasgow pig iron market this week business has been quiet, and the prices of warrants easier. The shipments of Scotch pigs turned out much better then was anticipated, amounting to 12,612 tons, as compared with 12,398 in the corresponding week of 1883. The preceding weeks were low, however, being only 8133 tons. Some brands of makers' iron are scarce in second-hands, and this has rather improved the demand for these in the open market, and of course somewhat improved their prices. An additional furnace has been put in blast, so that there are now 96 in operation, as against 113 at this date last year. The stock of Scotch pigs in Messrs. Connal and Co'.s stores exhibits a decrease for the week of 270 tons.

Business was done in the warrant market on Friday at 41s. 5d. cash. On Tuesday transactions occurred in the forenoon at 41s. 5d. to 41s. 5½d. and 41s. 4½d. cash, the market closing at the latter in the afternoon. Tuesday's market was quiet, with transactions at 41s. 4d. and 41s. 3½d. cash. On Wednesday forenoon business was done at 41s. 3½d. to 41s. 2½d. cash, and 41s. 2d. to 41s. 5d. one month; afternoon, 41s. 3½d. cash, and 41s. 5½d. one month. To-day—Thursday—business was done from 41s. 4d. to 41s. 3d. cash, and 41s. 6d. to 41s. 5d. one month.

The values of makers' iron are as follow:—Gartsherrie, f.o.b., at Glasgow, per ton, No. 1, 51s. 9d.; No. 3, 50s.; Coltness, 57s. 6d. and 51s.; Langloan, 53s. 6d. and 51s.; Summerlee, 51s. and 47s.; Calder, 52s. and 46s. 6d.; Carnbroe, 50s. 6d. and 47s.; Clyde, 48s. and 45s.; Monkland, 43s. 6d. and 40s. 3d.; Quarter, 42s. 6d. and 40s. 3d.; Govan, at Broomielaw, 42s. 6d.; Shotts, at Leith, 51s. 6d. and 51s.; Carron, at Grangemouth, 48s. (specially selected, 54s.) and 47s. 6d.; Kinneil, at Bo'ness, 44s. and 43s.; Glengarnock, at Ardrossan, 50s. and 43s. 6d.; Eglinton, 44s. 6d. and 41s.; Dalmellington, 46s. 6d. and 42s. 6d.

There have been a few orders to hand in some kinds of malleable iron since last report, but this department of the trade is still very slack. The further reduction of wages which has been made in Lanarkshire consists of 2½ per cent. on mill rollers, forgemen, shinglers, and others in connection with the finishing departments, and 3d. per ton in puddlers. This is the second reduction that has been made in the malleable trade since the beginning of the year, and the wages now paid are very low. The quotations are nominally without alteration.

The coal trade has become comparatively quiet, but it is no unusual circumstance for a stagnation to occur in the middle of summer. The very warm weather has reduced the domestic inquiry, and the dull trade affects the requirements of the factories, while the shipping demand is less active than of late. At Glasgow the shipments are considerably behind, consisting of 9726 tons for abroad, besides a few cargoes sent coastwise. From Ayr 8005 tons were despatched, 4155 from Troon, and 8608 tons at Grangemouth; while the exports from Leith were fully up to the average. Coal freights to foreign ports are just now comparatively good, although smaller than in some former times.

The miners in the western districts have been working steadily in anticipation of the trade holidays, which begin next week.

During the six months ending with June, the shipping trade of Glasgow has been fairly active, although not quite up to that of the first half of 1883, and less remunerative to those engaged in it. The tonnage of goods despatched from Glasgow was 725,648, against 745,030 in the corresponding six months, and the arrivals 480,567 compared with 498,880 tons.

The shipbuilding trade of the Clyde is very slack, notwithstanding that a few additional orders have been received. It is estimated that there are about 140,000 tons on the stocks, compared with 300,000 tons twelve months ago.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

THE Barry Dock Bill is expected to go before the House of Lords' Committee this week, when the interminable struggle will again begin. The evidence of Mr. W. T. Lewis alone before the House of Commons' Committee amounted to 118 folio pages of printed matter. Many are wishing to get a cheap reprint of this, as a most valuable survey of the mineral basin of South Wales. The Committee were fairly divided on the matter, and it was the chairman's casting vote which carried it. This is taken as not the best of auguries for success in the House of Lords. It is very evident that at the collieries, the docks, and on the rail a lessened amount of activity prevails, and though collectively a tolerable degree of prosperity is enjoyed, there is neither the push that used to exist nor the demurrages paid. I have a strong impression that when the Newport and Caerphilly line is in regular working condition, a still greater decrease will be noticed; that when the Swansea Bay is completed a less still, and coalowners will look at one another and exclaim, "What were we thinking about in wanting Barry Docks and railway?"

This week the Taff Vale Company put a working train party on the new line to Newport and conveyed twenty-seven laden coal wagons as far as Bassaleg *en route* for Newport, but at Bassaleg the Great Western Railway put a veto against further progress, and the Taff Vale men had to wire to Paddington for permission. It is a pity that any hitch should have occurred. I hope that it was an accidental, not an obstructive one. The Taff Vale Railway Company sustained a loss of £7000 this week by the burning down of its Penarth station.

The only features of unrest amongst the colliery community are being allayed. One at Dowlais, with respect to the length of hours, is being grappled with, though at one time it was feared that there would be a serious termination. Efforts are being made to do away with, to a great extent, the practice of leaving work in the event of accidents and funerals. At present, if a man is injured in a pit the whole of the colliers leave it, and similarly when a funeral is held. Messrs. Nixon and Co. have now taken a firm stand in the matter, and if more than ten leave on the occasion of an accident, summon them for breach of contract. The colliers have held a meeting, and sent in a notification to the manager to withdraw the notice at once.

I am still without any good news for the iron trade. A quiet sluggishness reigns in every direction—half-employed mills, half time, are conspicuous features, and but for a fair amount of trade at the tin-plate works, it would be worse. There is good steady work going on at the tin-plate works, and prices are firm, with strong probabilities of advancing. Some degree of uncertainty prevails in the steel departments with respect to puddlers, and in several works a reduction is sought to be enforced.

One would have thought that with the existing plethora of steamers Cardiff coalowners would have gone into the market to buy, instead of having them made. This week a fine steamer for Messrs. Gueret, of Cardiff, was launched at Jarrow. She is to carry 2600 tons, and is the third this firm have had made this year.

The new graving docks at Swansea are to be constructed by Young and Christie at Dickson's Wharf, and Messrs. Pongdestre at the Prince of Wales' Dock.

The Forest of Dean coal trade is not in the best of form, but this more or less characterises most house coal districts. The returns of the Forest for June show 26,024 tons, as against 25,180 tons for June last year. This shows that there is not much progression, but no falling off.

THE SOCIETY OF ARTS.—The Council of the Society of Arts have awarded the Society's silver medals to the following readers of papers during the Session, 1883-4:—To the Most Hon. the Marquis of Lorne, K.T., for his paper on "Canada and its Products;" to Rev. J. A. Rivington, for his paper on a "New Process of Permanent Mural Painting, invented by Joseph Keim;" to C. V. Boys, for his paper on "Bicycles and Tricycles;" to Professor Fleeming Jenkin, F.R.S., for his paper on "Telpherage;" to I. Probert, for his paper on "Primary Batteries for Electric Lighting;" to H. H. Johnston, for his paper on "The Portuguese Colonies of West Africa;" to Professor Silvanus P. Thompson, for his paper on "Recent Progress in Dynamo-electric Machinery;" to Edward C. Stanford, F.C.S., for his paper on "Economic Applications of Seaweed;" to W. Seton-Karr, for his paper on "The New Bengal Rent Bill;" to C. Purdon Clarke, C.I.E., for his paper on "Street Architecture in India." Thanks were voted to the following members of Council for the papers read by them:—To W. H. Preece, F.R.S., Vice-president of the Society, for his paper on "The Progress of Electric Lighting;" to B. W. Richardson, M.D., F.R.S., Vice-president of the Society, for his paper on "Vital Steps in Sanitary Progress;" to Colonel Webber, R.E., C.B., member of Council, for his paper on "Telegraph Tariffs;" to B. Francis Cobb, Vice-president of the Society, for his paper on "Borneo;" to J. M. Maclean, member of Council, for his paper on "State Monopoly of Railways in India;" to W. G. Pedder, member of Council, for his paper on "The Existing Law of Landlord and Tenant in India." A *conversazione* will be held at the International Health Exhibition by the Council of the Society of Arts, in conjunction with the Executive Council of the Exhibition, on Wednesday evening, 9th of July. The whole of the buildings will be open, and the gardens will be illuminated.

