## SHEAF-BINDING REAPING MACHINES.

No. 1.

In our last impression we gave a general account of the competitive trials which took place with sheaf-binding reaping machines at Montford, near Shrewsbury, under the auspices of the Royal Agricultural Society. These trials were probably the last that will be made with this class of machinery for some years, as they were carried out with a large number of machines, representing the best known makers, and as the results were, on the whole, such as showed that very satisfactory reaping and binding can now be done with one machine, the judges awarded the two high prizes offered by the Society. It is thought by many that there will not in all probability be any very remarkable changes in sheaf binders for some time. That is to say, that so much time and money have now been expended in perfecting these machines, that the success they have now attained shows that finality has been approached. Some account of the construction and working of those machines between which the real competition chiefly rested, will therefore be of interest.

In The Engineer of August, 1877, 1878, and 1881 we gave accounts of the trials which have been successively made with wire and with string sheaf-binding reapers, and in that of 17th August, 1877, complete illustrations of the McCormick wire binding mechanism were given, while the string binding mechanism of Mr. W. A. Wood was given on the 19th August, 1881. Messrs. Howard's wire binding apparatus was illustrated in our impression of the 12th December, 1879; while a series of engravings completely illustrating the Appleby knotter appeared in our impression of the 16th September, 1881, in connection with an account of Messrs. Samuelson and Co.'s sheaf-binder. A classified account of all the sheaf-binding machines exhibited at Derby was given in our impression for the 15th July, 1881. Our work in connection with the trials at Montford is thus lessened to some extent by what has gone before; but some modifications of an important order having been made, not only in the knotter and binder, but in the trip gear and other parts of almost all the machines tested, we must fully illustrate these in order to convey any idea of what the machine of 1884 is like.

Those who have followed the past seven years of the history of the sheaf-binder reaper will have gathered some idea of the amount of scrap iron that has been made in the endeavour to produce a satisfactory binding and knotting mechanism. A very strong effort was made to produce one which should be free of the American devices and work well. Only partial success was achieved, and of the large number of machines which entered the trial fields at Montford, not one had a strictly English binding mechanism. All but one, and that was the American machine of Mr. W. A. Wood, had the Appleby mechanism — Engineer, 16th September, 1881 — with slight modifications. This, perhaps, does not in any way detract from the English mechanics, but it is a fact which does great credit to those of America. The ingenuity displayed in the binder, knotter, and trip mechanism of a sheaf-binding reaper is second to nothing that was ever produced, though a reaper is not so interesting as a big clock, or perhaps a chronometer. To go through an ordeal such as that at Montford, however, a reaper must be almost as certain as the complicated movements of the clock at the New Courts of Justice, or, in fact, quite as certain, if we admit that a small earthquake is sufficient excuse for a clock to get a quarter of a second wrong. A reaper must have mechanism that will allow for the equivalent of the earthquake when it comes, and go on just the same. It must cut anything that good and bad farmers ever grew, on good and bad fields, so long as they call them crops, and say they are oats, or wheat, or barley, no matter what their condition. If the cutters one quarter minute, or even one second, cutting chock full, and the next nothing, or next to nothing, in one corner of the platform, the binder must and does hurry up, and takes two strokes instead of one, and the next quarter minute takes one or none instead of two. The thing "feels and acts like man," and if it does not think, it is only because its mechanism just stops short of that perfection which would make it, like humanity, unrenewable. The McCormick binding mechanism, for instance, is controlled, or rather set free by three different trips, each of which may act separately, or all in combination, two of which act automatically, and all of which may be actuated by the driver. There is hardly a complication of conditions or circumstances which this apparatus cannot cope with, so laboriously have all the peculiarities of crops and their conditions been studied, and the lessons acted upon, in its evolution. Many a very clever mechanist, accustomed to mathematical or astronomical machinery or looms, would find his hair curling, or on end, before he mastered one of these machines, and the hundreds of circumstances and freaks which it must allow for, and be sure all the time, especially if he had to learn it in a limited time; but this cannot be done; its mechanism might be learned by a good mechanic in a few hours, but its why's and wherefore's would be learned more quickly by a good sharp farmer who has made himself familiar with machinery, than by the professor in the shops or out of it. Not the least remarkable part of the performance of this machinery is that it works all the time, though it may be dancing, half of it, across water furrows or over land that is as up and down as a raised map of the Siebengeberge with the horizontal scale shortened up. If anyone not accustomed to these machines does not not think they really are such very clever pieces of mechanism, let him read conscientiously some of the descriptions which will follow with the cuts, and he will then, though he may believe more than he understands.

There seemed to be a general feeling on the part of those who took part in the trials that the judges, whom every one acknowledged had worked very hard in following up the machines, whatever might be their decision, had on the whole awarded the prizes in accordance with the performances, though for some reason a good many in the trade seemed unsettled in their minds as to whether Howard or Hornsby would be first, though their wishes on the subject were freely expressed. The general performance of the machines will have been gathered from our last impression. For trial on the dynamometer the machines so tested were put into a piece of wheat which was good, though not heavy, and was clean, though on a field which was not quite level. The cutting was done only on two sides of a parallelogram. On one side, which may be called the down side, the course was about three-fourths to four-fifths of its length nearly level, and the remainder an increasing down gradient to about 1 in 20 at the lower part. All the machines did their work in this wheat. There was a little difference in the cleanness of the sheaves, but the machine which made the most uniform sheaves and was the lightest in draught—namely, that of Mr. McCormick—had not done so well in other crops; not that the McCormick missed binding, for the machine seemed to bind everything it got hold of anyhow, and in the wheat the McCormick sheaves approached the most nearly to uniformity. Its draught was about 390 lb., and the mean weight of the sheaves 17·6 lb.

The Hornsby machines came next in draught and in uniformity of sheaf, and the finish of the sheaf was, perhaps, better than the others. The draught of the Hornsby machine was from about 400 to 410 lb., these figures being, as with McCormick, the means of the down and up runs. Three of Messrs. Hornsby's machines were tested, and all of them got through their work well. The weight of the sheaves made, varied a little more, though this is not of much importance, the average being 16 lb. The average width of cut by all the machines was 5ft. The knives were 5ft., except in the case of one of McCormick's machines, and in work they sometimes gathered somewhat and cut from 5ft. to 5ft. 5in., but the average effective cut, taking the width of two bouts at several places, was 5ft.

The Howard machines did good work, made good sheaves, and the machine which was ruled out was so in consequence of the driver's foot-board breaking. The draught of these machines was, however, higher, and ranged from about 430 lb. to 440 lb. The weight of the sheaves varied a little more than Hornsby's, the mean by one machine—No. 45—being 13·7 lb., and by No. 47 15·5 lb. In this wheat there was practically nothing to choose between the two makes of machines last referred to, but the work on other crops had been, in the opinion of the judges, better by Messrs. Hornsby's, and there was a point or two in Hornsby's machine which was preferred by them. Another question will be referred to further on. In one bout Messrs. Howard's machine was not set low enough, and to get the 6in. stubble the platform was tilted forward, so that the knives were far from horizontal. This considerably increased the draught, though this point was probably not the most important point in the judges' eyes.

The machine of Mr. W. A. Wood, when on the dynamometer in this wheat, cut, on an average, 5ft. 2in., and the draught was, on an average, about 435 lb.; but it must be remarked with respect to this machine, which did good work and is much liked for its simplicity, that in the down bout it was remarkably light in draught, while on going the up bout it was peculiarly heavy. This was probably the result of want of balance in the machine; but whatever the cause, it was very marked. The average weight of the Wood sheaf was 13·7 lb.

The Samuelson low delivery machine, the only really low delivery machine on trial, made sheaves which averaged about 16 lb., was higher in draught than the other machines; but as there was more uncertainty about these figures than the rest, we need not give them. The figures we have given may be taken as approximately correct, but the dynamometer was not in a fit state to appear on the field, and it may at least be hoped that the Royal Agricultural Society will, before any experiments requiring draught dynamometers are entered upon, see that a machine is possessed by the Society which does not throw discredit upon it. It may be remarked that in past years, when the dynamometer was used to test sheaf delivery non-binding machines, a spring which, with a given range, represented a pull of 600 lb. was sufficient. This was at first used at Montford, but it was found necessary to use a spring of 1000 lb. for the same range.

The variation in the girth of the sheaves made by the different machines was from 2in. to 4in. in round numbers, but the greatest variation with the McCormick was about 1·5in., Hornsby being next. Six of the machines used Manilla twine, and seven hemp; and the weight used was, of Manilla, from 2·5 to 2·75, or a mean of 2·5 lb. per acre; and of hemp, about 2·75 lb. per acre. The cost of the twine may be taken all round as about 8d. per lb., though it will be less in large quantity. This would make the cost of string about 1s. 8d. per acre, which is more than half way towards the cost in days gone by of binding wheat by hand, when that was done by women. In fact, it may be taken that the cost of binding by machinery is certainly not less than by hand, but the hands now are not so easily got at the right time. The machine cuts and works so cleanly that there is not a loose straw over half an acre, and the acre is cut and bound in the ordinary way easily in the hour. It is here, namely, in getting the work done while the sun shines, that the farmer is paid over and over again for the cost of the machine. The cost, by-the-bye, is about £60, and this is almost as remarkable as the mechanical ingenuity in its construction. About one-half the work and parts in any other species of machinery would be looked upon as cheap at the price.

Now we come to one point which, to some competitors, was a source of grievance, namely, that the prizes went as they did; firstly, because Messrs. Hornsby and Messrs. Howard had three machines, although the differences in their construction were small. One maker, of high repute, remarked that at a previous trial he had to select between two machines entered by him, which were really different in important points, but which were, nevertheless, not allowed to compete. He thought it would be the same this year, otherwise he would have had three machines, two of similar make, in for trial, instead of two of radically different character. There were, however, several competitors with more than one machine, but some of them got ruled out of competition early in consequence of some stoppages or failure; and it has been argued that failure in one crop should not disqualify a machine for trial in another, inasmuch as such failure may only be the result of want of adjustment, which a little time would, in the ordinary way of working on a farm, effect. It was also argued that having more than one machine, or rather that, having three machines in the running until the latter part of the competition was approached, was not quite fair, because it gave those who had them an advantage, in that they were able when entering a very bad crop, such as the tangled barley referred to in our last impression, to find out by the first machine which form of divider would suit best, and if one failed, this point would have been learned, and two machines still left for the fight. So much depends in such a crop on the division. If the division is not clean, it helps to the lumpiness with which the crop passes to the binder. A straw or two hangs up on the divider end of the platform, and one more and then more, until enough have accumulated to make the lot fall away, and then it gets carried up in a lump to the binder, and choking and stoppage is the result. On the other hand, if to avoid this a narrow width is cut, the straw will go up end on, and the binder often gets choked that way, or the sheaves get very miscellaneous as to sorts and sizes. But it must, in reply to this remark, be urged that if a maker has three machines on the field, and manages, even if he have a large number of men on the field to see after the machines each night, to get them all through tolerably, or extra well, he has not only had the advantage of some of these machines to fall back upon to some extent, but by doing well with all three he has afforded greater proof of what he can do with his machines. Further, it must be said that three firms had each three machines on the field; and although it was said that Hornsby's machines were racers, it will by them be urged that others were racers also, and if some were not, it was their proprietors' fault, for they knew the trials were coming off. Messrs. Hornsby made a good many points with their arrangement for windrowing, which, unlike another which was on the machine of Mr. W. A. Wood, worked equally well up hill and down hill. Messrs. Hornsby's is a carrier in two parts, which open between them like a bascule bridge turned upside down, while Mr. Wood's is only an inclined plane which does not deposit well in going up hill.

There was probaby not one of the machines tried which would not have done very good work in ordinary farming. Men on a trial get excited, and some do not do so well as on ordinary occasions; but with a little more time at disposal, and a little less hurry, most of them would have done their work very well; and it is noteworthy that two of the machines which were ruled out were bought on the ground before the trials were over, and one of them by a man who lets out machines as a business, and one therefore who must have a machine that will not cost him much for repairs.

The English machines which gained the prizes may be said to have done so chiefly because they were more solidly built and stronger than the American machines. They were, perhaps, better fitted, but they were certainly more rigid, and could be just put at the work, "do it or break," without fear. Hence they got through owing to solidity and strength. Not that the American machines broke, but they would not stand what the Hornsby machines, for instance, would. But it must again be admitted that all the machines which fairly entered upon the trials would perform good work at the rate at which it is judicious to work horses, and at which a little hitch is easily, unexcitedly overcome.

We shall refer in another impression to several questions which present themselves as the nuts to be cracked by sheaf-binder builders and by those who work them.

## NOTES ON THE EXCURSIONS TO WORKS AND COLLIERIES BY THE INSTITUTE OF MECHANICAL ENGINEERS.

In the Great Western Colliery, one of those visited by the members on Wednesday, the 6th inst., attention was particularly directed to the coke ovens and to the underground haulage by means of compressed air. The air is only compressed to about 40 lb. per square inch, by engines having two steam cylinders, each 46in. diameter, and two air cylinders, 42in. diameter and 6ft. stroke, and the steam necessary for driving the compressing engines is raised by waste heat from fifty Coppée coke ovens. Hence the cost of haulage is very small, the hauling engines, four in number, being by the Uskside Company, of Newport, and as far as we could see they are of the same type as the underground hauling engines made for steam by that firm, without any alteration in consequence of its being used with compressed air. We find, however, that all these engines are made with double exhaust ports, one of which is closed up when steam is used. Three of the engines have two 8in. cylinders and 12in. stroke, and one has 14in. cylinders and 18in. stroke. Some similar engines are at work with pressures varying from 30 to 300 lb. With this low and economical pressure no alterations, probably, are necessary. The hauling ropes are of Lang's patent, made by Messrs. Cradock and Co., and seem to be wearing very well and to be liked. Against this system of working there certainly can be no competition on economical grounds. The compressed air for working the underground hauling engines may be said to cost nothing but for wear and tear of the compressing engines and boilers, and with large engines, working at a slow speed, and compressing air to but three or four atmospheres, the wear is very small.

With many processes there is undoubtedly, and apparently unavoidably, a large waste of heat, and this is the case with coke-making. The large bar of coke as it is pushed through from one end of the narrow Coppée ovens to the other, where it is quenched with large quantities of water, affords an example of this. The coke comes

out nearly white hot, and as it probably weighs half a ton, and it comes out at, say, 1800 deg. Fah., the amount of heat lost is very large. For instance, for every ton of coke turned out at this temperature, or even at, say, 1000 deg. Fah., the specific heat of carbon being 0·25—it may be greater at these high temperatures—we have a loss of $2240 \times 0{\cdot}25 \times 1000 = 560{,}000$ units of heat, or enough to evaporate about 580 lb. of water. We do not see any way to utilise this at present, but the subject may be worth the attention of those who have, like M. Coppée, done so much in coke manufacture.

The Great Western Pit has two shafts, one 430 and the other 400 yards in depth, the former being 14ft. 4in. by 10ft. 9in. and the latter 16ft. in diameter. The larger shaft is worked by winding engines 40in. by 6ft. fitted with Stevens's expansion gear, and with flat rope drums 16ft. diameter. Flat ropes are also used in the second pit, but the engines have cylinders only 30in. diameter, 4ft. stroke, and winding drums 11ft. diameter. Ventilation of the pit is very perfect, and is effected by a 40ft. Guibal fan driven direct by an engine with cylinder 36in. by 36in. A large Schiele fan is now being erected. The pit is situated at Gyfellon, near Pont-y-Prydd, and on the way to it the celebrated Pont-y-tu-Prydd, over the Taff near New Bridge, was seen by the excursionists. This bridge, as far as the traffic of the place is concerned, has been replaced by a modern low-level bridge; but Edward's Bridge, with its 140ft. span and 35ft. rise, is still in use, and is an object of much interest. It was completed in 1750, and it affords not one of the least interesting pieces of British bridge history.

At the Lewis Merthyr Colliery at Hafod was seen another illustration of the use of the waste heat from coke ovens for raising steam for compressing air for underground haulage. As at the Great Western Colliery, Sheppard's coal washing machine is used.

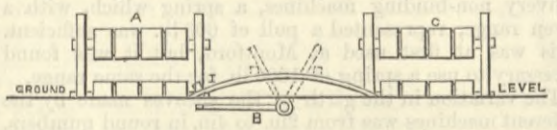
The Cymmer pit was also visited, where amongst other things was seen at work a 45ft. Waddle fan driven by a cylinder 32in. diameter and 48in. stroke, and delivering about a quarter of a million cubic feet of air per minute. At the Llynypia Colliery, the last visited, there are three drawing shafts in use, two of which, Nos. 2 and 6, are for working the steam coal measures at a depth of 370 yards, and the third for working the bituminous coal at a depth of but 108 yards. At this colliery some of the underground hauling engines are worked by steam and others by compressed air, but as the old Welsh coke ovens, 300 in number, are used, the waste heat *is* wasted, and the steam necessary for working a pair of air compressors with steam cylinders 26in. diameter and 4ft. stroke and 24in. air cylinders, has to be generated by the consumption of coal. The coke ovens are 12ft. by 6ft. by 5·5ft., each producing about six tons of coke per week, so that the waste heat is very great. They are charged at the top, and endless rope is used for hauling the coal from pit bank to ovens. Steam travelling coke drawing machines are used for drawing the coke, which is watered in the ovens.

In visiting the Dowlais and Cyfarthfa Ironworks—we might more properly say steel works—on the 7th inst., the excursionists found nothing more remarkable than the contiguity of the past and the present, of the very old, well-worn, and comparatively rude, with the new and much more refined plant now soon to be employed for producing at a lower price a much more scientific product. The Dowlais works are said to have been established about 140 years ago, while at Cyfarthfa the notion seems to be that there were always ironworks. The relics, if there are any, of the very early iron making, do not intrude themselves; but the ruins of furnaces, engines, mills, are to be seen on a large scale in both these works, and more especially in those at Cyfarthfa, where the new have been built by the side of the old, for which there seems to be a lingering affection that has not lessened because the big old things have stood in a majestic idleness for some time. In these two works one may read the history of one of the greatest industries of the world, one which has been the chief element in the greatest civilising changes. They have, however, been described so many times, that it would be occupying our space with what is now an old tale; though we might dwell more at length on the modern, and as yet unfinished, parts of the works, and show that the spirit that directed the old has descended upon the new, and has even increased the enormous capacity of these two great centres of iron and steel production. In both works it is seen with powerful evidence that things and work done in the past count not in the future; that as Ulysses is made by the great bard to say to Achilles, "To have done is to hang quite out of fashion, like a rusty mail in monumental mockery;" and feeling this, the proprietors of these very old works have, as it were, hung away the old mail only to put on the new. In the great Dowlais Works, about 1000ft. above sea level, and employing from 9000 to 10,000 workpeople, the process of conversion from the old into the new style is far advanced. They are in three sections—the old works, the Ivor Works, and the steel works. At the old works there are fourteen furnaces—six in work, two in course of building, and six out. Of six blast engines three only are working, two being idle, and one in course of re-erection. At the Ivor Works there are five blast furnaces—four in operation, and the other rebuilding. At the steel works there are six Bessemer converters and two blowing engines, four of the converters which are working making some 3000 tons per week. There are also six Siemens' furnaces, turning out some 500 tons a week; and what is known as the Old and New Cogging Mills, adjoining two steel rail mills, rolling above 2500 tons per week. Besides three puddling forges, with some fifty furnaces, there are one plate and seven bar mills, rolling from 1400 to 1500 tons per week. The alterations going on in connection with the Bessemer Works are of a most extensive character, and a very fine new set of reversing rail mill plant is being fixed. The rolls are 25in. in diameter, and the engines have cylinders 60in. by 60in., fitted with piston valves like others already at work. One of the most interesting features of the new works is a large installation of the coal washing machinery of M. Evence Coppée, of Brussels, capable of washing about 1000 tons per day. This machinery contains some most ingenious features, but as a description of these which would be of any service cannot be given without drawings, we must reserve further mention here, except to say that it was in full operation and seemed to be giving excellent results, though whether anything like 1000 tons per day were being washed we cannot say. A battery of Coppée coke ovens is here at work, the coke being pushed through, as before described, by a small engine on a track parallel with the ovens, and fitted with a light girder arm with which, by rack gear, it pushes the coke through. A tall chimney is in course of construction for the purposes of the new rail mill and its boilers, and it was found by several who went to its base with a view of looking up from within through the big flue entrance, that this entrance was bricked up, the reason being that the draught up this chimney, though unfinished and of course without artificially heated air inside it, is so great as to be of serious inconvenience to the men working at the top. A satisfactory explanation of this is not so easy.

In looking at some of the reconstructed blast furnaces cased with a cage-work of hoops and vertical bars, the hoops did not touch the brickwork by from 2in. to 3in. all round. This is left for the expansion of the brickwork; but as the expansion of bricks is nothing like that represented by this freedom, it must be supposed that a gradual swelling of the brickwork under the high internal temperature and the internal load takes place; but whether this takes the form or character of a slow flow of these refractory materials, or this accompanied by a gradual disintegration, which is ultimately stopped by the hooping, is not clear.

In the Cyfarthfa Works of Messrs. Crawshay, new plant of every and the completest kind for the production of steel and steel rails is being put down, the whole being carried out under the instructions of Mr. E. Williams, of Middlesbrough, by Mr. E. Hambly, resident engineer. A range of nine fine steel boilers by Messrs. Galloway have been erected to provide steam for the new plant, and they are heated with the waste gases from the blast furnaces, the gases being led down to a brick main. The boilers may be worked partly, or even wholly, with coal, when poorness of the gases or stoppage of them may require. The engines for the cogging rolls are geared, and those for the rail rolls are coupled direct. They are also by Messrs. Galloway, and are amongst the finest engines for this work ever built. The cogging roll engines have cylinders 40in. by 54in., geared 2 to 1, the rolls being 27in. diameter. The rail mill engines have cylinders 50in. by 54in., and the rolls are 27in. diameter. The mills are all by Messrs. Davey Brothers', of Sheffield; and the machinery for finishing, drilling, bending, and transferring the rails to and along the hot bank, by Messrs. Buckton and Co., of Leeds. To some of this machinery we hope to return. At Dowlais the visitors were entertained at luncheon by the invitation of Mr. George T. Clarke, and after visiting the Cyfarthfa Works, returned to Cardiff, where in the evening they were entertained at a *conversazione* by the invitation of the Mayor of Cardiff, Mr. Robert Bird.

The Rhymney Ironworks, where about 7000 people are employed, were visited on the 8th inst. Here also a great change has taken place. No wrought iron is now made there, and no puddling furnaces are used. The iron from the blast furnaces is taken in ladles on iron trucks to the converters, separated by some distance, and a very short time elapses from that at which the iron is tapped into the ladle to that at which it comes out as rails. The latter are rolled from ingots which produce four at a time, and it was noticed that from the time that a billet, or rather reheated reduced ingot, passed the cogging rolls to the time that it left the circular saws as four rails, was 3¾ minutes. An arrangement not observable elsewhere is used to move the billet from the roughing to the finishing rolls. It may be thus indicated :—From the rolls A reaches the position I on an arched grid. Under this grid is a shaft with a set of levers B. These are moved by power, and pass between the gridirons, as shown by




dotted lines, and thus transfer the billet more quickly than when this has to be done by slings. At these works the boilers are heated by waste gases, but all the boilers may be fired with coal if necessary. In the bottom of a chimney about 150ft. in height, connected with a battery of these boilers, a Bailey's pyrometer and a water gauge was placed, the former indicating 600 deg., and the latter 1·4in. A large number of Coppée coke ovens are in use at these works.

The Ebbw Vale Works, which were visited on Friday, comprise several works and colliery properties, and are amongst the most extensive of all those of South Wales. They contain a great deal that is new and some that is in a transition state; but some idea of their extent may be gathered from the fact that the total mineral properties cover nearly 11,000 acres. The Ebbw Vale properties proper, which are situated along the river Ebbw, cover 5000 acres. The works are of enormous extent, so that it need hardly be said that visitors gained but little in a two hours' scamper over part of them. The following figures were given on a card distributed under the direction of Mr. Holland, the engineer of the works, and serve to show the character of the works and the production :—

*Mineral Properties.*

| | | Acres. | Total. |
|---|---|---|---|
| Ebbw Vale | Freehold | 2800 | |
| " " | Leasehold | 2200 | |
| | | | 5,000 |
| Abersychan | Freehold | 60 | |
| " | Leasehold | 1750 | |
| | | | 1,810 |
| Pontypool | Leasehold | — | 2,500 |
| Abercarn | Freehold | 320 | |
| | Leasehold | 1300 | |
| | | | 1,620 |
| | | | 10,930 |

*Collieries.*

| Ebbw Vale :— | Tons. | Output in 1883 |
|---|---|---|
| Ebbw Vale | 364,209 | |
| Sirhowy | 247,195 | |
| Victoria | 185,644 | |
| Waunllwyd | 258,154 | |
| | | 1,055,202 |
| Abersychan | | 256,215 |
| Pontypool | | 174,604 |
| | | 1,486,021 |

*Coke made* 1883.

| | Tons. |
|---|---|
| Ebbw Vale | 203,097 |
| Pontypool | 37,253 |
| Abersychan | 33,032 |
| | 273,382 |

The entire coking plant is equal to a production of 340,000 tons per annum.

*Bricks made* 1883.

| | No. |
|---|---|
| Ebbw Vale | 5,433,644 |
| Abersychan | 524,075 |
| | 5,957,719 |

*Iron and Steel Works.—Production* 1883.

*Pig Iron and Spiegeleisen.*

| | Tons. |
|---|---|
| Ebbw Vale | 161,313 |
| Pontypool | 24,984 |
| Abersychan | 26,115 |
| | 212,412 |

*Finished Iron and Steel.*

| Ebbw Vale :— | Tons. |
|---|---|
| Bars, angles, and fish (iron) | 11,120 |
| Steel rails, bars, and fish | 116,572 |
| Pontypool :— | |
| Coke, bars, sheets, &c. | 4,088 |
| | 131,780 |

*Castings Made.*

| | |
|---|---|
| Ebbw Vale foundries | 10,997 |
| Pontypool ,, | 581 |
| | 11,578 |

Amongst the novelties in these works was seen a small bar mill train, driven direct by two engines and rope gearing. One engine had a grooved fly-wheel about 13ft. diameter gearing with a wheel on the roll shaft about 5ft. diameter, the engine running at fifty revolutions per minute and driving by four ropes. The other engine driving the finishing rolls had a fly-wheel about 14ft. diameter, and ran at eighty-five revolutions per minute, and drove a pulley on the roll shaft of about 7ft. diameter. This driving gear has only recently been started, so that the measure of success obtainable by it is not known, but indications are in its favour.

It seems but a short time since that the idea of using anything other than the old coke ovens was opposed in all directions and in the hottest fashion, and now the number of Coppée ovens in use is remarkable. At Ebbw Vale there are no less than 180, and the waste heat is utilised for raising steam in a fine battery of boilers. The boilers are roofed over by galvanised roofs having a span equal the distance between centre and centre of boiler. They are supported on light, strong longitudinal principals made chiefly of old rails; these and other roofs on the works being made by Mr. C. D. Phillips of Newport. Some very fine chimneys are being erected in these works, and all seem to be solid. It is said that the chimneys with the internal separated brick tube do not stand as well as those built up solid. One instance of the failure of the internal liner was mentioned by Mr. Worton, of Blaenavon, who said that in this case a chimney which received gases from gas-heated boilers had its liner so heated at the lower part, and the whole came down to the bottom. This may, of course, be looked upon as an accident, but it is one which might happen again, and perhaps the custom of building solid chimneys for ironworks is the best.

After a very substantial lunch given by the Ebbw Vale Co., and then visiting the Abercarn Tin-plate Works and the Newport Docks, the visitors returned to Cardiff, and dined in the Cardiff Public Hall at the invitation of the Patent Nut and Bolt Company, who came forward with the invitation when Sir George Elliot withdrew his invitation. On the following day the visit was made to the Severn Tunnel under construction by Mr. T. A. Walker. To this work we shall refer hereafter.

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Naval Engineer Appointments.—The following appointments have been made at the Admiralty :—G. J. Fraser, chief engineer, to the Pembroke, additional, for the Ruby; John Dunlop, chief engineer, to the Pembroke, additional, for the Ajax; and J. D. Rees, assistant engineer, to the Inflexible; Thomas Burnes, chief engineer, to the Indus, additional for service in the Raleigh; Robert William Jones, chief engineer, to the Indus, additional for service in the Resistance; and Robert Haxby Cooper, engineer, to the Victor Emanuel, additional for service in Hongkong-yard; Richard W. Jones, assistant engineer, to the Iris; and Walter J. Featherstone, assistant engineer, to the Northampton.

University College, Bristol.—Announcement is made of the commencement of the new session of this college, the engineering department of which includes courses of instruction for those intending to become civil, mechanical, or electric engineers, or surveyors or architects. It will be remembered that several engineers and scientific men, including the late Mr. W. Froude, were instrumental in the organisation of the combined practical and theoretical courses for the different parts of the year in and outside the college. The courses arranged for civil engineers, architects, and surveyors are intended to meet the generally acknowledged want of a preparatory training for one or two years before the usual entrance as articled pupil into an office. The course for civil engineers has received the approval of local engineers; and the course on architecture has also received the approval of local architects. Students who attend the mechanical engineering course enter engineering works during the six summer months, and in accordance with this scheme various manufacturing engineers in the neighbourhood have consented to receive students of the college into their offices and workshops as articled pupils. Special courses have been arranged for students studying for the profession of engineering, who wish to include in their professional training some knowledge of electricity and its technical applications, especially with regard to electric lighting and telegraphy, electro-plating, &c. The engineering laboratory has recently been provided with a powerful testing machine; and a practical acquaintance with the use of tools is afforded in the workshop. Theoretical and practical courses in surveying are given, and excursions for field practice are frequently made.