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.

1st July, 1884.

9594. GRINDING and SMOOTHING SLATE, &c., T. P. Williams, Huddersfield.
9595. FORGING NAILS, B. P. Walker, C. B. Ketley, and T. D. Clare, Birmingham.
9596. TRANSPORTING GRAIN, &c., A. J. Lehmann, Kirkdale.
9597. REDUCING the CONSUMPTION of GAS, &c., S. A. Brown, Rainbow Hill.
9598. PREVENTING DOWN DRAUGHT in CHIMNEY TOPS, J. Adams and J. Telford, Liverpool.
9599. MINERS' SAFETY LAMPS, L. Jenkins, Londonderry.
9600. RECEIVING, &c., PAPERS, G. A. Wilson, Liverpool.
9601. DATE INDICATORS, J. J. Raggett, Aston.
9602. LOADING HAY and CORN STACKS, T. Thompson, Carlow.
9603. CONTINUOUS BRAKE for TRAINS, R. Robinson, Liverpool.
9604. CURTAIN STRETCHING APPARATUS, J. H. Gibson and W. Glazier, Liverpool.
9605. TIPPING ROAD WAGONS, T. Monk, Bootle.
9606. PRODUCING YELLOW COLOURING for DYEING, W. W. Grieves.—(*Farben Fabriken vormals F. Bayer and Co., Germany.*)
9607. ELECTRIC BELL PUSHES, W. A. Liepner and C. Brotherhood, Clifton.
9608. SHIP STEERING GEAR, W. P. Thompson.—(*G. F. Clemons, Springfield, U.S.*)
9609. HANGING-VALVE DISTRIBUTOR, &c., C. Eichler, Austria.
9610. SHAPING the HANDLES of CUTLERY, H. Bramall, Sheffield.
9611. AUTOMATIC FARE COLLECTORS, H. J. Allison.—(*J. H. Small, New York.*)
9612. PREPARING SURFACES for PRINTING, A. G. Brookes.—(*E. Kunkler and J. Brunner, Switzerland.*)
9613. SCREWS, A. G. Brookes.—(*W. A. Rogers and G. F. Ballon, U.S.*)
9614. PRINTING COLOURS SIMULTANEOUSLY on COTTON HANKS, T. G. Charlesworth, Leicester.
9615. MANUFACTURE of NUTS, &c., J. Ashton, U.S.
9616. GEARING for the PROPULSION of TRICYCLES, &c., T. J. Hood, Eccles.
9617. STEAM ADMISSION VALVES, J. Thom, Barrow-in-Furness.
9318. WAIST BELTS, P. A. Martin, Birmingham.
9619. SAFETY APPARATUS for LIFTS, M. Martin, Prussia.
9620. SAFETY LIFTS, M. Martin, Prussia.
9621. TREATING PHOSPHATE of LIME, J. Plummer, jun., Edinburgh.
9622. OBTAINING SULPHURETTED HYDROGEN from ALKALI WASTE, J. Plummer, jun., Edinburgh.
9623. HOLLOW STOPPERED SUPPOSITORIES, E. H. Gibbs, New York.
9624. MACHINES for TRIMMING FABRICS, R. J. Walker, Philadelphia.
9625. DOWN QUILTS and CLOTHING, &c., R. and E. McLintock, Barnsley.
9626. MITRE JOINT for PIPES, C. F. Newman, Lower Tooting.
9627. SCARF RETAINER, A. J. Boult.—(*J. Sandilands, San Francisco.*)
9628. GLOVE FASTENINGS, J. Hinks, Birmingham.—*1st May*, 1884.
9629. RESPIRATORS or INHALERS, O. Imray.—(*D. Genese, Baltimore.*)
9630. COLLAR, SHIRT, and CUFF STUDS, D. Vimpany, Rickmansworth.
9631. TEACHING SOLDIERS the USE of the RIFLE, &c., W. E. Heath, London.
9632. DYES or COLOURING STUFFS, E. Capitaine.—(*Ewer and Pick, Berlin.*)
9633. CHURNS, J. Paton, Skelmorlie.
9634. MOULDING MACHINES, H. J. Haddan.—(*C. T. Sweet, Cleveland, U.S.*)
9635. FIRE-ESCAPES, H. J. Haddan.—(*J. S. Oram and H. R. Dickerman, Cleveland, U.S.*)
9636. BRIDLES and BITS, V. C. di Tergolina, London.
9637. SWIMMING CLOTHES, B. Benecke and B. Liedtke, Koenigsberg.
9368. SCOURING, WASHING, and DYEING PIECE GOODS, J. Worrall, Ordsall, and J. Kershaw, Wadsworth.
9639. KEYS for SECURING RAILWAY RAILS, B. Swaine, Leeds.
9640. MAKING COFFEE and BOILING MILK at the SAME TIME, D. Lindo, Finsbury.
9641. FRAMES for FASTENING PHOTOGRAPHS to GLASS, R. C. Wittman, London.
9642. TAG HOLDER, J. Kydd, New York.
9643. SAFETY DEVICES for ELEVATORS, R. C. Smith, New York.
9644. MANUFACTURE of CARBONATE of STRONTIUM from SULPHATE of STRONTIUM, S. Pitt.—(*E. A. Mebus and J. W. de Castro, New York.*)
9645. GAS ENGINES, E. J. C. Welch and R. C. Rapier, London.
9646. FASTENING BUTTONS, H. H. Lake.—(*T. Porter, Montclair, U.S.*)
9647. VENTILATING CAP or COWL, H. H. Lake.—(*H. L. Day, Minneapolis, U.S.*)
9648. LACING HOOKS for BOOTS, &c., H. H. Lake.—(*M. Bray, Newton, U.S.*)
9649. INCANDESCENCE ELECTRIC LAMPS, H. H. Lake.—(*N. S. White, Canton, U.S.*)
9650. CARDING FIBROUS MATERIALS, H. H. Lake.—(*J. C. Gerlach and C. E. Wentworth, Boston, U.S.*)
9651. ICE, &c., H. H. Lake.—(*J. Patten, New York.*)
9652. IMPARTING INTERMITTENT MOTION to ENDLESS BELTS, H. H. Lake.—(*W. H. Anderson, Brooklyn.*)
9653. RECEPTACLES or BOXES, &c., W. A. Barlow.—(*E. Ritter, Germany.*)
9654. LIFTING and LOWERING the CHIMNEYS of ENGINES, H. Vaughan, Lincoln.
9655. AMMONIA, A. Brin, Paris.
9956. ARRANGING GIRDERS and JOISTS, &c., W. Baird, Glasgow.

2nd July, 1884.