## RAILWAY MATTERS.

IN concluding a report on a collision, which took place on the 29th June at London Road station, Manchester, on the Manchester, Sheffield, and Lincolnshire Railway, Major Marindin says "there was scarcely time for the continuous brake to have much effect before the collision, but the train would not have run, as it did, for 75 yards after the collision if this non-automatic brake had not been rendered useless by the breaking of the vacuum pipe on the passenger engine when it struck the light engine."

THE chief countries of the continent of Europe have been negotiating concerning proposed uniform regulations for international freight traffic. The subject was recently brought before the Prussian National Railroad Council, an organisation of representatives of shippers provided for by law, and it urged the adoption of the regulation, and urged that it is desirable that an article forbidding secret rebates of rates in international traffic should be extended to the internal traffic of the different countries.

THE works of the new Hull and Barnsley line in the South Yorkshire district are still standing idle, only a few men being kept on the spot to keep things in working order. A large number of men have been thrown out of employment, but a majority of them have left the district. The telegraph wires along almost the entire length of the line to near Cudworth are completed. During the past week the executed works have been measured up, and it is stated that this step has been taken in order that the contractors, Messrs. Lucas and Aird, may be able to give an estimate as to what the line will cost to complete, in order, if possible, that some arrangement may be made for completing the line at an early date.

IN a report on the collision that occurred on the 3rd ult. at Lime-street station, Liverpool, on the London and North-Western Railway, Colonel Rich, in speaking of the brake in use, says:—"The brake is not a continuous brake, but a very indifferent sectional brake; and I would stongly urge the company to adopt one of the automatic continuous brakes that have now been in use on many of the railways in the kingdom for some time, and have proved to be fairly effective. I would further suggest that the company should encourage their engine-drivers to use the continuous brakes for stopping at roadside stations, and that they should not only forbid their use at terminal stations, but take measures to prevent this rule being more honoured in the breach than in the observance."

THE last section of the Asturian Railway, which was inaugurated by King Alfonso on the 15th inst., is the most difficult and costly piece of railway engineering work in the Peninsula, or perhaps in Europe. The section consists of 44 kilometres only, from Busdongo to Puente de Fierros, in which at short distances are no less than fifty-six tunnels, one—the longest in Spain—extending for 3000 metres. The whole length of the tunnelling is nearly 30 kilometres. This line, the concession for which, a Madrid correspondent of the *Times* says, was granted as far back as 1860, completes the north-western system, and places in direct communication the capital, the centre, and the south of Spain, the important port of Gijon, and the enormous and still undeveloped coal-fields of the Asturias.

THE Corporation of Barrow-in-Furness, having entered into an agreement with the Barrow-in-Furness Tramway Company for the construction and use of the proposed lines, authorised by the Tramway's Confirmation Order of 1884, 8¼ miles in length, the Tramways Company has entered into a contract for the construction of the line and for the proper equipment of the same. The Tramways, which are proposed to be worked by steam traction, extend from Roose, and the Devonshire and Buccleugh Docks to Furness Abbey, and at the present time the works are in course of construction. It is expected that the cost of line construction and equipment will not exceed £8000 per mile of single line. The engineers are Messrs E. Pritchard and R. Vawser, MM.I.C.E, the contractor being Mr. John Fell of Leamington.

THE South-Eastern Railway Compay has just turned out from its works at Ashford a new six-wheeled detaching composite carriage, the panelling of which is electro-plated, to avoid the expense of repainting. The vehicle is 32ft. long, and consists of two first-class compartments 6ft. 10in. long, giving 58·88 cubic feet of space per passenger; two second-class compartments, 6ft. 3¼in. long, giving 40·25 cubic feet of space per passenger; and a guard's compartment. The carriage is luxuriously fitted, and the interior, and it is thought by some the exterior, also have a very handsome appearance. The mouldings are of sheet copper, stamped out under the press and electro-plated. In order to obtain greater strength metal has been chiefly used in the construction of the carriage. All the pillars and roof sticks are of angle iron; the underframe is made entirely of iron, while rivetting has been brought into use wherever practicable. The carriage is to be attached to the morning down mail from Charing-cross, and slipped at Shorncliffe.

SOME idea may be formed of the traffic on English railways from the following facts:—Through Farringdon-street Junction of the Metropolitan Railway 1800 trains pass in twenty-three hours every day. There are four lines of rails, used by the Metropolitan, Great Northern, Midland, London, Chatham, and Dover, and Metropolitan Extension Companies. Through Watford Junction, on the London and North-Western Railway, 233 trains pass every day. This gives something like one in every four minutes of the twenty-four hours. At Cannon-street Station, on the South-Eastern line, the number of trains using the station is 750 in one day. Through Clapham Junction the London and South-Western Railway had, in the year 1877, on an ordinary week day, 656 trains, while on the Derby Day of 1876 no less than 1023 trains passed through this junction. The number is now over 1000. The total number of passengers conveyed in 1883, exclusive of season-ticket holders, was—first-class 36,387,177; second-class, 66,096,784; third-class, 581,233,476; total, 683,718,137; and season-ticket holders, 180,000,000; total, 863,718,137. Of minerals there were conveyed 189,485,612 tons; of general mechanise, 76,897,356 tons; number of miles run by passenger trains, 139,545,464; number of miles run by goods and mineral trains, 129,351,774; total miles run, 268,897,236; miles of railways, 18,668; number of persons employed, 367,660.

A GERMAN correspondent of the *Railroad Gazette* says:—"Wood-working machinery in German shops is comparatively small in amount, owing to the great and yearly increasing use of iron in all parts. This is due to increasing cheapness of iron as compared with wood, and of wrought iron as compared with cast in proportion to its security. The use of wrought iron instead of cast is very extended. I saw narrow-gauge stock building at Chemnitz and Leipsic with iron frames throughout, which had absolutely no cast iron in any part except the journal boxes. The increased use of iron is regretted by some master mechanics, on account of the greater rigidity and of the consequently greater violence of shocks in train service. A surfacer, band saw, cut-off saw, or driving planer and boring machine are the tools ordinarily found in German wood-shops. Suctions for carrying shavings to the boiler room are not used in the shops I have seen. The shavings are used, however, very extensively for firing, in combination with about nine times their weight of coal slack. This coal slack costs 84½ cents per ton delivered at the railroad. It is fired automatically with a hopper and a screw which pushes the fuel in under the fire. It is also fired by being run from a hopper above the fire-door over a grate inclined forward, from which it drops into the fire. The latter is raked partly back under the inclined grate, so that the fuel is well heated before joining the fire, and its smoke products pass over the front portion of the fire on their way to the flues and are very effectually consumed. This firing method is common, I believe, to several styles of fire-box, but I do not remember to have heard before of its application to this kind of fuel, to which it is well adapted. By the use of this fuel and firing the boilers of the Chemnitz shops of the Saxon State Railway evaporate 100 lb. of water at an expense of 1·11 cents."

## NOTES AND MEMORANDA.

IT has been found that a mixture of seventy parts of air and thirty parts of hydrogen gas ignites at a temperature between 1026 deg. and 1028 deg. Fah, while the ignition point of a mixture of coal gas with air in similar proportions varies from 1202 deg. to 1215 deg.

A REMARKABLY low rate of mortality for the past month has just been notified by the Medical Officer of Health for the urban sanitary authority of Great Driffield, East Yorkshire. The deaths were three in number, the rate per annum being only 5·8 per 1000. The rate for the previous month was also low.

OF nearly 300,000 patents which have been issued by the United States Government, it is said that 6505 have been for railway cars and 3504 for railways. As separate items, 5111 for steam engines and 734 for nut locks are pointed out as observable. Electric applications and car couplers will soon figure as being the most patented things.

A BLASTING paper, made by a M. J. Petry, of Vienna, is described as consisting of unsized or ordinary blotting-paper coated with a hot mixture of 17 parts of yellow prussiate of potash, 17 of charcoal, 35 of refined saltpetre, 70 of potassium chlorate, 10 of wheat starch, and 1500 of water. When it is dried it is cut into strips, which are rolled into cartridges.

THE report of the medical officer of health at Southend states that, for the second quarter of the present year, there have been in that district 23 deaths and 62 births, the ratio of mortality per thousand being 10·8. As at other watering places, it may be said that people go to them to get well, but leave before it is definitely proved they cannot do this. Hence the rate should be low.

THE census which was held in Athens recently shows the population of the capital of Greece to be 84,903, which gives an increase of 18,069 since 1879. In 1856 there were 30,000; in 1861, 41,000; in 1869, 50,000; this gives an increase of nearly 55,000 souls in the last twenty-eight years, or 180 per cent. It is curious to note that the proportion between the sexes is 47,000 males to 37,000 females, a phenomenon which the census papers do not explain.

THE deaths registered in twenty-eight great towns of England and Wales for the week ending August 16th corresponded to an annual rate of 24·1 per 1000 of their aggregate population, which is estimated at 8,762,354 persons in the middle of this year. The six healthiest places were Bristol, Derby, Huddersfield, Birkenhead, London, and Brighton. In London 2579 births and 1634 deaths were registered. In Greater London there were last week 3303 births and 2062 deaths registered, equal to annual rates of 33·8 and 21·0 per 1000 of the population.

M. CH. MONTIGNY has published at Brussels a *brochure* on the results of his studies on the state of the atmosphere as effecting stellar scintillation, with a view to forecasting the state of the weather. From the fact determined by W. Spring, that the colour of pure water in great bulk is blue, he explains the predominance of this colour in the scintillation of the stars just before and during wet weather. The luminous rays, he argues, traversing the air charged with large quantities of pure water are necessarily tinged with the blue colour of this medium. The excess of blue thus becomes an almost certain means of predicting rain.

A CURIOUS barometer is said to be used by the remnant of the Araucarian race which inhabits the southernmost province of Chili. It consists of the cast-off shell of a crab, which, from its curious application, is called the "Barometro Araucano." The dead shell is said to be extremely sensitive to atmospheric changes, remaining quite white in fair—dry—weather, but indicating the approach of a moist atmosphere by the appearance of small red spots, which grow both in number and in size as the moisture in the air increases, until finally, with the actual occurrence of rain, the shell becomes entirely red, and remains so througout the rainy season.

DURING the week ending July 26th, 1884, in thirty-one cities of the United States, having an aggregate population of 7,310,300, there were reported 3959 deaths, which is equivalent to an annual death-rate of 28·2 per 1000, a decrease of 0·1 as compared with the previous week; also a decrease of 0·1 as compared with the corresponding week of last year. In the North Atlantic cities, the *American Sanitary Engineer* says, the rate was 25·8; in the Eastern cities, 29·2; in the Lake cities, 29·8; in the River cities, 24·0; and in the Southern cities, for the whites 25·0, and for the coloured 39·7 per 1000. Over one-half, or 55·6 per cent., of all deaths were under five years.

M. HERVE MANGON announced to the Paris Academy on the 18th inst. that the problem of steering balloons had at length been solved. The inventor is Captain Renard, a military engineer, in conjunction with Captain Krebs. The difficulty to overcome was the construction of an engine combining sufficient power with extreme lightness. This the two officers have succeeded in doing, and, according to the *Temps*, the propeller is moved by an electro-motor and a series of accumulators, providing 10-horse power for several hours. On the 9th inst. the balloon ascended over Meudon and proceeded to Viellebon. Here the balloon was seen to turn a semicircle, and return to its starting point, in the teeth of a slight breeze. The balloon went and returned exactly to the spots fixed upon beforehand. The persevering efforts of the French War-office to turn balloons to good account appear to have arrived at some success, if our contemporary is well informed.

IN order to ascertain the degree of advantage obtainable by felting and lagging steam boilers, Mr. B. H. Thwaite, F.C.S., C.E., carefully carried out the following experiments on a Bull type of vertical boiler:—A definite quantity of water was poured into a vessel of a size sufficient to cover a square foot of plate surface; this vessel was externally lined with wood. The rise in degrees of heat during the hour's exposure was noted. The same weight of water, with identical initial temperature, was then placed for the same time on the surface of the lagging, which consisted of three thicknesses of ⅜ felt covered with ½in. tongued and grooved battens. On the naked plate it was found that 516·75 heat units per square foot were absorbed by the water, and on the lagged portion only 145·75 units per square foot were given off. This is equivalent to a reduction of wasteful radiation, due to the lagging, of 34 per cent. or with a vertical boiler, say, 4ft. in diameter and 9ft. in height, working for 10 hours, there would be a saving due to the lagging of at least 70 lb. of coal.

THE Russian review, *Russkaya Starina* and the *Journal* of the Russian Chemical and Physical Society have lately devoted some attention to the first steam engine that was made in the Russian Empire, in 1763, at the ironworks of Barnaoul, in Western Siberia, by a mining engineer, Polzunoff. It appears from M. Woyeikoff's description of this steam engine, the model of which, *Nature* says, exists still at Barnaoul—both reviews have figured it on plates—that Polzunoff's engine was a re-production of the "fire-engine" of Newcomen, with some original improvements. Thus, it has two cylinders, instead of one, and, instead of the beam, Polzunoff made use of a wheel which received the chains of the pistons, and transmitted the circular movement, transformed again into a rectilinear one, to a pair of bellows, used for blowing air into a high furnace. The distribution of vapour was automatic, as in Newcomen's engine, but with several improvements. The engine, which had cylinders 9ft. long and 9in. in diameter, worked during two months from May 20th, 1766, and 3100 cwt. of silver ore, yielding 5 cwt. of silver, were melted with its help. But Pulzunoff did not see his engine at work, as he died from consumption four days before. He was a remarkable man for his time. In his theoretical remarks about "Air, Water, and Vapour," he notices also that physicists are not agreed as to the origin of heat, some of them seeing in it a much-divided, fine moving matter, while others "see the origin of heat in friction and in the vibratory motion of the particles inaccessible to our senses, of which the bodies are constituted." He obviously quotes here the words of Lomonosoff, who stated in these words the mechanical origin of heat in his little known memoir, written as an instruction to Tchitchagoff's Polar Expedition.

## MISCELLANEA.

THE *Lawrence American* of July 9th says:—For more than ten days past the entire power for running not only the large Hoe press upon which this paper is printed, but for the cylinder and job presses of the entire printing establishment, has been from electricity coming over a single wire from the dynamos, four blocks away.

IT is stated that the Belgian Government are about to build four new Channel steamers for the service between Dover and Ostend. The boats are to be larger and capable of making a higher rate of speed than those at present running. The traffic by this service is larger than it has ever been before, the boats now averaging 130 passengers per journey—more than double what it has hitherto been.

ON the 14th. inst. the members of the Civil and Mechanical Engineers' Society made an excursion to the East and West India Company's new docks at Tilbury. The party were conducted over the works by the resident engineer, Mr. Donald Baynes, They afterwards went by special boat to Thames Haven to inspect the petroleum stores, over which they were conducted by the engineer, Mr. William C. Street.

THE Swedish Government has appointed a Royal Commission for the Antwerp Exhibition, 1885, and decided to convey the goods of exhibitors on the State Railways free. Norway will also take part in this Exhibition, and local committees have been appointed in the principal towns. France, Italy, Portugal, Spain, Holland, Belgium, and Germany are also occupied in active preparations, and British exhibitors are coming forward freely.

A DESPATCH from Newport, U.S., says:—Important experiments were attempted at the Torpedo Station on Thursday, August 1st, but were not very successful. The Lay-Haight torpedo did not work well, and the same result was experienced with the electrical torpedo boat. While the latter was being removed from one point to another the whole of the keyboard and steering apparatus was pulled overboard and lost, and a heavy expense will be incurred in replacing them.

A LARGE meeting of the subscribers to the parliamentary fund of the Manchester Ship Canal was held at Manchester, when about 1000 persons were present. Mr. John Mark moved a resolution authorising the provisional committee to continue their efforts to obtain an Act for the construction of a ship canal to connect Manchester with the sea in such a manner as they might deem most expedient and effectual, and this was seconded and passed unanimously.

REPORTS from the National Armoury at Springfield, Mass., speak well of the new ramrod bayonet. The bayonet portion of the ramrod is 15in. long, slightly thicker than an ordinary rod, with a four-grooved blunt point. It is held in position when ready for use by a simple spring clasp, invented by Colonel Buffington, and when not wanted is pushed down until it occupies the same position as the ordinary Springfield rifle ramrod. On the experimental gun which has recently been fitted up according to Colonel Buffington's plans, a guarded bead front sight is used, and also a 2000 yard screw adjustment peep hind sight, with a 1·4in. windage movement. An automatic allowance for the bullet "drift" is one of the features of the new pattern hind sight.

A NEW harbour is about to be constructed at Sutton-le-Marsh, on the Lincolnshire coast, which will not add considerably to the trade of that part of the kingdom, but will be of much value as a port of shelter on a long and exposed coast. The locality is a few miles to the south of the watering place of Mablethorpe, and opposite the Inner Dowsing Bank, which runs parallel with the coast, at a distance of some nine miles from shore. The works, which will be under the superintendence of Sir John Coode, will consist of an outer harbour of 14 acres, leading by a lock of 50ft. in width to an inner dock of nearly ten acres in extent. The outer harbour will be protected by a north and south pier, respectively 517 and 418 yards in length, with a lighthouse on the former, and an entrance on the latter one, which is most sheltered.

UNTIL a short time ago the Hythe local authorities held an undisputed right to the foreshore extending within the limits of the borough, but the Board of Trade has now disputed the right of the Council, and have issued a writ against the Mayor and Corporation. The matter has caused much indignation amongst the inhabitants, and is being watched by the authorities of other towns on the coast with considerable interest, as it is believed the Board of Trade intend to make the action a test case. New Romney and those towns in the immediate neighbourhood have now, from the manner in which the sea has receded at this point, many hundreds of acres of land which they would not have had had they allowed their right to depart from them. The Hythe Corporation have decided to oppose the Board of Trade most strenuously, and although the town is but a poor and a small one, 200 guineas has already been privately subscribed towards the law costs.

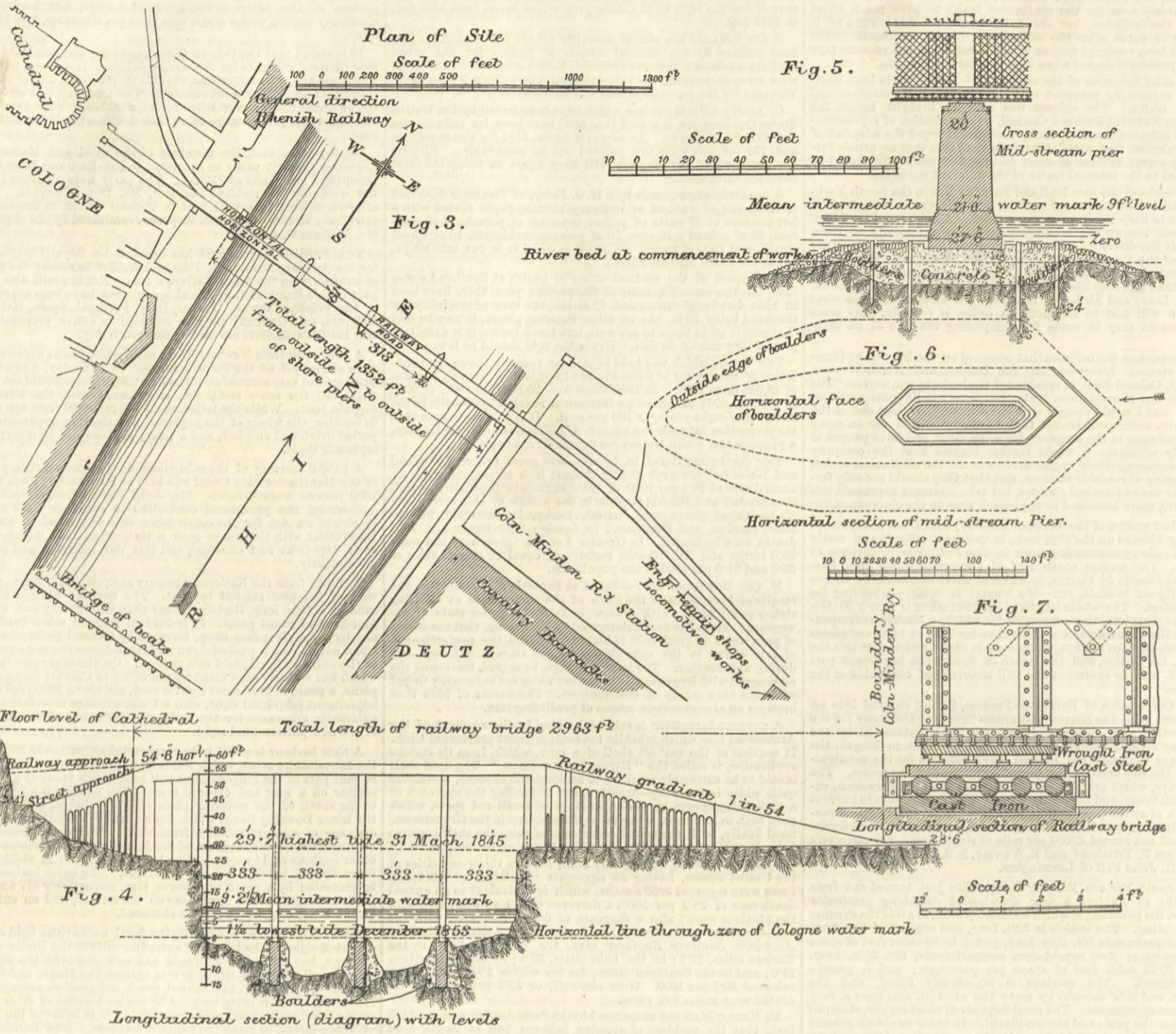
AT this season alarm is expressed at the diminution of the water supply of Paris, and the municipal bodies are in a hurry to deal with the question forthwith every year. But it is forgotten as soon as the drought is at an end. The volume of water in the reservoirs is again reported very low, and the waterworks are unable to yield at the present moment more than 378,000 cubic metres per day, which is scarcely half the quantity considered necessary for the supply of Paris. In many quarters of Paris there is not a dwelling supplied with water. Water-closets, properly so called, are only to be found in the newest houses; and, as everybody knows, the system of sewage is behind the age, every Paris house being still supplied with a cesspool, which is emptied about once a year, and from which, from year's end to year's end, noxious gases ascend into the apartments, rendering, a *Times'* correspondent says, the French metropolis a hotbed of typhoid fever.

THE Wellington statue, which has now safely accomplished its journey to Aldershot, weighed about 38 tons. It could not travel, however, like a 38-ton gun by rail, owing to its being about 30ft. high, and therefore unable to pass through tunnels and under bridges, nor could it travel by road under any bridges. It was handed over to Colonel Close, R.A., the superintendent of the Royal Carriage Department. He first removed the head of the Duke, which was in a separate piece, then divided the Duke at the waist, and finally cut the horse in two about the line of the girths of the saddle. Before doing so, strong steel clamps were fastened on the inside of the statue across the line about to be cut, so that by replacing these the statue should come together precisely in its original position. The division is effected by a very fine line, which, after the statue is re-assembled, is to be filled up with copper. It seems a matter to regret deeply that the old friend of our childhood should have to be thus cut up, however neatly.

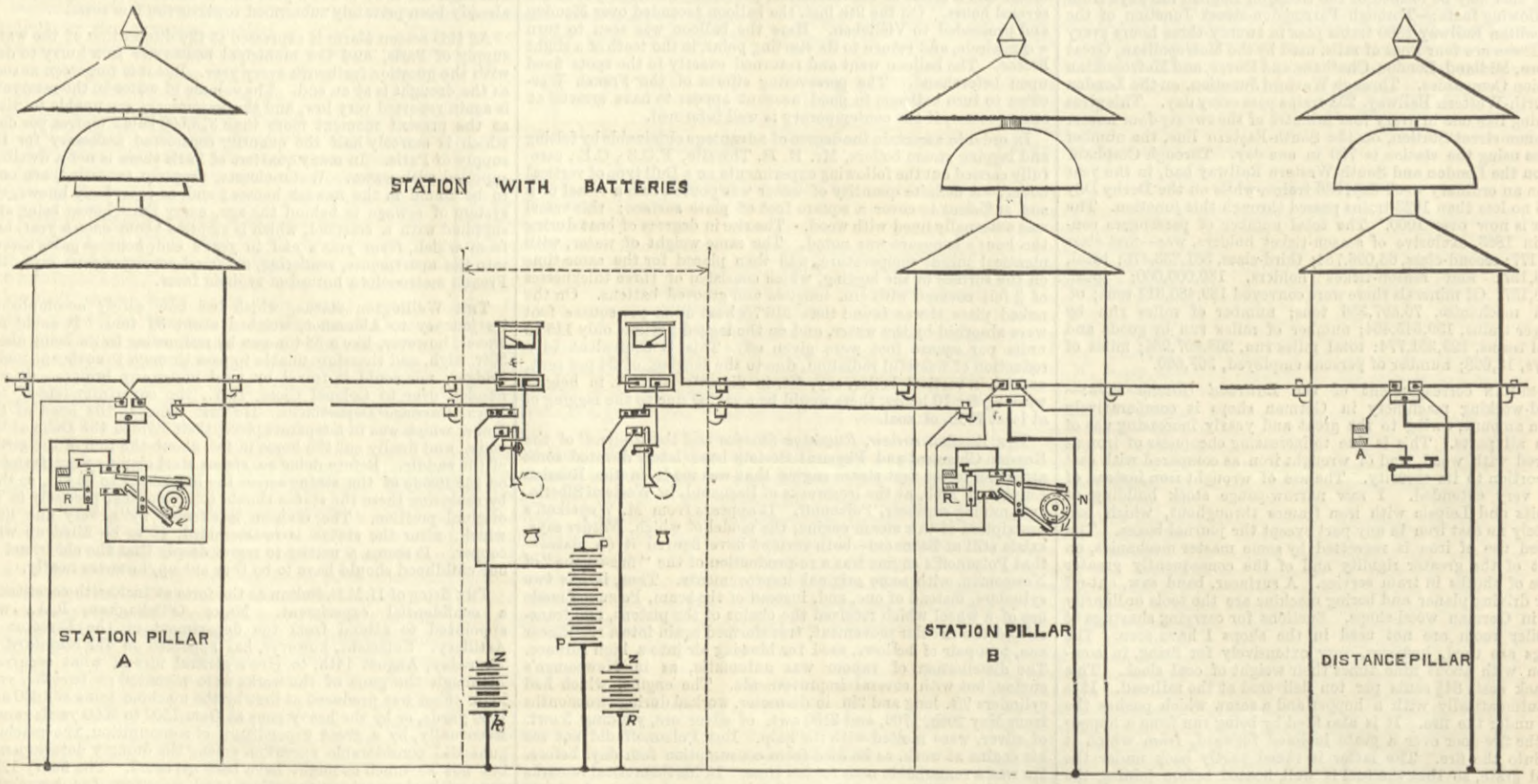
THE firing of H.M.S. Sultan at the forts at Inchkeith constituted a confidential experiment. Major O'Callaghan, R.A., was appointed to attend from the department of the Director of Artillery. Sufficient, however, has appeared in the *Standard* of Thursday, August 14th, to give a general idea of what occurred. Although the guns of the works were mounted *en barbette*, very little effect was produced at first by the machine guns at 1000 and 1500 yards, or by the heavy guns at from 1500 to 3500 yards range. Eventually, by a great expenditure of ammunition, the machine guns did considerable execution among the dummy detachments, but not so much as might have been expected. The heavy 12in. guns with shrapnel, on the other hand, were found so destructive that the firing was discontinued without trying the power of common shell. As the *Standard* observes, in all this there was nothing revolutionary to our present system of organising armaments. On the other hand, it rather indicated that we ought not to withdraw our confidence from our regular armaments of heavy guns and shrapnel, and depend on new weapons without abundant proof, for the work of firing at the *personnel* of an enemy.

# RAILWAY AND ROAD BRIDGE, COLOGNE

(For description see page 139.)




# THE ST. GOTHARD TELEGRAPHS.




In The Engineer of May 16th last, was a description of the elaborate telegraphic system of train signalling on the St. Gothard Railway. The accompanying engraving represents the apparatus inside each station, two of the pillars on the platform, and a pillar at a distant point along the line, worked by the station batteries. These pillars are nearly twice the size of common English pillar letter-boxes; at each station one pillar has a double bell at the top and the other a single bell, which, together with differences in the signal beats, distinctly enable the listeners to distinguish between signals for up and down trains. A feeble current is always flowing along the line wire, so that the signals are primarily initiated by breaking this line current, for which reason the man at the distance pillar, where there are no batteries, can give signals by disconnecting the line wire by depressing the key of the apparatus in the pillar. For a complete description of the details of the apparatus, and an explanation of the way in which it works, we may refer to page 371, May 16th.