9657. CHIMNEY POTS, J. J. Green, Halifax.
9658. REEL FASTENING for FISHING RODS, T. H. Izod and W. M. James, Redditch.
9659. AUTOMATIC SAFETY BRAKE, J. H. Ashton and J. Darwin, Leeds.
9660. SHAVING BRUSHES, J. H. Smith, Birmingham.
9661. ATTACHING WIRE MATTRESSES to BEDSTEADS, I. Chorlton and G. L. Scott, Manchester.
9662. PREVENTING FIRES by FIRE GRENADES, W. J. McCaw, Castlecary.
9663. HAULAGE CLIP, J. W. Smallman, Nuneaton.
9664. READY-OPENING ENVELOPE, &c., W. P. Thompson.—(*W. Goodbody, New York.*)
9665. DRIVING BELTS or STRAPS, D. Williams, Liverpool.
9666. MILLING or FELTING WOOLLEN FABRICS, G. Tolson, Dewsbury.
9667. BRICKS, J. C. Snelling, Croydon.
9668. RAISING, &c., PORTABLE ENGINE CHIMNEYS, W. Hornsby and R. Edwards, Grantham.
9669. DRAWING COMPASSES, C. Rhodes, London.
9670. VENTILATORS, W. W. Fyfe, Aberdeen.
9671. BLIND-HOLDER, I. Sinden, London.
9672. COOLING APPARATUSES, A. Kind, Mira.
9673. ACHROMATIC IMMERSION PARABOLOID ILLUMINATOR, J. Swift, London.
9674. TELEPHONIC RECEIVERS, J. H. Johnson.—(*P. G. Skrivanow, Paris.*)
9675. STOPPERING BOTTLES, S. Skerritt, Sheffield.
9676. TUBING APPARATUS for MULES, G. Pickford and J. Rayner, Oldham.
9677. FIRE-EXTINGUISHING APPARATUS, J. K. J. Foster, Bolton.
9678. SPINNING MACHINES, A. Youngson, Belmont.
9679. SPECTROSCOPES, &c., W. N. Hartley, Dublin.
9680. PENHOLDERS, W. D. Ross, Aberdeen.
9681. SCREW-PROPELLERS, O. Imray.—(*F. Young, Durban, Natal.*)
9682. MINE CAGES or LIFTS, E. Capitaine.—(*A. Strauss, Germany.*)
9683. WATERING CANS, J. Kaye, Kirkstall.
9684. ANNEALING HARDENED STEEL WIRE, E. de Pass.—(*La Société Veuve A. Miroude et Compagnie, Paris.*)
9685. DETECTING BURGLARS, &c., ENTERING PREMISES, G. L. Pearson, London.
9686. SHIFTING SPANNER, A. J. Boult.—(*L. J. Bassery, Amiens, France.*)
9687. LOADING and DISCHARGING COAL CARGOES, G. Taylor, Penarth.
9688. CHLORINE, &c., W. Weldon.—(*M. M. Pechiney et Cie., France.*)
9689. SCREW BOLTS, &c., F. Brückert, France.
9690. STOPPERS for BOTTLES, S. Leoni, London.
9691. PROPELLING TRICYCLES, &c., G. Zanni, London.
9692. STOPPING STEAM and OTHER ENGINES, H. Oelert, and A. Bolzani, Prussia.
9693. AIR-TIGHT RECEPTACLES for PRESERVING BUTTER, &c., G. Partridge, London.
9694. STARTING GARDEN ROLLERS, W. S. Simpson and J. W. Phillips, London.
9695. BOTTLE STOPPERS, J. H. Teale, London.
9696. NEWSPAPER, &c., HOLDER, R. S. Cuming, Mount Preston.
9697. FURNACES, J. Sawyer, London.
9698. EMBALMING DEAD BODIES, A. S. Lovett, U.S.
9699. DAMP-PROOF COMPOUND, S. Frankenberg, London.
9700. CARRIAGE RUGS, &c., H. Emery and S. White, London.

3rd July, 1884.

9701. FIXING INSOLUBLE AZO COLOURS upon COTTON, &c., D. Dawson, Milnsbridge.
9702. WASHING CLOTHES, J. Shaw, Lockwood.
9703. COMBINED SHOW-CARD and PRICE-LIST, J. M. Williams, Huddersfield.
9704. PLAIDS or SCARVES, A. Millar, Glasgow.
9705. PANELS, &c., for DECORATIVE PURPOSES, W. P. Thompson.—(*W. Saul, Jersey, U.S.*)
9706. FEEDING WATER to STEAM BOILERS, D. and J. J. Allingham, London.
9707. STEAM PUMPS, G. Weir, Glasgow.
9708. BODIES of PERAMBULATORS, &c., G. P. Lee, Longsight.
9709. ATTACHMENT for COLLAR and TIE, J. Y. Johnson, Glasgow.
9710. GUARD RAZORS, C. Edley, Sheffield.
9711. PURIFYING MIDDLINGS, &c., J. B. Holgate, Burnley.
9712. SMOOTHING YARN in SPINNING and TWISTING MACHINES, J. J. Broadbent, Bradford.
9713. BUFFERS for RAILWAY, &c., VEHICLES, J. Trippett and T. and H. Searls, Sheffield.
9714. WHEELS, J. Trippett and T. and H. Searls, Sheffield.
9715. ENGINES, T. Harrison, Sheffield.
9716. TOOLS for EXPANDING RINGS in BOTTLE NECKS, J. Wilkinson, Swinton.
9717. STOPPER for BOTTLES, A. Muir, London.
9718. POLISHING MACHINERY, &c., F. A. Paget, London.
9719. LIFTING BED-RIDDEN PATIENTS, &c., J. Newham, London.
9720. BOOTS or SHOES, A. J. Boult.—(*S. McCullough, Toronto, Canada.*)
9721. UMBRELLA, &c., FRAMES, A. J. Boult.—(*F. Jorns, Berlin.*)
9722. DISINFECTING NIGHT-LIGHT, G. Brownen and J. I. Eden, London.
9723. MATERIAL for BOOKBINDING, S. Barlow, Castleton, near Manchester.
9724. INDUCING ELECTRIC SPARKS, A. Molison, London.
9725. NUT FORGING MACHINE, O. Imray.—(*F. A. Hasenclever, Germany.*)
9726. BOILERS, J. Hanna and T. Shillington, Belfast.
9727. TREATING DISEASE by MAGNETISATION, R. Eustace, Warrenpoint.
9728. RING SPINNING, J. Lyon.—(*J. Brooksby and R. Roscoe, Nagpur, India.*)
9729. WINDING YARNS, J. W. Bullock, Wigan.
9730. COLOUR BOXES, D. E. Langham, Wimbledon.
9731. REMOVING ASHES, &c., H. H. Lake.—(*G. Lustig, Bohemia.*)
9732. STEAM ENGINES, I. Vernon, Tipton.
9733. FOLDING ROUT SEATS and TABLES, W. M. Holdom, London.
9734. TOY WATCH, H. Haddan.—(*F. Tütemann, Leipzig.*)
9735. SECONDARY BATTERIES, W. Taylor and F. King, London.
9736. CRANES, R. C. Rapier, London.
9737. WATER, &c., BOTTLE, A. W. Birt, London.
9738. TRICYLES, J. and T. Webb, Coventry.
9739. FIRE-GRATES for MARINE BOILERS, G. Mead, Cardiff.
9740. STRETCHING LACE CURTAINS, L. R. Marsden, Darwen.
9741. CASE for BATS, &c., B. Nicoll, New York.
9742. EXCENTRIC for SLIDE VALVES, W. H. Beck.—(*V. C. Tripier, France.*)

4th July, 1884.