## BRIDGE OVER THE RHINE, COLOGNE.

## ANDERSEN'S ELECTRO-MAGNETIC CUT-OUT.

The accompanying engravings represent Andersen's electro-magnetic cut-out, made by the Electric Power Storage Company. The object of the invention is to provide a cut-out in which all the parts are permanent, instead of requiring partial renewal each time the cut-out is brought into action. It consists mainly of an armature held against a contact piece by a spring, which can be set to any tension. An electro-magnet acts upon the armature, and when the current increases, and thus gives the magnet greater attractive power than can be resisted by the spring as set, the armature flies to the magnet, and the circuit is broken. In our engravings, Figs. 2 and 3 are plan and elevation of the apparatus, and Fig. 1 a general view of the same in its case. The current enters at the terminal A, passes in the normal strength through the coil around the core B to the stud D, from the stud D through the contact piece E to the stud F, and to the other terminal. The armature is, as will be seen, opposed to a spring, and the pull of the core upon the armature has to overcome the strength of the spring. As soon as the current renders the core sufficiently powerful, the armature is attracted, and the contact piece E, which has a slight projection fitting into a notch in the armature, is released, and under the influence of its spring is pulled through a quarter of a revolution, breaking contact with the armature and both studs at the velocity due to the recoil of a spring, and thus breaking the circuit. The contact piece is put into position again by simply turning the handle through a quarter revolution, and causing the projection referred to to take into the notch in the armature back. The ebonite finger-piece upon the axle of the contact piece of the cut-out slips round the axle before the contact can be broken, and having neither sledge hammer nor poker handy, the contact is safe. By means of the screws shown, the delicacy of the setting can be altered within certain limits as desired. The cut-out is well made, and has been in use some time.

Fig 1

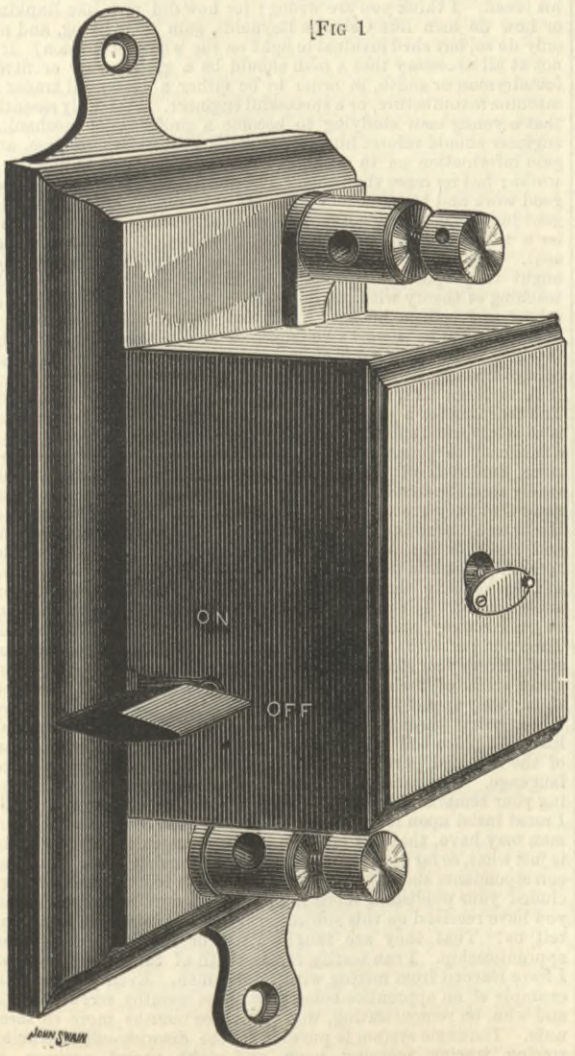



Fig 2

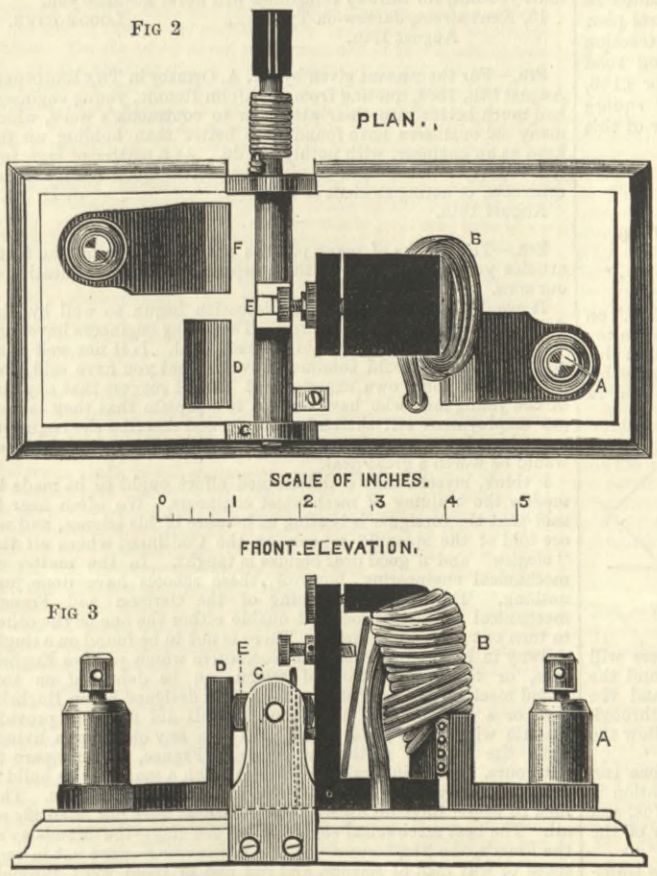



Fig 3




## RAILWAY AND ROAD BRIDGE, COLOGNE.

Cologne, the chief town of Rhenish Prussia, was the Ubiorum Oppidum of 37 B.C., but in 50 A.D., became the Colonia Agrippina, in honour of the Emperor Claudius' wife, who founded there a colony of Roman veterans. Its cathedral, one of the noblest specimens of Gothic architecture, was begun in 814 A.D., burnt to the ground in 1248, recommenced between 1270 and 1275, and only completed in 1881, its two magnificent towers, more than 500ft. high, being visible for miles around of the level country. Cologne is a fortress of the first rank, forming a semicircle with the Rhine as diameter, the opposite town of Deutz being the *tête du pont*. Although so early as 308 A.D. Constantine the Great began a bridge over the Rhine, there was, until 1859, no better communication between Cologne and the manufacturing towns of Deutz, Kalk, &c., on the opposite side of the river, than a bridge of boats, which is still used. But the great inconvenience and loss of time ensuing from the unmooring, floating aside, and removing of a barge, to allow a vessel to pass, together with the desire for uninterrupted railway communication from east to west, led to several projects being made for a combined railway and road bridge that should afford a waterway for vessels of the largest class. Ultimately the design of Hof Baurath Professor Strack was adopted; and the works were begun in 1855, King Frederick William IV. of Prussia laying the foundation stone of the west shore pier. In the following year the east shore pier and the river piers were begun. By the end of 1857, two spans were finished; and on 3rd October, 1859, the bridge was opened to the public. It was finally completed in 1862, with the exception of the bronze equestrian statues, one of which is shown in

the end view, Fig. 2, p. 139, of the accompanying illustrations; and these were erected in the following year.

The site chosen is a prolongation of the centre line of the cathedral, through the cross in the chancel, striking the northern side of the Köln-Minden Bahnhof on the opposite side of the river, which it cuts at right angles, see Fig. 3, p. 138. The street leading from the bridge to the cathedral is on the centre line, being at the latter point about 38ft. above the datum. The datum for levels is the zero of Cologne water-mark—see vertical scale of feet on longitudinal section, Fig. 4. From the cathedral to the river the ground falls to 25ft. above datum, the already existing wharf wall being laid at the level 24ft. Close under this wall the river bed was at the level of zero before the piers were made, and then fell regularly until, at about one-third the breadth of the stream, it had a level of 8ft. below datum, when it rose regularly to zero at a distance of about 200ft. from the right bank, and at the latter point attained a height of 8ft. above datum. The bank itself rose with a slope of 1 and 1½ to 1 until it reached a height of 28ft. above the datum, from which point the ground is nearly horizontal. As was anticipated, the scour of the river has deepened the channel under the right bank and also between the river piers; but repeated gauging showed that no change has taken place since 1860.

The highest water mark at which navigation can be carried on is 25ft. above datum, though practically the steamboat traffic ceases when 18ft. is attained. The underside of the superstructure is laid at 53ft. above datum, so that the largest steamers and sailing vessels can pass under the bridge, with their chimneys and masts lowered, at all times when the navigation of the Rhine can be carried on.

At Cologne the Rhine flows towards the north; and the position of the left shore pier was determined by the then recently constructed wharf wall, a 17ft. roadway being retained between the pier and the river. The right shore pier is built so far from the river as to leave a 12ft. towing path between it and the 9ft. wall. The shore piers, which have no batter, are 20ft. wide in the direction of the centre line of the bridge. The three river piers are the same width at the top—also in the direction of the centre line—but have a batter of 6in. on either side, so that they are 21ft. wide at about 10ft. above datum. Here they spread out with eight perpendicular steps, 18in. high, to 27ft. 6in. on the pile and concrete foundation, the top surface of which coincides with zero—see Figs. 5 and 6. The total length of the bridge between the outsides of the shore piers is 1352ft.; and, as the total width, between these two points, of the roads, wharves, right bank slope, and of the piers at a level of 9ft.—the mean intermediate water mark—is 1494ft., it follows that the total clear water-way is 1202½ft., which is made up as follows :—

| | ft. |
|---|---|
| The two river spans (333 − 23½) × 2 .. .. .. .. .. .. | 619 |
| The right shore span, 333 − (22 + 9½ + 11¾) .. .. .. .. | 289¾ |
| The left shore span, 333 − (27½ + 11¾) .. .. .. .. .. .. | 293¾ |
| Total clear waterway .. .. .. .. | 1202½ |

The superstructure consists of four lattice girder spans, all 333ft. between centres of piers, and of 313ft. clear opening. The common piers carry two perfectly independent bridges, together 61ft. wide over all, with a foot space between them. The northern portion, 24ft. wide in the clear, serves for a double line of railway, and the southern, 27ft. wide in the clear, has a 16ft. roadway in the middle, with footways 5½ft. wide, and 2in. rising to 5in. above the roadway, one on each side. Neither trains nor wagons are allowed to pass over the bridge at a rate of more than five miles an hour; and engine drivers are forbidden to open their whistles or cylinder cocks while on the bridge, the necessary signals being given by horns.

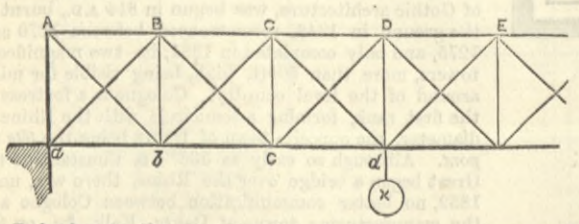
All the longitudinal dimensions of the superstructure depend upon the distance between the cross girders, as they must be either multiples or aliquot parts of this dimension. In the railway bridge, the distance between centres of cross girders is 5ft. This makes the general lengths of the longitudinal girder plates 10ft., and the diagonal distance—in a horizontal line—between the lattice bars, 2½ft. The vertical distance between the innermost rows of rivets is 8ft. × 2½ft. = 20ft., while the longitudinal girders are 25ft. deep over all. The rivets are spaced the $\frac{1}{16}$th-part of 5ft., that is to say, 3¾in., except in the last division, where it is 7½in. The diameter of the rivets is generally 1in., which is increased to 1$\frac{1}{16}$in. in the neighbourhood of cover plates. The heads are slightly countersunk. The sectional areas of the four sizes of angle iron used are 6, 4·4, 3·25, and 2·6 square inches, the weights per running foot being respectively 19·9, 16·6, 10·7, and 8·6 lb. Fig. 5 shows the manner in which the longitudinal girders are carried by the central pier, and Fig. 7 the provision made for the expansion and contraction of the railway bridge at the shore piers. The railway and road bridge, irrespective of masonry, cost about 946 thalers, or £140, per running foot, and about 18½ thalers, or £2 14s. per square inch of platform. Our supplement gives a general view of this celebrated bridge.

## LETTERS TO THE EDITOR.

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

### STRESS DIAGRAMS.

Sir,—Adverting to the letter of your correspondent "C. S." on the above subject, it is evident the writer is perplexed as to the way in which the load is transmitted to the abutment, and in this he does not stand alone. It appears to me to be quite impossible to calculate correctly the strains in a girder of the type in question.




Referring to the accompanying sketch, some engineers will assume that the load X is entirely borne by the bar *d* D, and the effect transmitted to the abutment by the struts D *c* B *a* and the tie B *c*; whereas, others will assume that it is transmitted through the ties C *d* and A *b* and the strut C *b*, or that it will follow the path *d* C, C *c*, *c* B, B *b*, *b* A.

Now, Sir, it seems to me that neither of these assumptions can be correct, for, taking the load X applied at *d*, my contention is that each of the members C *d*, D *d*, E *d* must take a part of it, and that the amount taken is entirely dependent on the quality of the work and the nature of the material used.

Let us for a moment suppose that the effect of the load is transmitted to the abutment through *d* D. This member will at once begin to stretch, but in so doing it will of necessity cause the members *d* C and *d* E to stretch also, and will thus be relieved by them of a part of the load. A similar argument will apply if we suppose the load to be on the top boom, and transmitted to the abutment through D *d* or D *c*.

This type of girder is, I think, one that should be avoided where possible. It is not a cheap form, and its only advantage, if any, is that of appearance. If an open web be required, a Warren girder or one of the N truss kind is much to be preferred, especially the latter, as in this the struts are in their most economical position, viz., at right angles to the load, and the stresses have but one path to follow. A. H.

July 25.

### WATER TUBE BOILERS.

Sir,—Having a special interest in steam boilers, I have perused the bulk of what has been written on them for a number of years, and have often pondered over diagrams of the parts of many that have exploded, which are to be seen in your publication, and others similar and graphically depicted and described in the circulated reports of steam boiler assurance societies; but Mr. Graham Stevenson, who writes in yours of Saturday, has condensed into his letter more sound reasoning in regard to the causes of steam boiler explosions then is contained in all that has come under my observation if piled into one heap; for, in regard to the getting up steam quickly and running off water slowly, to use the words of Angelo to Isabella, "He speaks, and 'tis such sense that my sense blends with it." For what more natural could be than the heating of the upper side of a boiler flue before the water below the flue is brought up to a boiling heat, which can only be done after the flue underneath the boiler, or what I would call the third flue, has been heated up to an equality with the first one which holds the furnace in the centre of the water. Heat takes place there by slow degrees, but I doubt if ever it is as high as to boil water rapidly, for the smoke on entering it is then on its direct way to the chimney, and will be pretty well exhausted. It is very easy to conceive how in this way unequal expansions will be brought on the boiler.

I myself put this to the test just before taking my seat to write this, for I was so struck with the idea of a fish living in water of a boiler in one part when steam was being made rapidly at another, that I gave instructions to my engineer on Saturday, so as to be able to inform me to what extent Mr. Graham Stevenson's letter was borne out, which I gave him to read; and now he tells me that it is all quite true, and not only so, but I have felt under side of boiler for myself, and find that the heat of the under side of the boiler is a very long way from being equal to the upper, and it is now nearing midday. My engineer says it may be mid-week before the two parts are found to have reached the same temperature, and I fancy that is much the same thing as saying they will never be equal at all. It is no difficulty for anyone acquainted with expansion strains to see how this state of things may lead to the destruction of a boiler, and more than a boiler, for life is often sacrificed along with them. I don't profess engineering, and have never seen a water-tube boiler except as a picture in advertisements; but with the light of this valuable letter I look at the matter in this way. Two summers ago I saw the rails of the main line here bent in a most extraordinary way by being pressed end to end by the heat of the sun, which, as I was informed, might have led to an accident, and I was curious enough to keep an eye to the same rails. When winter came round I found the ends instead of being pressed together, standing open so that I could nearly put the point of my umbrella between them. Now, if the upper side of a boiler is to represent the summer and the underside the winter, I don't see how we can escape having great strains on boilers in the way this writer makes very simple indeed, or that we need expect anything else than such explosions as took place at Blackburn and other places I have read of, where the boilers were reported on as being as good as the day they were made.