9743. HOLLOW LASTS in CAST IRON, &c., J., P., and A. Cave, Rushden.
9744. SMOKE PREVENTERS, T. Telford, Newcastle-on-Tyne.
9745. SCREW NUTS, W. H. Woolley, Birmingham.
9746. SPRING BRACES, D. and S. Timings, Birmingham.
9747. TRANSLUCENT PLATES for ROOF LIGHTS, &c., W. Kennedy, Glasgow.
9748. CRANES, C. Clayton, W. N. and R. Dack, Preston.
9749. PROPELLING VESSELS, G. Warsop and H. W. Hill, Nottingham.
9750. FEEDING STEAM BOILERS with WATER, D. Allingham, Liverpool.
9751. DRAWING DESIGNS for CARPETS, &c., W. L. Fawcett, Kidderminster.
9752. ORNAMENTAL SIGN-BOARDS, &c., J. R. Collier, and D. S. Musgrave, Manchester.
9753. ELECTRICAL POWER, J. B. Denis, London.
9754. RAZOR STROPS, W. Nathan, West Brighton.
9755. MACHINERY for WINDING YARNS, J. Ashworth, Patricroft.
9756. SULPHUROUS COLOURS, E. Capitaine.—(*Ewer and Pick, Germany.*)
9757. TAPS and VALVES, J. A. Elstob, and G. C. Gibbs, London.
9758. TAPS, T. G. Fisher.
9759. PRODUCING WRITING on PAPER, A. Ford, London.
9760. MATCH-BOXES, J. E. T. Woods, and G. V. Jameson, London.
9761. EXTRACTING SULPHUR from PYRITES, A. C. Henderson, London.
9762. CATTLE DRINKING TROUGHS, R. Pringle, London.
9763. APPLIANCES for WASHING GROWING HOPS, &c., W. Levett, Cranbrook.
9764. BRAKES for VEHICLES, J. P. Davies, Chester.
9765. DECARBONATING CARBONATE of STRONTIA, J. Imray, London.
9766. CHRONOSCOPES for SHOWING TIME, W. Gillett, Croydon.
9767. TREATING CORPSES, H. J. Haddan.—(*F. Boitel, France.*)
9768. EFFECTING the RECOVERY of SULPHUR from SODA WASTE, W. L. Wise.—(*H. Grouven, Germany.*)
9769. SHIP PROPELLERS, G. T. Dickinson, Newcastle-upon-Tyne.
9770. STOP ATTACHMENT for DOORS, J. H. Johnson.—(*Variclé and Co., and M. M. F. Moulin, Paris.*)

5th July, 1884.

9771. RECEIPT CHECK, W. Tilley, Brighton.
9772. FELT, W. G. Bywater, Holbeck, and T. B. Beanland, Beeston Hill.
9773. SPEED GEAR of VELOCIPEDES, G. Taylor, Birmingham.
9774. GAS-FIRED DIGESTER, T. A. Reid, Bootle.
9775. TAKING OFF GAS from RETORTS, &c., J. King, jun., Manchester.
9776. RANGING PATTERNS, T. Chattaway, jun., and J. G. Chattaway, Leicester.
9777. RANGING PATTERNS, T. Chattaway, jun., and J. G. Chattaway, Leicester.
9778. STOP MOTION for SPINDLES, A. Brearley, W. Bagshaw, and R. Clark, Batley.
9779. TOPS of BOTTLES, J. Meeson, Sheffield.
9780. LIMING FUSTINS, VELVETS, &c., J. R. Meanock, Royton.
9781. DISINFECTING APPARATUS, W. Fearenside, Liverpool, and R. Baynes, Liscard.
9782. MIRROR DECORATION, M. T. Sharpe, London.
9783. RAISING LAGER BEER, &c., J. Formby and C. Keizer, Liverpool.
9784. LOOMS, O. Wilkinson, Manchester.
9785. BOLTS, NUTS, &c., S. Rideal, Manchester.
9786. GAME or PUZZLE, R. Ferguson, Glasgow.
9787. CUTTING the PILE of VELVETS, &c., H. Greaves, Oldham.
9788. CLIPPING GRASS VERGES, J. McCrae, Camphill.
9789. STOPPERING BOTTLES, T. and J. Brooke, Sheffield.
9790. HANSOM CABS, D. E. Langham, Wimbledon.
9791. OPENING and CLOSING BOTTLES, D. E. Langham, Wimbledon.
9792. PROPELLING, &c., PHOTO VIEWS, &c., R. R. Beard, London.
9793. PLUMB RULE, T. Wright, Northampton.
9794. BEE-HIVE, T. E. Clark, Sudbury.
9795. EXTINGUISHING FIRE, E. G. Reuss, Withington.
9796. SPINNING and DOUBLING FRAMES, J. Hargreaves, Bolton.
9797. CELLULOSE and GLUCOSE, A. Behr, Coethen, Germany.
9798. LOCKS and LATCHES, E. R. Wethered, Woolwich.
9799. MAINTAINING the TEMPERATURE of LIQUIDS, J. M., J., and A. J. Gimson, Leicester.
9800. TYPE MATRIX, &c., MACHINES, A. J. Barker, London
9801. MEASURING, &c., ELECTRICAL ENERGY, F. Walker, London.
9802. BLEACHING LINEN, &c., R. B. Lytle, Belfast.
9803. FIREPROOF PAINTS, VARNISHES, &c , S. J. Blane, London.
9804. GRAIN DRESSING and SCREENING MACHINES, T. Corbett, Salop.
9805. PUMPS, J. Tobin, London.
9806. PUMP, J. Imray.—(*La Société Poron Frères, Fils, et Mortier, France*)
9807. SEWING MACHINES, W. Beecroft and D. Noble, Leeds.
9808. COLOURING MATTER, W. R. Lake.—(*L. Vignon and Co., France.*)
9809. WORKING DETONATING SIGNALS, T. F. Fenney, Yarm.
9810. TYPE-WRITING MACHINES, E. Howard, London.
9811. TYPE WRITERS, J. P. Smith, Birmingham.
9812. COLOURING MATTERS, W. R. Lake.—(*L. Vignon and Co., France.*)
9813. ADMITTING, &c., STEAM to ENGINES, G. T. Dickinson, Newcastle-upon-Tyne.
9814. LOCOMOTIVES, &c., G. T. Dickinson, Newcastle-upon-Tyne.
9815. REVERSING MOTION, G. T. Dickinson, Newcastle-upon-Tyne.

7th July, 1884.

9816. WINDING THREAD into BALLS, T. G. Coats and T. Watson, Paisley.
9817. FOLDING ELEVATORS, W. Hornsby and R. Edwards, Grantham.
9818. CHURNING BUTTER, J. H. Thompson, Huxley.
9819. RAILWAY FOG SIGNALS, T. Whitaker, Horsforth.
9820. BOOT STANDS, S. Harris, Birmingham.
9821. VELOCIPEDE FOOT PEDALS, J. A. Ewins and A. T. Andrews, Birmingham.
9822. HOT AIR ENGINES, H. Robinson, Manchester.
9823. TAKING OFF PRESSURE in CASKS, P. Duff, Liverpool.
9824. METALLIC PACKING, J. N. Taylor, North Shields.
9825. ALPHABETICAL ELECTRIC-TELEGRAPHIC INSTRUMENTS, R. C. Williams, Birmingham.
9826. WINDING THREAD, T. G. Coats and T. Watson, Paisley.
9827. FIXED POINTS for TRAMWAYS, &c., M. Phillips, Darlaston.
9828. MOVABLE POINTS for TRAMWAYS, &c., M. Phillips, Darlaston.
9829. CAGE GUIDES for HOISTING PURPOSES, D. McAdoo, Wakefield.
9830. WRINGING, &c., MACHINES, J. Willis, Sheffield.
9831. LAMPS, F. Bosshardt.—(*W. Clauss, Berlin.*)
9832. VELOCIPEDE, J. H. Reynolds, Birmingham.
9833. OBTAINING MOTIVE POWER, W. S. Sutherland, Birmingham.—*22nd May*, 1884.
9834. GLASS BOTTLES, R. Mayall, jun., Oldham.
9835. WATER-WHEELS, J. V. and W. C. Toone, Warminster.
9836. IMPLEMENT for DECAPITATING CEREALS, H. H. Duke, Brixton Deverill.
9837. UNLOADING, &c., CEREALS, H. H. Duke, Brixton Deverill.
9838. SHELTERER for CEREALS, H. H. Duke, Brixton Deverill.
9839. SEED and EAR STORER, H. H. Duke, Brixton Deverill.
9840. COMBINATION MUSICAL INSTRUMENT, J. H. Abel, London.
9841. MAKING NOTCHES for UMBRELLAS, &c., C. F. Nokes, Aston.
9842. THURMING of SIDED OBJECTS, R. H. Manning, London.
9843. FRAMES for ELECTRODES, F. G. Howard, London.
9844. ATTACHING BUTTONS to BOOTS, &c., J. R. Green, F. W. Plant and J. Newman, Birmingham.
9845. AIR-PRESSURE SHOE, W. Howard, London.
9846. EXCAVATORS, J. F. Sang, London.
9847. TREATING PASTEBOARD, W. E. Gedge.—(*E. P. Louvot, Paris.*)
9848. HORSESHOES, J. Macdonald, London.
9849. CONVERTING ROTARY into RECIPROCATING MOTION, L. Hopcraft, London.
9850. COOKING RANGES, J. B. Colbran, London.
9851. TRAWLING NETS, S. Kemp, London.
9852. PLOUGHS, H. J. Haddan.—(*R. Sack, Saxony.*)
9853. IRON, J. G. Williams, West Hampstead.
9854. REMOVING SOOT from STEAM BOILERS, A. O. Stopes, Colchester.
9855. TELEPHONE SWITCHES, &c., P. Jensen.—(*Messrs. Stockholms Bell Telephon Aktiebolag, Stockholm.*)
9856. THREE-HIGH ROLLER MILLS, I. Imray.—(*H. Simon, Switzerland.*)
9857. INTERMITTENT FLUSHING APPARATUS, F. Cuntz, Bohemia.
9858. ROTARY MOTOR ENGINE, P. B. A. Ganot, Paris.
9859. ORGAN, J. Jones, Bristol.
9860. COMBINATION ORGAN and HARMONIUM, J. Jones, Bristol.
9861. APPARATUS for BORING MINERALS, T. Jacob, London.
9862. AUTOMATIC CUT-OFF VALVE GEAR, G. Low, Ipswich.
9863. TRAIN SIGNALLING APPARATUS, J. Enright, London.
9864. TRANSMITTING MOTION to SPEED INDICATORS, J. M. Napier, London.
9865. SECURING, &c., COVERINGS of BOILERS, C. F. Wormald, Newcastle.
9866. IMPARTING HEAT to FLUID, A. T. Booth, Hoxton.
9867. INSERTING PINS in UMBRELLA FRAMES, &c., G. F. Redfern.—(*D. M. Redmond, Philadelphia, U.S.*)
9868. ATTACHING HEELS to BOOTS, T. Peberdy, H. J. Cherry, and W. Earp, Leicester.
9869. KNITTING MACHINES, E. Hélin, Belgium.
9870. GALVANISED WIRE, L. Hill, Middlesbrough.
9871. TREATING BOTTLED BEER, C. Graham, London.