Herbert Manners.

Cement Works, by Chester, August 20th.

[If our correspondent puts in a few Galloway tubes he will find hot water in the lower part of his boiler soon after lighting up.—Ed. E.]

### THE PROSPECTS OF YOUNG ENGINEERS.

Sir,—With your permission I should like once more to express myself on the prospects of young engineers. The letter of "Young Engineer"—August 15th—contains the whole pith of the matter, and many will endorse his remarks, that it is considered a heinous crime to take notes or dimensions in the shop; and although we want to know all about prices, time, and cost of labour, information is placed beyond our reach; and yet when an advertisement appears for a foreman, the usual request is: "Must be steady and have a good knowledge of piece-work, estimating, &c.," therefore, what chance have we of getting on? Your promised articles on how and why some men succeed and others do not, will be looked forward to by many with pleasure, as it may teach us how to remove our deficiencies.

But, as I said before, the great evil is promotion by influence, not by merit. I think when one reaches twenty-three years of age, and has spent the whole time in the shops and has a good education, it is weary work to trudge on in the shops until someone finds you out, for railway companies will never advance you.

15, Kent-street, Jarrow-on-Tyne, Locomotive.
August 17th.

Sir,—For the reasons given by Mr. A. Ormsby in The Engineer, August 8th, 1884, quoting from Sir John Rennie, young engineers had much better turn their attention to contractor's work, which many old engineers have found pays better than holding up the head as an engineer, with nothing to do. As a matter of fact, few real engineers now-a-days trouble themselves much except under contracts, or acting as clerk of works. J. H. H.

August 18th.

Sir,—The thanks of many parents are due to you for the three articles you have written on the prospects, and on the education of our sons.

It would be a pity that the discussion begun so well by Mr. Audain should be allowed to drop. The young engineers have said something; you, Sir, have said a great deal. Is it not well that the young men should comment now on what you have said, and give some of their own experiences? May I suggest that any one of the young men who have written to complain that they cannot get employment will sketch his career, and describe the engineering education that he has received? Information on this subject would be worth a great deal.

I think, myself, that a determined effort ought to be made to modify the training of mechanical engineers. We often hear it said that the foreigner is beating us because of his science, and we are told of the splendid schools on the Continent where all the "ologies" and a good deal besides is taught. In the matter of mechanical engineering, however, these schools have done just nothing. The scientific training of the German and French mechanical engineers does not enable either the one or the other to turn out decent machinery. There is not to be found on a single railway in France or Germany a locomotive which pleases English eyes, or the construction of which can be defended on any sound mechanical basis, unless it has been designed by an Englishman or a Scotchman. Mr. John Haswell did more to provide Austria with really good locomotives then any other man living. Take the average stationary engine of France, and compare it with ours. Scientific training will not teach a man how to build a good steam engine, or a good lathe, or any other machine. The men to whom England owes all her greatness were not scientific at all. The best mechanical engineers of the day—the Maudslay's, the Penn's, the Stephenson's, *et hoc genus omne*—were not in any sense or way men of science, and not one of them went through the training now supposed to be essential to the young engineer. It is really time, Sir, that an effort was made to direct the studies of young engineers in the proper direction, and to train them to become really useful, which they are not now.

I am an engineer; I have sons, one of whom is going to be an engineer; but I am taking uncommonly good care so to direct his education that his time will not be wasted, and yet that he shall be as far superior to a mechanic on the one hand as he will be to the pupil of science on the other. I have fortunately special opportunities for training him in the way an engineer should go, but others are not so fortunate, and yet all might be well if parents only knew what it was their sons ought to be taught, and took care that they were taught it. Now-a-days, the parent, as a rule, knows nothing about engineering. The would-be engineer knows as little, and they are unable to control the operations of the scientific teachers, who, as a rule, have not even a remote idea of how money is made by a practical engineer. Cannot some means be devised of altering this state of things? Pater.

London, August 18th.

Sir,—It seems to me that you press rather hard on heads of firms in your strictures on the education of young engineers. In reply I as one would point out that we do not ask for pupils; we do not want them, and I can cite hundreds of instances where employers will not take pupils for love or money. It is next to impossible now to article any youth as a premium apprentice in a really respectable firm. The North-Eastern Engineering Works, Sunderland, may be cited as an example. Apprentices are taken there, it is true, but no premium is paid. There may be a very few exceptions; I give the rule.

The reason of all this is obvious. Mechanical engineers' shops are not educational establishments. There is no one in them who has time to teach. There is no one whose special duty it is to instruct pupils. The general public ought to know this, and, as a rule, parents and guardians are told all about it. They insist on forcing their sons into places where they are not wanted, and then they complain. I know firms who make a high premium, £700, essential, and this they do for two reasons—first, to keep pupils away; secondly, to pay for time lost in giving them a special training.

Again, it seems to be forgotten that the premium is almost always returned in whole or in part in the shape of wages paid for work often badly done. If only young men would not crowd into a business where they are not wanted, they would have less to complain of. Of course there are firms who take money and give no return. There are also card sharpers, and people who do the confidence trick, and long firms, and foolish folk who are gulled by them.

Liverpool, August 20th. M. I. M. E.

Sir,—I have read with much interest and attention the correspondence you have published upon the above subject, as well as your editorial comments thereon. Perhaps you can kindly afford me space for some remarks on this, to a large number of young men, very important topic.

It appears to me unfortunate that so far the discussion has been carried on without any previous definition, and will therefore, I fear, determine nothing. Let me suggest the expediency of some attempt being made to define the meaning of the term "engineer" as applicable to those whose future interests are concerned in this debate. The meaning I shall attach to the term in what I am about to say will be applicable to mechanical engineers. I understand that a young man and his friends, holding what I may call the position of gentlemen, regard mechanical engineering as a profession ranking with law, physic, or divinity; that as soon as the student of its mysteries completes his studies he will be as well received in good society as any member of either of the so-called learned professions; and that his chances of earning his bread will be equally good—perhaps I ought to say equally bad. The barrister seems to have the least chance of any of supporting himself by his own calling. The divinity student is generally able to get bread and cheese as a curate, and, however poor, is always treated as a gentleman; and this, to a refined mind, counts for a good deal. The medical student is still better off. Having got his licence, he can readily obtain a berth as an assistant; and though the work is very hard, he enjoys some facility for saving a little money, as well as gaining excellent practical experience in the ordinary routine of medical practice. At any time he can start himself on his savings as a general practitioner, and work his way. I now come to the student of engineering. You, Sir, say that all the training and instruction he has acquired in college he finds perfectly useless to him when he goes into a works. Well, in some respects this follows as a matter of course. If it were otherwise, why should he go into a works? He goes to the two places to learn respectively in each that which was not taught him in the other. Permit me to say that your own remarks about this seem a little confused. At one part of your articles you lead your readers to believe that it is simply waste of time and money to learn theory or mathematics, dwelling upon the assumption that such things are perfectly useless. You say elsewhere you assert nothing of the kind, but that a knowledge of these alone will not enable an engineer to earn his bread. I think you are wrong; for how did men like Rankine, or how do men like Osborne Reynolds, gain their living, and not only do so, but shed invaluable light on the whole profession? It is not at all necessary that a man should be a good turner or fitter, foundryman or smith, in order to be either a successful trader in machine manufacture, or a successful engineer. It is highly essential that a young man studying to become a professional mechanical engineer should inform himself generally about shop practice, and gain information as to what can and what cannot be done in a works; but no more than this. The ability to distinguish between good work and bad is rather a quality of common sense and intelligent judgment than a point of handicraft skill. A man need not be a tailor to distinguish between a well-made and an ill-made coat. The points concerning which a young man proposes, or ought to propose, to gather information, are to compare the teaching of theory with the demands of practice. For example, at school and college he has, I suppose, been taught mensuration. When he goes to a works he ought to ascertain how to apply this teaching to the taking out of quantities, and he will find that mere college training will not suffice here. More has to be learned, and it is to learn this, amongst other things, that takes him there. The true line for a young man meaning to be a mechanical engineer is to select what special branch he will adopt. A neglect of this—a tendency to generalise and run after anything that turns up—ruins hundreds of young men, who at six or eight-and-twenty vainly read the advertisements in your own or other journals, and see none that they are specially fitted to answer. Let a young man at the outset determine to be, say, a marine engineer, study for that, and stick to it; or let him decide to make steam boilers his speciality, let him do likewise. He may have great struggles early in life; so have the practitioners of all callings other than mere artisan work. His college education will always give him a footing in good society, and even enable him to make influential friends. Time and perseverance will help him on. This line is seldom pursued. Every year scores of young men crowd into engineering works, great sums of money in the shape of premiums are paid with them; they spend three or four of the best years of their lives there, going through a simulacrum of training, and commonly leave the place bad draughtsmen, worse artisans, and as ignorant of the financial part of the business as they are of the Chinese language. Of course, such folk come to grief, and notwithstanding your remarks, Sir, that an engineer must be born, not made, I must insist upon it that however great a genius a lad or a young man may have, that gift must be trained and cultivated, and this is just what, so far as works' teaching is concerned, it is not. Your own correspondents show this, and without doubt lack of space has precluded your publishing more than a small number of the letters you have received on this subject. What do your correspondents tell us? That they are taught little or nothing during their apprenticeship. I can testify to the truth of this myself by what I have learned from mixing with young men. Even you cite the example of an apprentice being kept three months screwing bolts, and who, on remonstrating, was put three months more to screw nuts. The same system is pursued in the drawing-office; tracing, tracing, tracing, morning, noon, and night, varied, perhaps, by getting a fully-figured sketch of an axle or a plummer block to

draw out to scale, not a word of instruction being given as to why it is so designed.

Now, I fearlessly assert that the practice of charging parents and guardians hundreds of pounds, and then treating their sons and wards thus, is neither more nor less than obtaining money under false pretences, and the only thing that removes it from a criminal act, is that the firm receiving the money and pupil does not take the initiative; it does not invite the sending of the student, but if he is received the payment of the premium is insisted upon. But let me ask, Sir, if you send your son to an expensive school, would you be satisfied with the same system, not only of neglecting to teach, but of actually obstructing the efforts of your son to teach himself? Great public schools seldom or ever invite parents to send their sons, and in this respect they resemble engineering works. Why, then, should parents have to submit to a state of things in one case that don't obtain in another? or at least does not in our first-rate schools. In the case of Board Schools the Government have secured efficiency of teaching by the institution of capitation grants by results ascertained at examination.

I maintain that it is a monstrous evil that a parent or guardian should pay a very large sum of money under the impression that his son or ward will be efficiently trained in the business of the firm, and that not only is the apprentice not so taught, but positively is obstructed in his efforts to teach himself. Such a system is highly discreditable to the trade or profession of manufacturing engineering. I repeat, it is obtaining money under false pretences. You in one of your articles advise the apprentice to go about with his note book, rule, and calipers. See what reply one of your correspondents gives to that, and no doubt his experience is but one example out of many. If I remember the words of an indenture rightly, there is an undertaking on the part of the master to "instruct the apprentice in the art and mystery of his craft." An indenture is a very stringent legal document, giving a master very great power over his apprentice, but on the other hand, the rights of the apprentice are also guarded; and most certainly if I paid a large sum with any son or ward of mine, I would without hesitation put the law in force against any firm taking my money and keeping my son screwing bolts and making tracings. I would insist on his being properly educated in prime cost, in making out estimates, and in practical design. I would have him taught how to design a machine, to make all the detail drawings, work out the weights, draw the specification, and make out the estimate. I would take care that he followed his drawings into the shops, and was both a witness and a sharer in making the patterns, the castings, and the forgings, and helped to fit and erect it. To do all this he need not be an expert fitter, a clever patternmaker, or an experienced founder. As I have said above, this is not necessary to make a man a professional mechanical engineer. The practical knowledge gained by this plan, allied with a sound mathematical and theoretical education, would, if the man was fairly endowed with brains, enable him to earn his bread as a manager or chief draughtsman, and at the same time retain the position of a gentleman, with the prospect of rising in the latter part of his life to the dignities of a consulting engineer. Such a man only would I define as a mechanical engineer. I am certain that the existing system of training, or rather sham training, ruins hundreds of men who possess plenty of abilities if they had proper teaching. The existing system simply floods the business market with a multitude of half, or less than half, informed draughtsmen, who struggle to be thought professional men and gentlemen. The latter, many of them, were but disappointments, and the wretched drudgery of a poor draughtsman's life gradually breaks down both their health and their finer feelings.

Employers pose as victims, and solicit sympathy on the score that they are ready and willing to employ good men, but that such are not to be had. Whose fault is it if such is the case? Simply their own. They take no pains to keep up the supply of good men, they ridicule school, college, or theoretical training, yet refuse to impart any other themselves. From whence, then, are good men to be derived? Then, again, look at the scale of pay offered to induce good men to apply. A head draughtsman, with all the brainwork of the establishment to do, most of the responsibility to incur, and he is offered the pay of—a fitter.

I apologise for this very long letter. If you will allow me, I will in another touch on the examination system as applied to engineering, and one or two other points. C.

August 19th.

MR. MOON ON CONTINUOUS BRAKES.

SIR,—It has been frequently remarked that when railway chairmen have to announce a reduction of dividend, they entertain the shareholders with a few remarks upon some subject far away from the question; and continuous brakes seem to be a very favourite topic upon which to dilate. At Euston, on Saturday, Mr. Moon announced a considerably less dividend, and also referred to a large item in the carriage department for changing the chain brake to the vacuum. Years ago many shareholders regarded the adoption of the chain brake as a great mistake, and many now consider that the present change is but another great mistake and a further waste of money. For a long time North-Western shareholders were told at the half-yearly meetings that air, vacuum, and other brakes were far inferior to "their chain brake, which was the best in use." The rolling stock has been fitted with the best chain brake, and the shareholders now, to their surprise, find that instead of having an efficient brake in return for their money, there is a large item for changing to the vacuum system, which Mr. Moon now states is the best. Considerable time was occupied, if not wasted, on Saturday, by the quotation of details relating to miles run and failures recorded by automatic and non-automatic brakes. I have before pointed out that the returns require cases to be recorded under one of three headings. Nos. 1 and 2 are failures to act; No. 3 is simply delays, &c.