ABSTRACTS OF SPECIFICATIONS.

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

4968. HEATING FLUIDS, *H. Defty, London.*—*18th October*, 1883. 6*d.*

This relates to an arrangement of vertical and elongated tubes subjected to heat from gas-burners.

5135. SIGNAL LAMPS, &c., *J. Rogers, London.*—*30th October*, 1883. 6*d.*

This relates to improvements on patent No. 1035, A.D. 1883, and consists in causing coloured discs of glass to be moved up between two lenses of white glass for adapting the lamps to railway signals. Two plain convex lenses are arranged a short distance from each other in front of the light, the convex surface of each lens being directed outwards.

5144. MOUNTING the WHEELS of RAILWAY CARRIAGES, &c., *J. E. S. Thornhill, T. Forknall, and E. Thornhill, near Manchester.*—*30th October*, 1883. 6*d.*

The journals of the axles of railway, tram, and other cars are reduced in diameter, and each wheel is mounted on a separate axle, the object being to reduce the tractive force of the vehicle. Each axle has a journal on each side of the wheel.

5222. MANUFACTURE and PRINTING of RELIEVO MAPS, *H. E. Newton, London.*—*2nd November*, 1883. —(*A communication from J. J. de Mendonca-Cortez, Lisbon.*) 4*d.*

Relates to the use of hollow composite engraved moulds for the production, by the aid of pressure, of relievo maps.

5223. CARBONISING or DESTROYING VEGETABLE MATTER CONTAINED in WOOLLEN or SILK FABRICS, *G. and J. B. Tolson, Dewsbury.*—*2nd November*, 1883. 8*d.*

The apparatus is divided into suitable compartments or chambers, some of which are heated in order to prepare the pieces or slivers for proper and effective carbonisation, whilst the other chambers are employed for the purpose of carbonising and neutralising the effects of the acid.

5224. PENCIL CASES, &c., *A. H. Woodward, Birmingham.*—*2nd November*, 1883. 6*d.*

Relates partly to pencil-cases, &c., in which the part or movement containing or holding the lead, pen, &c., is capable of being projected from, or withdrawn into its case, either by pressing or sliding inwards the terminal cap of the holder or case, when unsheathing or shooting forward the writing or other instrument; also by partially rotating the said pusher mount, the writing or other instrument is again shot within its case or holder, in order to protect the point from injury or otherwise.

5225. SPRING SEATS or SADDLES, APPLICABLE for BICYCLES, TRICYCLES, &c., *W. P. Thompson, Liverpool.*—*3rd November*, 1883.—(*A communication from C. E. Duryea, St. Louis, U.S.*) 6*d.*

Relates to a bicycle saddle consisting of a frameless flexible seat, a sustaining spring at its lower end, and a clip or equivalent device at the forward end, adapted for positive connection with the neck of the backbone.

5226. STATIONERY to ENABLE PERSONS to ASCERTAIN the POSTAGE to BE PAID upon ANY LETTER, without WEIGHING the SAME, *G. A. Robinson, Manchester.*—*3rd November*, 1883.—(*A communication from R. E. Ogilby, Los Angelos, California.*) 4*d.*

Consists principally in printing or stamping upon such paper a device or symbol indicating the amount of postage required to be paid thereon.

5228. SPINNING MACHINERY, *J. M. Hetherington, Manchester.*—*3rd November*, 1883. 6*d.*

Consists partly in passing the yarn directly from the rollers to the tip of the spindle at such an angle as that the yarn shall coil around the tip of the spindle before passing to the traveller.

5229. WINDING and REELING YARNS, &c., *L. Haslam and C. Marshall, Bolton.*—*3rd November*, 1883.—(*Not proceeded with.*) 2*d.*

The apparatus consists of a snick plate cut diagonally at the bottom of the slits, in the front of which are arranged catches or levers of suitable shape as to form with the plate, eyes, through which the yarn is drawn in the process of being wound.

5230. CARDING COTTON, &c., *B. A. Dobson and W. I. Bromiley, Bolton.*—*3rd November*, 1883. 6*d.*

Refers, First, to an arrangement for casing in that portion of the carding engine between the doffer and the cylinder; Secondly, to a method of setting, regulating, and arranging the two back knives or casing between the cylinder and licker-in, and between the cylinder and flats upon one fixing on each side, which are cut or turned truly to the radius of the cylinder, or planed or cut at right angles to the centre line of the cylinder, or any suitable arrangement. Other improvements are described.

5231. SEWING MACHINES, *H. Beech, Denton.*—*3rd November*, 1883.—(*Not proceeded with.*) 2*d.*

Relates, First, to the feed motion; and Secondly, to the guide or folder.

5232. PIPE SYSTEMS for DISTRIBUTION and SUPPLY of COMPRESSED AIR, *J. Sturgeon and C. J. T. Hanssen, London.*—*3rd November*, 1883.—(*Partly a communication from F. A. English, Copenhagen.*) 6*d.*

Relates, First, to constructing the pipes used in pipe systems for distribution and supply of compressed air with longitudinal beads or ribs; Secondly, to the applications in pipe systems for distribution and supply of compressed air of self-acting valves.

5234. ANNEALING WIRE and METAL in OTHER FORMS, *S. Fox, London.*—*5th November*, 1883. 6*d.*

Consists partly in the arrangement of annealing furnaces and apparatus, the body of the furnace being divided into two compartments, serving the one as a heating and the other as a cooling chamber, and containing annealing cylinders, to which a rotary motion is imparted.

5235. TREATING ORES, *T. R. Jordan, London.*—*5th November*, 1883. 6*d.*

Relates to machinery for passing ores containing gold or silver in a finely divided condition through mercury, for the purpose of separating the precious metals from such ores by amalgamation, and for concentrating the residue of such ores or similar materials.