Now, it is a well-known fact that the non-automatic failures are actually dangerous cases of collisions or running past stations, coming under classes 1 or 2, whereas automatic brakes appear only as delays or faults of servants under No. 3. A hundred instances of delay of a minute or so cannot possibly be equal in danger or importance to one accident caused. Mr. Moon does not seem to take these facts into consideration, but simply says there have been so many failures in a certain number of miles run. Thus collisions, runs past signals, and a leak in a pipe, are all taken as of equal value; they are all reckoned as one. In the same way, with regard to miles run, one train runs 100 miles without a stop, another stops, perhaps, a hundred times in the same distance. Miles and failures are therefore heaped together in such a way that it is hopeless to expect useful or reliable information to be obtained. It would be one of the greatest advantages if the Board of Trade were to give a summary of the failures, showing failures to act in cases of danger, failures under ordinary circumstances, and delays, distinguishing whether they arose from neglect of servants or fault of machinery or materials. Of course railway shareholders know nothing about "classification of failures," and from conversations I have had with some of those present at the Euston meeting, there can be no doubt that they came away with very erroneous and misleading impressions upon the brake question.

40, Saxe-Coburg-street, Leicester, CLEMENT E. STRETTON.
August 18th.

SIR,—The directors of this company much regret that they are obliged to ask for space in your columns, but they feel that they would not be doing their duty to their shareholders or to the travelling public if they neglected to take public notice of the remarks made by Mr. Moon, the chairman of the London and North-Western Company at the half-yearly meeting of that company on Saturday last.

Mr. Moon, on being asked by Mr. F. Hill, a shareholder, for information as to whether there was any cause to apprehend a disaster such as that which had occurred on another railway, stated in reply as follows:—"They themselves—the London and North-Western Railway Company—had made every provision to prevent accidents. A year ago he—Mr. Moon—told them that finding the South-Western, the Great Western, Midland, Lancashire and Yorkshire, Great Northern, and North Staffordshire Companies are all using the vacuum brake, they had decided that it was better for them to interchange with those companies and use the same brake. They were, therefore, now putting on the vacuum brake to a great extent. He had no doubt this brake would work well, and, as far as could be, would prevent accidents."

Mr. Moon went on to make a most unfair attack upon the Westinghouse brake, to which I shall presently refer; but before doing so, it is only right to point out the fallacies contained in the above quotation. As a matter of fact—and of indisputable fact—the vacuum brakes used by the various companies which Mr. Moon enumerates differ from one another in various essential particulars. The Great Northern Company, working with the Manchester, Sheffield, and Lincolnshire Company, which Mr. Moon now omits from his list, use the brake known as Smith's vacuum brake, which is not automatic, and which becomes useless when a coupling is fractured, for instance, between the engine-tender and the leading vehicle. It was this brake which so palpably failed at Penistone—and the failure of which led to the death of twenty-five persons, and the injury of numerous others—and it was a joint Sheffield and Great Northern train to which this disaster occurred. This is, with the modifications to be hereafter explained, the brake which Mr. Moon proposes for adoption; to supersede the chain brake which he has hitherto so much belauded on the London and North-Western Railway. The Midland, another company referred to by Mr. Moon, employs mainly an automatic vacuum brake, which contains a leakhole only too well known to those who are in the habit of using that brake. The effect of this leakhole is that when the brake has been applied the force leaks away in about 1½ minutes: and when it is necessary to apply it two or three times in rapid succession, as in approaching junctions and terminal stations, the engine-driver is unable to make use of it until one or two minutes have elapsed to allow him to recuperate his power. It is also useless on steep inclines, because it is no sooner applied than it begins to leak off and to lose power. Other modifications of the automatic vacuum brake are employed on the Great Northern, the Lancashire and Yorkshire, and other companies referred to by Mr. Moon.

The brake now applied to certain trains on the London and North-Western Railway is, however, used upon only one of the railways enumerated by Mr. Moon, viz., the North Staffordshire, and is different in important and essential particulars from the brakes employed by the other companies referred to, as well as from those in use on any other railway in the United Kingdom, the Continent of Europe, or America. The London and North-Western brake is, in fact, a non-automatic vacuum brake, with an automatic arrangement in the brake vans only. Such a brake would be useless to prevent loss of life and injury to passengers in the case of any accident in which the couplings between the carriages became detached, as at Penistone. The brake arrangement in the London and North-Western van would, it is true, so far as its brake power went, prevent a few carriages from running back down an incline on becoming detached from the remainder, and it might in such a case give warning to the guard; but the London and North-Western system would be just as useless as the ordinary Smith's vacuum brake in any sudden emergency when its action would be most required for automatically locking every wheel throughout the train.

The great objects of automatic action in all brakes are to provide that on the sudden occurrence of accidents of the most fatal class, such as those of Penistone, Downton, Abbots Ripton, Shipton, Wigan, Morpeth, Marsham Meadows, Lockerbie, and numerous others, the brake shall instantly, and without any action of the guard or engine-driver, be applied to every wheel of the train and prevent the hinder carriages from running forward unchecked upon the engine and tender or upon the leading carriages, so as to cause destruction to the rolling stock and loss of life to the passengers.

This point is completely met by the Westinghouse brake, but having special reference to the above accidents, it cannot be obtained at all by the Smith vacuum brake, and it can only be obtained partially, and in an inferior degree, by the other brakes referred to. In the case of the Westinghouse brake, there being a store of high-pressure air in a reservoir on each vehicle, the following combination of advantages is provided in the best manner, viz.:—(1) Instantaneous action on every wheel of the train; (2) instant application by guards, as well as engine-drivers; (3) unfailing tell-tale of its own efficiency.

The above considerations lead further to the accusations so often made by the advocates of the vacuum brake, and now reiterated by Mr. Moon, of the number of failures recorded in the Board of Trade returns by the various descriptions of automatic and non-automatic brakes respectively. A vast number of the so-called failures of the Westinghouse brake are in reality the most important proofs of its success. They are made up of short periods of delay in the running of trains, obliging the servants of the company to make it efficient before they are able to proceed with their trains; and it is observable that the failures of the vacuum brake, and especially of Smith's vacuum brake, are, in a large proportion, dangerous failures, such as when the brake was required to act and did not act, in case of an accident to a train, or of an imminent collision. On the other hand, those recorded of the Westinghouse brake are mainly from neglect of servants, or defects of material, which have caused the brake to fly on, and have therefore been sources of delay without danger. I have the pleasure to enclose a copy of the latest circular which has been issued by the Westinghouse Company on this subject, which will fully illustrate these points, though it is too long to introduce into this letter.

Referring to the same subject, Mr. T. E. Harrison, in his report of the working of the Westinghouse brake on the North-Eastern Railway, makes the following forcible remarks:—It may here be remarked that the above delays are not attended with danger—though called "failures," they are in most cases the best proof of the reliability of the automatic brake acting as a "tell-tale" to call attention to any slight derangement, and they will certainly be gradually and greatly diminished in number, particularly in the bursting of the hose pipes. The whole result is a delay to one train every other week day of three to five minutes, out of all the trains working on the North-Eastern system—not as great a delay as occurs every hour under the working of the block system. The returns of failures made by different companies for the half-year ending 31st December, 1883, vary a great deal, in one case being relatively more than six failures to one on the North-Eastern.

Referring again to the companies stated by Mr. Moon to be using the vacuum brake, though different varieties of it, it is only right to conclude by saying that the following companies have adopted and are successfully using the Westinghouse brake in this country:—The North-Eastern, the London and Brighton, the Great Eastern, the Chatham and Dover, the North British, the Caledonian, the Glasgow and South-Western, the Rhymney, the West Lancashire, and Eastern and Midlands Railway, and that there is not one of these companies that has not found the greatest advantage from it in avoiding or mitigating serious accidents, as, for instance, at Healey, Whitehall Junction, Ormside, Kirkstall Forge, Blackwell sidings, Bickley, Waterloo Colliery, Leeds, Thirsk, Redhill, New Cross, Bricklayers' Arms, Helpringham, Streatham Fen, near Ely, and many others, not to refer to the numerous accidents which have been altogether avoided, and of which, having never been made public, there is no record. Mr. T. E. Harrison, in his report above alluded to, states as follows:—"There does not appear to be any one point in the principle and arrangement of the Westinghouse brake, as now in use, requiring alteration, and it entirely complies with all the requirements of the Board of Trade."

ALBERT KAPTEYN, Sec. and Manager.
August 21st. For the Westinghouse Brake Company.

THE NEW PATENT ACT.

SIR,—The great interest you take in inventors, leads me to hope you will find space for a few remarks anent above Act, and the way in which the Board of Trade officials are working it. Not to speak of the serious delay in dealing with applications, I particularly wish to call your attention to the fact that "notices of interference" are practically discontinued, in flagrant violation of sub-section 5 of Section 7 of the above Act. Up to a recent date, an applicant might be sure of being informed by the Patent-office if an application similar to his had been sent in. This was obviously a great convenience, and in many cases a saving of expense to inventors, and its discontinuance is felt to be a great hardship.

It was always said that the permanent officials of the Board of Trade would be too strong even for a powerful Minister like Mr. Chamberlain, and would, by their old-fashioned red-tape notions, do their best to nullify the Act. This is rapidly proving true, and if Mr. Chamberlain would only spare an hour from the time he is devoting to the abolition of the House of Lords to inquire personally into these and like matters, the results might on the whole be more beneficial to the community at large than the pulling of the wires of the Caucus. A POOR INVENTOR.

August 9th.

RAILWAY SPEEDS.

SIR,—In the *Times* of August 1st, 1884, there is a paragraph on "Express Trains," giving extracts from a paper read before the Statistical Society by Lieut. Willock, R.E., in which he gives the running speed on several lines of railway in the year 1883. In what way he arrived at these deductions the paragraph does not state. Now, referring to a table of mine on "Railway Speed," published in THE ENGINEER of October 20th, 1883, it will be found that in nearly every instance the speed I have set down is considerably higher than that given by Lieut. Willock, though at the time some of your correspondents were of opinion that my figures were too low. The time, distance, &c., in my table were all taken from "Bradshaw's Railway Guide," and I fully explained the method I used in working out the speed.

Appended is a table showing Lieut. Willock's figures compared with mine:—

| Railway. | Lieut. Willock's. Miles per hour. | My table. Miles per hour. |
|---|---|---|
| Great Northern | 46·75 | 46·15 |
| Midland | 45·00 | 48·39 |
| Great Eastern | 43·25 | 44·44 |
| Great Western | 46·25 | 43·80 |
| South-Western | 44·33 | 46·15 |
| L., C., and Dover | 43·12 | 44·78 |
| South-Eastern | 41·75 | 45·11 |
| Brighton | 41·08 | 40·54 |

Lieut. Willock makes the average speed of all the lines mentioned by him 44·33 miles per hour. I made it 44·55 miles per hour.

35, Alma-square, St. John's Wood, August 19th. M. M.

MECHANICAL STOKERS.

SIR,—I notice in your issue of 1st inst. a description of "Hodgkinson's Mechanical Stoker," and particularly the combination with it of a self-acting damper. Without wishing to detract from the merits of this application, I beg to say that the same combination has been in use here since 1877. The facts are these:—Finding the loss arising from steam blowing off, I applied in August, 1876, Cuthell's patent self-acting damper apparatus to a swivel damper in the main flue. In 1877 I put in mechanical stokers, and I at once saw how great an improvement would ensue if I connected the damper gear to the driving strap of the stokers. My arrangement works almost identically the same with the one you describe. It has been working now seven years with complete success. The stokers stop feeding simultaneously with the closing of the damper, and *vice versâ*, and it is extremely sensitive. I have two Lancashire two-flued boilers, 30ft. by 7ft., supplying steam to engines indicating about 300-horse power. One man looks after all easily, as after filling the hoppers, he can leave the boilers for fully half an hour at a time. Since I made this arrangement I have never had to complain of steam blowing off, but the great advantage is that it is kept at one steady pressure, and as a consequence my engines run evenly and regularly in speed. Many steam users have adopted this combination, which, I am led to believe, I was one of the first, if not the very first, to put to practical use. I may add that my boiler pressure is 75 lb., and I am burning now in the summer 2·8 lb. of slack per horse-power per hour, which is very fair with a low-pressure engine—beam—about forty years old, and the high-pressure—horizontal—twelve years old. The latter has plain cut-off slide valves, controlled by a high-speed governor.

Pole-street Mill, Preston, August 20th. M. B. COPLAND.

THE RAILWAYS OF NEW SOUTH WALES.

SIR,—Permit me a few lines of space to notice the somewhat angry rejoinders to my former letter, made by Messrs. Austin and Booth, in your issue of 15th August. If they will read my letter again, they will probably see that I do not accuse either the late Minister of Public Works, or the present Commissioner for Railways, of jobbery. If they cannot see it, possibly others may. In trying to set me right, why are your correspondents not careful of accuracy themselves? Why do they speak of Mr. Goodchap's predecessor, when they must know him to be the first permanent Commissioner for Railways appointed in New South Wales? Why do they allude to Sir H. Parkes and his colleagues as if they were the Government in power? Do they not know Sir H. Parkes' political opponents are now in power these two years? How the latter will smile at the eulogy pronounced on their predecessors. Why do they speak of the tendency of New South Wales as being strongly Protectionist? They might as well say the tendency of Britain was strongly for Fair-Trade, because a small minority exhibits such a tendency.

If, instead of eulogising and whitewashing colonial statesmen, your correspondents had made definite assertions on the following points, their letters, which for brevity's sake I have dealt with as a whole, would have carried more weight, namely, that the present Commissioner for Railways was appointed because the best railway administrator in the colony; or, at least, that he was a practical railway man, having practical experience in railway working; and that his appointment was in no way, however remote, a reward for services of a political character. Instead of giving us definite information of this sort, they have wasted space with what, with your permission, can only be characterised as irrelevant bounce.

August 18th. C. E.

LIQUID FUEL.