5236. EXTRACTING METALS from THEIR ORES, &c., *T. R. Jordan and J. N. Longden, London.*—*5th November*, 1883. 6*d.*

Relates to an automatic and continuous process for the extraction of gold and silver from their ores, by reduction and amalgamation with mercury without the use of water.

5237. MACHINERY EMPLOYED for SIZING YARN, *A. Hitchon, Accrington.*—*5th November*, 1883. 8*d.*

Relates to the friction motion of the class known as lever friction motions, and the object is to reduce the loss of power occasioned by contact of boss or exterior of the apparatus on and against a stationary part of the machine.

5239. APPARATUS for BEATING SCYTHES, *H. J. Haddan, London.*—*5th November*, 1883.—(*A communication from J. Fangere, Montignac de Lauzan, France.*)—(*Not proceeded with.*) 2*d.*

Relates to an apparatus for holding the scythe on the anvil.

5240. NET, *B. J. B. Mills, London.*—*5th November*, 1883.—(*A communication from F. Marion, Lyons.*) —(*Not proceeded with.*) 4*d.*

The net is distinguished from others by the fact that the threads which form the meshes are composed of two or more threads plaited, braided, or twisted together during the manufacture of the net, and that their junction takes place no longer by a knot, but by the crossing of the plaited or braided threads, or the plaiting or braiding of the twisted threads which compose the two strands to be united,

5241. SCREWING AND TURNING MACHINES, *J. Barrow, Leeds.—5th November*, 1883. 6*d*.
Relates particularly to the arrangement of the line of traverse of the die holders, and the position of the dies with regard to the traverse of the die holders.

5242. WATERPROOFING FABRICS, LEATHER, &c., *E. de Pass, London.—5th November*, 1883.—(*A communication from A. Libre, Paris.*) 4*d*.
The composition consists of liquid Bordeaux turpentine, or turpentine paste, tallow, wax, and styrax melted together.

5243. INSTRUMENTS FOR HOLDING, DAMPING, &c., POSTAGE OR OTHER STAMPS, *W. A. South and C. F. Sarpy, London.—5th November*, 1883.—(*Not proceeded with.*) 2*d*.
Consists of a holder or receptacle for containing the stamps, and a pad on which the stams are damped.

5245. PENCIL-CASES, *C, D. Abel, London.—5th November*, 1883.—(*A communication from F. Froescheis, Nüremburg.*)—(*Not proceeded with.*) 2*d*.
Relates to pencil-cases in which a stick of graphite or other marking material is held by spring claws that can be opened by external pressure.

5246. SELF-CLOSING UMBRELLAS, &c., *A. J. Boult, London.—5th November*, 1883.—(*A communication from F. Jorns, Berlin.*)—(*Not proceeded with.*) 2*d*.
The umbrella is caused to close by means of a spring.

5247. ROTARY DEVICES FOR DISPLAYING ADVERTISEMENTS, &c., *H. H. Lake, London.—5th November*, 1883.—(*A communication from G. L. Chapin, Chicago, U.S.*) 6*d*.
A gas globe is attached to a wheel with inclined blades, which is supported over a gas or other burner, and is thereby caused to revolve.

5248. APPARATUS FOR MECHANICAL PLAYING OF KEYBOARD INSTRUMENTS, &c., *R. H. Bishop and W. Downs, London.—5th November*, 1883. 8*d*.
Relates to apparatus for mechanically playing on pianos or other keyboard instruments, the moving parts of which are worked by pneumatic power.

5250. LAMPS FOR BURNING OILS, *A. Martin, Old Windsor.—5th November*, 1883.—(*Not proceeded with.*) 2*d*.
Relates to means of supplying air to the flame.

5253. MICROMETER VALVES, *J. Ohren, Rio de Janeiro.—6th November*, 1883.—(*Not proceeded with.*) 2*d*.
The regulation of the outflow of gas or other fluid is determined not by increasing or diminishing the size of an orifice, as in ordinary cocks or valves, but by increasing or diminishing the length of the conduit through which the fluid has to travel.

5256. SOUNDING APPARATUS, *J. B. Hannay, Glasgow.—6th November*, 1883. 6*d*.
Consists in the combination of a pointer moving over a dial, a ratchet wheel and catch for retaining the pointer when moved, and mechanism for transmitting motion to the pointer, with a barometric hermetically closed vessel, the form of which alters with changes of pressure, the whole being arranged for sinking and acting as sounding apparatus.

5257. OBTAINING GLYCERINE FROM SPENT LYE PRODUCED IN THE MANUFACTURE OF SOAP, *G. Payne, Wakefield.—6th November*, 1883. 2*d*.
To a convenient quantity of lye is added some caustic lime, about three parts by weight of lime to four parts of lye, which are boiled together. To this liquid is added a mineral acid, preferably hydrochloric, the acid being slightly in excess. This mixture is boiled and the excess of acid is neutralised by lime.

5258. COLLAR CLIP FOR NECKTIES OR SCARFS, *A. Hogg, Manchester.—6th November*, 1883.—(*Not proceeded with.*) 2*d*.
Relates to the employment of an S-shaped clip.

5259. CAR COUPLINGS, *A. J. Boult, London.—6th November*, 1883.—(*A communication from R. H. Dowling and C. H. Follet, Newark, and E. Crowl, Cleveland, U.S.*)—(*Not proceeded with.*) 2*d*.
Consists in the construction and arrangement of an oblique slide pin and its stops, and in connection therewith a spring lever having transverse arms extending to the sides of the car.

5260. TRICYCLES, *A. Gent and C. N. Spencer, Nottingham.—6th November*, 1883.—(*Not proceeded with.*) 2*d*.
Relates to improvements in the general arrangement of the parts.

5261. GAS METERS, *T. G. Marsh, Oldham.—6th November*, 1883.—(*Not proceeded with.*) 2*d*.
Relates to wet gas meters in which the drum is mounted in suitable floating bearings, which, with the drum, are free to float in and rise and fall with the water through which the drum moves.

5264. GEAR WHEELS, *W. R. Lake, London.—6th November*, 1883.—(*A communication from R. K. Noye, G. Urban, jun., and B. F. Ortman, Buffalo, U.S.*) 6*d*.
Relates to a gear wheel having a non-metallic noiseless body, constructed wholly or partially of vulcanised fibre, and having cogs or teeth formed in the said body.

5265. GAS ENGINES, &c., *P. M. Justice, London.—6th November*, 1883.—(*A communication from W. E. Hale, Chicago.*) 8*d*.
Relates to several improvements in the general construction of the engine, the charge of gas being ignited by electricity.

5266. ROTARY STEAM ENGINES, *J. Sant, Newcastle-under-Lyme.—6th November*, 1883.—(*Not proceeded with.*) 2*d*.
Relates to the general arrangement of the cylinder, piston, and valve.

5270. VENTILATOR, *T. Bauchop, Alloa, N.B.—7th November*, 1883. 6*d*.
Relates to improvements in the general construction of ventilators for buildings.

5271. MANUFACTURE OF BOOTS AND SHOES WITH INDIA-RUBBER SOLES, *J. Frankenburg, Salford.—7th November*, 1883. 2*d*.
The rubber soles are secured to the leather soles by cement, and the two are then fastened together by means of rivets or other metal fastenings.

5432. FIRE-SCREENS, &c., *A. Hildesheimer, London.—17th November*, 1883.—(*A communication from E. Nister, Bavaria. (Complete.)* 4*d*.
The fire-screen is made of pasteboard or other material, and forms separate chambers.

5445. INTERNALLY-STOPPERED BOTTLES, *D. Rylands, near Barnsley.—19th November*, 1883. 6*d*.
This relates to means for punching holes in the necks of bottles before the bottles leave the moulds.

5487. ROTARY ENGINES, *A. A. W. Van Reede, Holland.—22nd November*, 1883. 6*d*.
A cylindrical block is mounted excentrically on a shaft and works as a piston in a cylinder, which it causes to move to and fro, steam being admitted alternately to the top and bottom of the cylinder by a sliding valve upon the cover, to which a vertical movement is imparted by an excentric.

5496. PURIFICATION OF WATER, *W. Anderson, London.—23rd November*, 1883. 6*d*.
Spongy iron is placed in a revolving vessel, and water caused to pass through the hollow trunnions of such vessel, in at one end and out of the other.

5507. MECHANICALLY COOLING AIR FOR PRESERVATIVE AND OTHER PURPOSES, *J. J. Coleman, Glasgow.—24th November*, 1883. 6*d*.
This relates to cooling air by compressing, cooling, drying, and expanding it, and it consists in arranging the motive power, air compressing and re-expansion cylinders horizontally in two parallel lines, the steam cylinders being connected to different cranks on separable parts of a shaft, each with an air compressing cylinder and a re-expansion cylinder, with their pistons on same rod as steam cylinder, the steam cylinders being of different sizes and working on the compound system, and also independently.

5515. MANUFACTURE OF COLOURING MATTERS, *W. R. Lake, London.—24th November*, 1883.—(*A communication from Messieurs L. Vignon et Cie., Lyons.*—(*Not proceeded with.*) 2*d*.
Relates to a method or process of manufacturing colouring matters, such as yellow, orange, red, and violet from a naphthol.

5516. MANUFACTURE OF GIMP, *F. C. Glazer, Berlin.—26th November*, 1883.—(*A communication from C. L. Hohl, Dresden.*) 10*d*.
The machinery makes simultaneously two principal motions, of which one serves to form the loop or bow, and the other to interlace the binding cord, &c., so as to produce the gimp. An arrangement is employed for introducing pearls or beads between the separate loops of the gimp.

5517. CONTROL APPARATUS FOR VEHICLES, *G. Prölss, Dresden.—26th November*, 1883.—(*Not proceeded with.*) 4*d*.
The object is to calculate the fare for one or more persons according to the distance travelled, and to enable the passenger as well as the owner of the vehicle to control the fare charged and the money received.

5518. SCULLS AND OARS, *J. O. Spong, London.—26th November*, 1883. 6*d*.
The object is to enable a sculler to face the direction of travel, and it consists in forming the sculls in two parts with toothed segments at their ends gearing together, so that when the part grasped in the hand is moved in one direction the blade part moves in the opposite direction.

5519. PRESERVING AND HARDENING WOOD, &c., *A. Egestorff, Kingston-upon-Hull.—26th November*, 1883.—(*Not proceeded with.*) 2*d*.
Consists in the employment of alkalies and phosphates varied by use of urine and salts which are caused to impregnate and permeate into, through, and among the pores and fibres of the wood.

5521. SEWING MACHINES, *J. E. Péchard, Paris.—26th November*, 1883. 6*d*.
This consists in forming the needle with a flattened surface so as to enable it to be correctly set in the socket of the needle bar.

5526. FASTENINGS FOR DOORS AND WINDOWS, &c., *H. Hancock, London.—26th November*, 1883. 6*d*.
A central handle is by suitable mechanism caused to actuate bolts arranged at the top, bottom, and sides of doors and windows.

5528. PROPELLING AND STEERING SHIPS, *B. Dickinson, Bourne End, Bucks.—26th November*, 1883. 6*d*.
Consists in the use for propelling a ship or vessel of two screw propellers, having blades of quick or coarse pitch, the one being right-handed and the other left-handed, these two screw propellers being arranged side by side with their axles parallel, and being caused to rotate in unison, but in opposite directions, in such a manner that by the reciprocal and simultaneous pressure of their respectively corresponding blades upon the water for the time being within their influence, resistance is created to the rotation of the propellers.

5530. FURNACES FOR HEATING IRON, &c., *W. Farnworth, Dudley, and W. Felton, Stourport.—26th November*, 1883. 6*d*.
Consists in a furnace for heating iron or for other purpose, in which the escaping or waste gases are employed for heating a boiler or for other heating purposes, of the provision of air passages or pipes in connection with the flues or surfaces heated by the said escaping or waste gases, the said air passages or pipes opening into other passages or pipes by which heated air is conducted to the furnace to effect the combustion of the gases.

5531. HYDRAULIC HOISTS FOR SHIPPING COAL, *B. Walker, Leeds.—26th November*, 1883.—(*Not proceeded with.*) 2*d*.
A framework is provided, mounted on wheels, and capable of traversing upon rails along the quay wall. Upon this framework two cradles are provided, and they are connected together by chains passing over pulleys at the top of the framework, so that the weight of one cradle is balanced by that of the other. By means of chains actuated by the rams of inverted hydraulic cylinders, these cages can be hauled up and down in the framework, one ascending as the other descends.

5532. WINDING COTTON AND OTHER YARN AND THREAD, *H. C. Hill and H. H. Brown, Stalybridge.—27th November*, 1883. 6*d*.
Relates to mechanism which is intended more particularly for winding yarn or thread, either in a cylindrical or conical form on to spools without heads, in which a quick traverse or to-and-fro distribution of the yarn or thread is required to bind the coils together, prevent ravelling, and build the ends straight and square to the axis of the spool.

5533. MANUFACTURE OF BLOCK ICE, *H. C. Smith, Richmond.—27th November*, 1883.—(*Not proceeded with.*) 2*d*.
The process consists in the congelation from the centre of the block outwards.

5536. PENCILS, *J. Darling, Glasgow.—27th November*, 1883.—(*Not proceeded with.*) 4*d*.
Relates to improvements in attachments for sharpening the leads of "solid ink" pencils, or pencils of analogous class, and in the actuating of the leads thereof, &c.

5537. HEATING AIR, *J. Murray, Paisley.—27th November*, 1883.—(*Not proceeded with.*) 2*d*.
The object is to effect the heating of air by utilising the waste heat escaping from the flues of steam boiler and other furnaces, by causing the waste heat to be taken up by air contained in or passing through one or more chambers placed between the flue or flues of the chimney.

5538. COMPOUND MARINE ENGINES, *W. P. Thompson, Dundee.—27th November*, 1883. 6*d*.
Relates to "triple compound engines," and the improvements consist in placing over each of the cylinders, which correspond to the two respective high and low-pressure cylinders of an ordinary compound engine, a high-pressure cylinder. These high-pressure cylinders may be of equal or different bores, so that the balance of potential or driving power is capable of being adjusted to exactitude. Both the high-pressure cylinders receive steam direct from the boiler, and alternately exhaust the same into the casing of the second cylinder, whence the steam passes to the largest or lowest pressure cylinder.

5539. SUPPLYING AN ELECTRIC CURRENT TO THE COMMUTATOR OF ELECTRO-MOTORS, &c., *M. Immisch, London.—27th November*, 1883.—(*Not proceeded with.*) 2*d*.
The collectors consist of a number of separate metallic balls, each of which fills an annular groove formed in the outer surface of the commutator.

5541. PRODUCING MOTIVE-POWER, *W. Ross, London.—27th November*, 1883.—(*Not proceeded with.*) 2*d*.
Relates to apparatus for producing motive-power by currents of air or water for the purposes of ventilation, or for its adaptation as a chimney cowl.

5544. MANUFACTURE OF BICARBONATE OF SODA BY MEANS OF AMMONIA, &c., *A. M. Clark, London.—27th November*, 1883.—(*A communication from La Société Anonyme des Produits Chimiques de l'Est, Nancy, France.*) 8*d*.
Relates partly to the means for multiplying the passages of the carbonic acid gas through the ammoniacal brine, and also the number of liquid surfaces and of gas spaces, consisting in the employment of a number of inverted trough or bell chambers having notched edges and arranged in superposed series in a single receiver.

5546. LATHES, *J. A. B. de Castelberg, Chaundefonds, Switzerland.—27th November*, 1883.—(*A communication from C. Piquereq, St. Ursanne, Switzerland.*) 6*d*.
Relates to a lathe adapted for turning the bezels and centres of watch cases, and having a movable tool holder within a series of tool carriers and tools and adjustable stops, by which the tool holder can rapidly be brought to several pre-arranged positions, one position suited to each tool, and other adjustable stops by which the movements of the tool carriers and tools relatively to the tool holder are limited and controlled.

5547. ADVERTISING, *H. A. Bonneville, Paris.—27th November*, 1883.—(*A communication from A. Ralu-Eaubonne, France.*)—(*Provisional protection not allowed.*) 2*d*.
Relates to utilising the inner surfaces of envelopes for advertising.

5548. INCANDESCENT ELECTRIC LAMPS, *J. C. Mewburn, London.—27th November*, 1883.—(*A communication from J. Kahn and I. Bräuer, Vienna.*)—(*Not proceeded with.*) 2*d*.
This relates to spring ring holders for incandescent lamps. Four modifications and a reflector arrangement are described.

5550. MANUFACTURE OF MANURE FROM SEWAGE, &c., *J. H. Kidd, Wrexham.—27th November*, 1883. 2*d*.
Consists in taking either dried sewage, sludge, or dried excretal matter, and after adding to it as much sulphuric acid as it will absorb, or more or less, placing it in trays in a purifier, so as to allow the gas, which is generated in the retorts, after cooling, to be passed through such purifying materials for the purpose of fixing any free ammonia that might otherwise pass away with the gas and be lost.

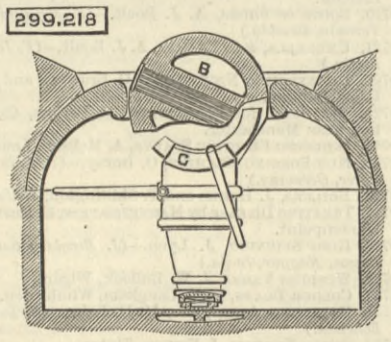
5551. REVERBERATORY GAS FURNACES, *W. L. McNair, Golden, U.S.—27th November*, 1883. 10*d*.
Consists, First, in the combination of suitable muffles in which fuel is placed, with an inclined plane in front of the grate, and upon which the fuel is banked for the purpose of preventing the escape of the volatile matter in the fuel without first passing through the mass of heated coke, so as to decompose its moisture and regenerate the gas; Secondly, in the combination of the muffles and the inclined plane upon which the coke is banked, with suitable air flues, for the purpose of conducting air or steam through the coke for the purpose of reducing the coke to carbonic oxide; Thirdly, in muffles which are built in sections, or of brick, and then thoroughly washed over with any glazing compound, so that when heated they form a solid body; Fourthly, the combination of the hearth with a water chamber, which is placed under it for the purpose of preventing the hearth from being injured by the heat; Fifthly, in the arrangement and combination of air flues and passages.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

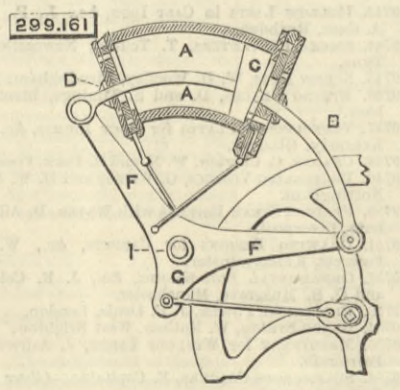
299,218. MORTAR AND GLOBULAR SHIELD FOR THE SAME, *Herman Gruson, Buckau, near Magdeburg, Prussia, Germany.—Filed December 21st*, 1883.
Claim.—A barrel for mortars or other pieces of ordnance, rigidly secured within and completely closing an opening in a spherical or nearly spherical shell or casing whereby it is carried, in combination with suitable means for supporting said shell or casing, substantially as and for the purpose set forth. (2) The combination, with the globular shell or casing B, carrying the barrel, and the base piece C, of the anti-friction balls *k*, annular bearing ring *l*, and support D, as and for the purpose set forth. The combination, with the barrel of a gun, having a suitable carriage, of a universally swinging weight depending therefrom, and a suitable frame for supporting said carriage, so constructed as to allow free lateral movement to said weight to compensate for the rolling of the vessel or to take up the recoil of the gun, or both, substantially as set forth. The combination, with the shell B, carrying the barrel, and the pillar C, having weight G depending therefrom, of the support D and anti-friction balls *k*, located between said support and the pillar C, substantially in the manner and for the purpose set forth.

299.218



299,161. STEAM ENGINE OR WATER MOTOR, *Gerritt S. Peppard, Kansas City, Mo.—Filed October 2nd*, 1883.
Claim.—(1) The combination, with the cylinder A A, of the piston-rod of this form B, the arms F F and G, the main pin I, and the packing-boxes D, arranged for operation substantially as shown and described.

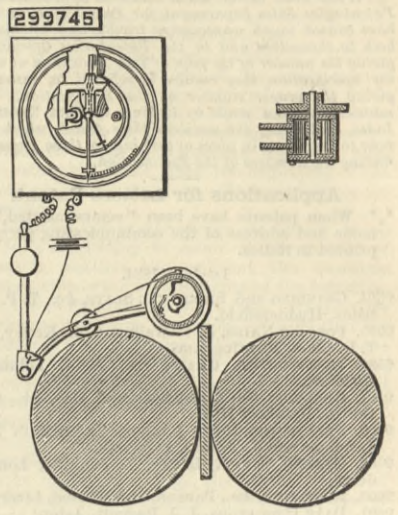
299.161



(2) In an engine for motive power, a radially-bored cylinder, a piston-rod conforming to the circle of the same, and having attached the piston C, and a balanced slide valve, with openings, as shown, at each end of the cylinder, all arranged for operation substantially as set forth.

299,745. APPARATUS FOR MEASURING THE LINEAL FEET OF WORK DONE BY A WOOD-WORKING MACHINE, *Francis Crosby Cooke, Whitehall, N.Y.—Filed March 17th*, 1884.
Claim.—(1) In a wood-working machine, a friction wheel adapted to ride upon the wood, and provided with a mechanism for making and breaking an electric circuit, in combination with an electric circuit and electro-magnet actuated by said circuit, a registering dial, indicating hand or hands, a spring or weight actuated train of wheels, and a connecting mechanism between said train of wheels and the armature of said magnet, whereby the movements of the wheels are controlled by the magnet, all the parts being arranged substantially as and for the purposes set forth. (2) The method of registering the number of lineal feet of work performed by a wood-working machine, consisting of actuating a circuit breaker by contact with the wood to make and break an electric circuit at regular known space intervals, and registering or indicating the number of said intervals upon a space

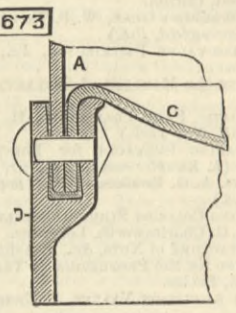
299745



dial by one or more hands moved by a train of spring or weight actuated wheels controlled in their movements by the armature of a magnet operated by said circuit.

299,673. METALLIC VESSEL, *Adam O'Hara, New York, N.Y.—Filed March 11th*, 1884.
Claim.—The combination, in a metallic vessel for resisting heavy internal pressure, of the sides A, flanged bottom C, and channelled ring D, of rigid cast

299.673



metal, embracing the flanges on the sides and bottom, and rivetted through said flanges, whereby a strong bottom joint is formed, substantially as set forth.

299,886. DRILL CHUCK, *Chas. S. Westbrook, Sprague-ville, N.Y.—Filed 10th December*, 1883.
Claim.—The combination of a drill spindle having its outer end tubular, and provided with two diametrically-opposite longitudinal slots, a chuck or clamp clamping the outer end of the drill spindle, and having

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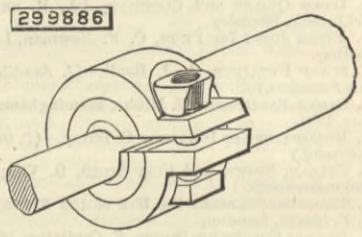

perforated lips for the reception of a screw bolt, and having recesses in its outer sides near the lips for the reception of the head of the bolt and of the nut, a soft-metal bushing having two diametrically-opposite longitudinal slots, and a drill bit, as and for the purpose shown and set forth.

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