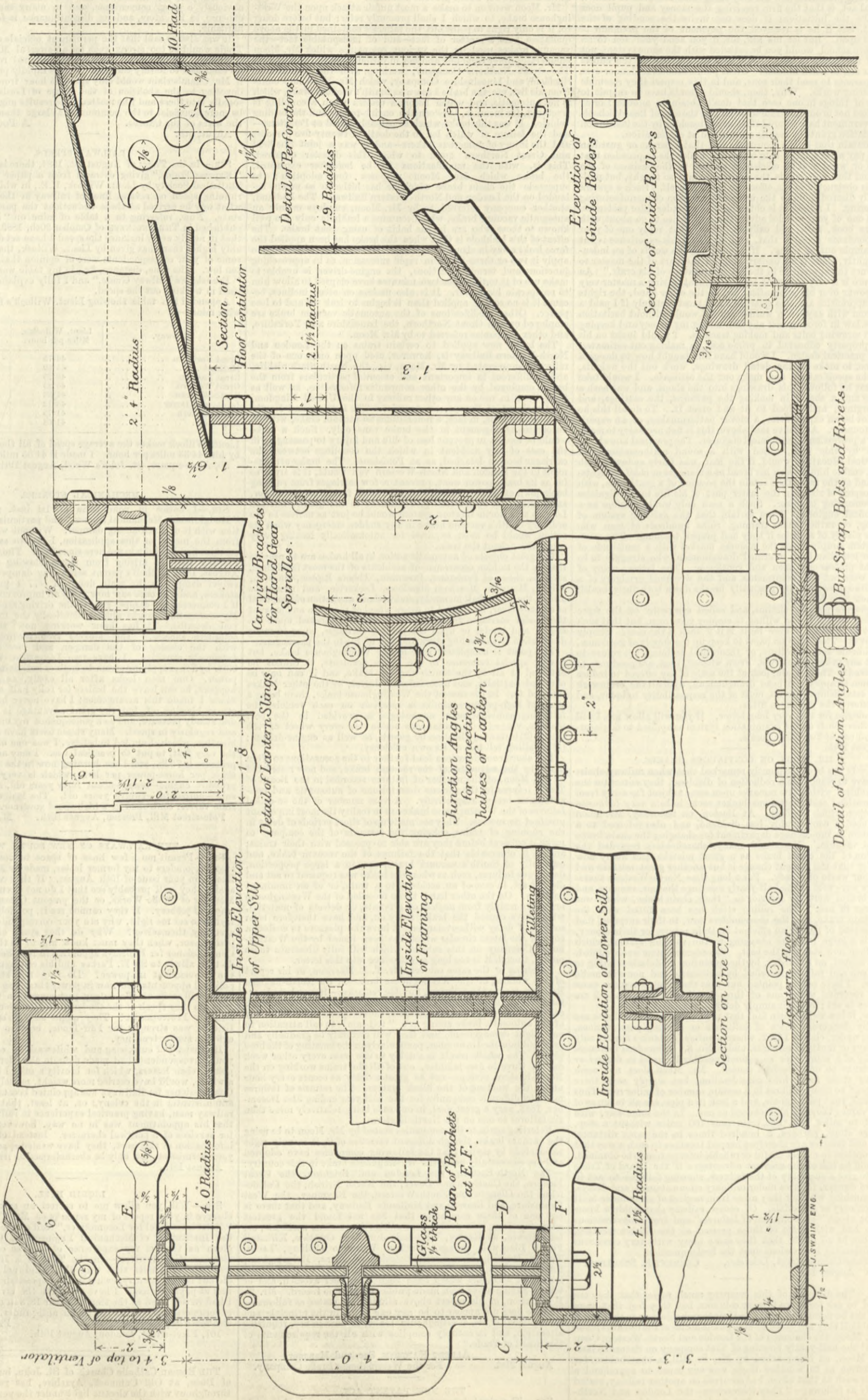
SIR,—Will you allow me to correct an error in date which I observe in your report of my remarks on Mr. Urquhart's paper on "Petroleum Fuel for Locomotives," read at the recent meeting of the Institution of Mechanical Engineers at Cardiff. The date given as that of my experience of the use of liquid fuel on a steamer—the Retriever—on the Thames is 1878, but should be 1868, and soon after that time the liquid fuel question began to die out in this country, owing to the impossibility of obtaining that fuel at paying prices. I have no doubt the error was my own, as I had in my mind at the time the year 1878 in connection with my experiences with petroleum as an anti-primer, and to which you also refer in your report. PERRY F. NURSEY.

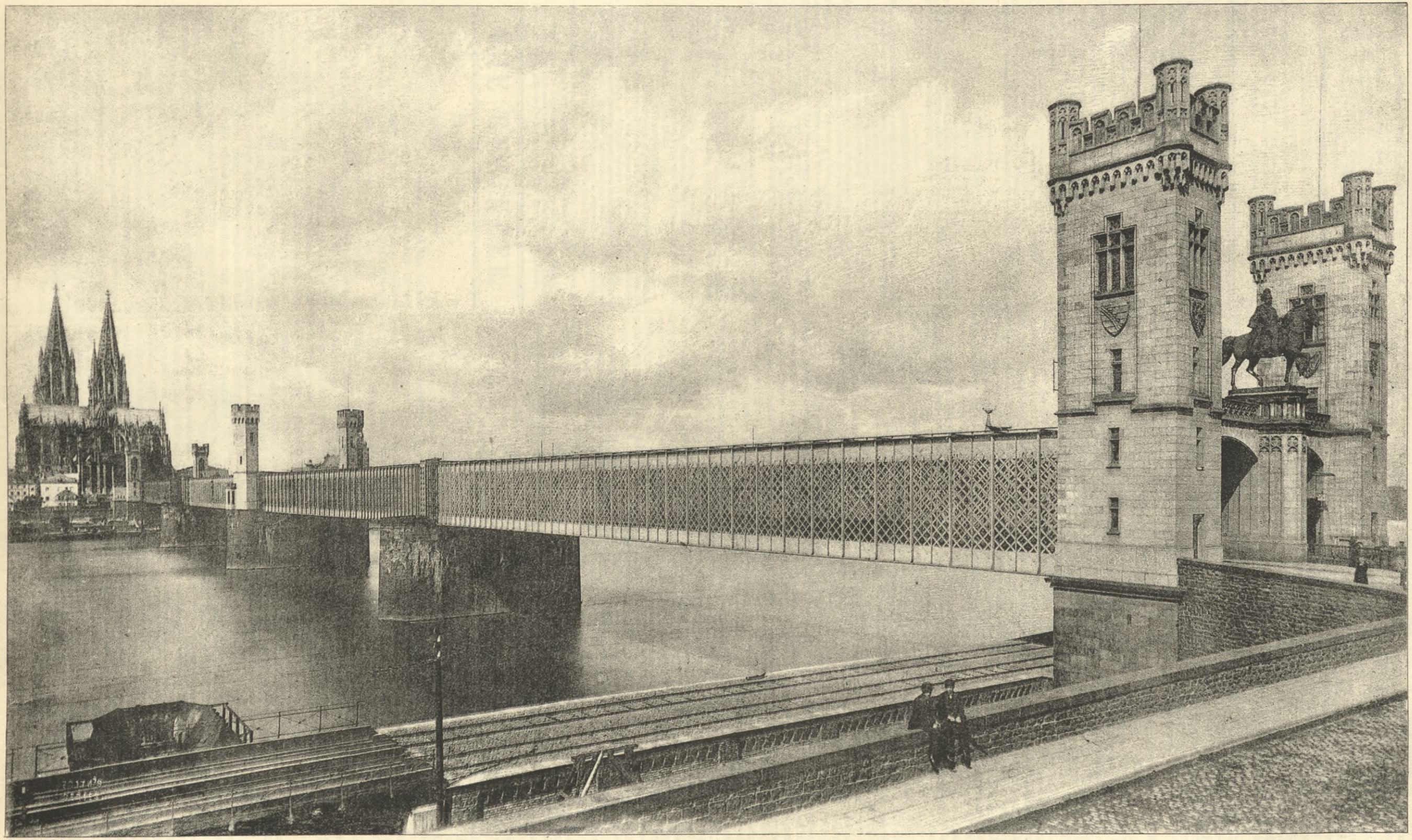
161, Fleet-street, London, August 19th.

THE Roman Catholic Church of St. John, built by the Marquis of Bute, at Old Cumnock, Ayrshire, has recently been fitted throughout with the electric light under the personal superintendence of Mr. William Massey, of Twyford, electrical engineer to the Royal Palaces. There are in all about seventy glow lamps of twenty candles each.

# DETAILS OF REVOLVING LANTERN FOR LIGHTSHIPS.

(For description see page 145.





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J. B. McC. (Blackburn).—*Have you any idea what your scheme would cost?*

J. C.—*The large book by Mr. W. T. Walmisley, published by Messrs. E. and F. N. Spon, is the most likely to meet your requirements.*

J. J. T.—"*Practical Photography,*" *by O. Wheeler, the* Bazaar *Office, Strand. Marion's "Practical Guide to Photography," by Marion and Co., Soho-square.*

### ROTARY PUMPS.

(*To the Editor of The Engineer.*)

SIR,—Can any reader give me the address of makers of a rotary pump which will deliver a certain definite quantity of water per revolution—quantity delivered varying exactly as the speed—against a moderate pressure, say 10 lb. per square inch, speed to be slow? PUMP.

August 20th.

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# THE ENGINEER.

*AUGUST* 22, 1884.

### SIR T. BRASSEY ON THE NAVY.

THE speech of Sir Thomas Brassey before the Liberal Association at Portsmouth affords an illustration of how statistics may be made to support a position declared wholly untenable by some of the highest authorities, if the statistics are selected by the speaker at his will. We do not urge that this is deliberately done to mislead. An enthusiast, for example, sees everything coloured according to the particular bent of his mind, and almost unconsciously selects the facts that appear to support his views. Startling statistics have been brought forward by sincere enthusiasts, to prove strange and conflicting conclusions, on almost any subject, from the Great Pyramid to the condition of the Navy. The bare fact that men in office should all be on one side, and men out of office on the opposite side, must in itself prepare us to receive statistics with caution and examine them. When examined, it will be found that the figures quoted on each side do not contradict each other quite point blank; they appear to be strangely inconsistent, but the inconsistency is to be accounted for from the fact that they do not apply to quite the same thing. The term of years on which an average is taken is different in one case from another, or some special class or group of classes of ships is made the subject of the statistics. This generally accounts for the difference. To illustrate our meaning. Sir Thomas Brassey says:—"In the thirteen years, 1872-85, the expenditure on unarmoured vessels—hulls only—was no less than £7,305,432, as against £9,762,681 expended on armoured ships. In the extent ot our unarmoured construction, we were immensely ahead of the French. The public would be surprised to learn that the figures for the French Navy corresponding to those which he had just given for the British were for armoured ships, £8,350,375; and for unarmoured, £3,007,521. As regards the tonnage to be built, they propose to build in 1884-85 8065 tons, or 1500 tons more than last year, and an amount appreciably in excess of the average of the last six years." The Portsmouth Liberal Association may cry "Hear, hear," but they should also add the companion word "Heed, heed." Doubtless the general impression produced is that we have spent more money in shipbuilding than the French during the last thirteen years, and that we are building more this year than our average latterly, but this is by no means enough. First, we want to know, why is thirteen years taken? Sir Thomas may consider that ships built during that time are generally serviceable, and that there is a good reason for fixing the limit at thirteen years. This takes us back to the completion of the Sultan, which is, perhaps, one of the earliest vessels still to be called first-class; but it includes the Cyclops, Gorgon, Hecate, and Hydra—ships that are regarded as rubbish by many authorities. This date, however, it happens, enables us to compare ourselves with peculiar advantage with France, because at the time of the Franco-German War France dropped shipbuilding in a great measure. Taking Sir T. Brassey's own work for our authority, we observe that in 1865 the French completed six armoured ships, in 1866 two, in 1867 four, in 1868 five, in 1869 one, in 1870 two, in 1871 one, in 1872 two, in 1873 one, in 1874 none, in 1875 four, in 1876 one, in 1877 three, in 1878 one, and in 1879 three. Thus in the four years previous to 1871 France completed 3¾ ships on an average annually, and in the nine succeeding years only 1⅝ ships annually, or not much over one-third the amount. The fact is, that Sir Thomas's statement does not deal seriously with the point raised. The cry has been uttered and pressed home that just at the present time the French are gaining enormously on us in naval strength. It is no answer to this to tell us that if we include their period of inactivity after the German War, thirteen years ago, we have on the whole built ironclads in the proportion of 97 to 83. To begin with, this is a disgracefully low preponderance; further, it includes vessels in both fleets which damage its significance. If Sir Thomas Brassey is satisfied that England, with the bulk of the carrying trade of the world, should stand in this proportion to France, it shows what a sanguine view he takes of the matter. He may no doubt reply that our unarmoured men-of-war are in a much greater preponderance, but this is no sufficient answer in the judgment of most authorities.

To come to the serious question of what we are doing now, the natural statistics to ask for are the numbers of ships built and building by France and by England last year, this year, and probably next year. To this perfectly natural, matter-of-course question, Sir Thomas Brassey gives no answer whatever. He says that we are spending appreciably more than we spent on the average of the last six years; but a demand to rouse ourselves from a state of torpor is not met by doing "appreciably more." A man may be sound asleep, and on a shake he may do "appreciably more" by turning or grunting out a sound; but this is not waking up. Sir Thomas may say that "we, at all events, have spent more than the Conservatives;" but as we do not view these matters in any party way, we should only say, more shame for the Conservatives. It must be pointed out, however, that the Conservative Government *bought* several ironclads, which were just completed for foreign Powers. We presume that Sir Thomas does not include this money as spent in building. If not, it puts the Conservatives probably far ahead of the present Government in money spent on the Navy, though perhaps not in building. Once more, what does Sir Thomas say as to our expenditure this year compared with that of France? On this he does not give us any direct information. He tells us that building in France is almost the same price as in England. He tells us that we are spending £3,891,000 on building expenditure in 1884-85, but this is not explained in any way in which we can utilise it. How much explanation is needed is apparent from the figures quoted above, which amount to only £16,978,113 for thirteen years, or £1,306,009 per year for hulls only. Now definite statements have been made by able men on the other side. Sir Thos. Symonds —see THE ENGINEER, May 16th—states that France this year is spending £596,248 more on building armoured ships than England. Is this true? Sir Thomas Brassey, to whom the statement must have been sent, does not contradict it further than to say that we are spending appreciably more than we did, and that if he selects thirteen years, including the French period of stagnation, he can show that our armour-clads have been built in the proportion to France of 97 to 83. If this is all, things are indeed bad.

Sir Thomas, however, passes on from armour-clads to torpedo boats. This is a subject again alarmingly interesting. Mr. Yarrow, in a paper read at the United Service Institution—see ENGINEER, May 23rd last—in which he stated that of torpedo boats 75ft. long and 10ft. beam Russia has 115; France, 50; Holland, 22; Austria, 17; Italy, 18; and England, 19. That is, we have one to six possessed by Russia and two and a-half by France. Sir Thomas Brassey says: "Looking to the possibilities of torpedo warfare, it would be obvious how incomplete were those comparisons lately presented to the public in which the relative strength of the armoured fleets was accepted as the only test." This is surely the language of a man who has seen the statistics put forward by the authorities to whom we have referred, and who does not wish to stand his ground on armour-clads, but turns to torpedoes for additional support. Certainly, then, we may expect to find Mr. Yarrow's figures contradicted. Sir Thomas, after thus commending torpedo boats to us, will surely crush Mr. Yarrow's figures. Russia has not six times our number, France has not two and a-half times as many; quite the contrary. Is this what he says? No; it is that our Admiralty are not neglecting the construction of torpedo boats; they had "introduced into their programme a sea-going torpedo boat, the Scout, of a much more powerful type than any they had yet built, and capable of cruising with the ironclads in any weather." This may be very well if it is supplemented by the fact that we are building a number; but this is rather problematically expressed by the statement that, "If the type proved successful, Scouts would be added to our squadrons in considerable numbers." When What will be done if Scouts are not very successful? Considerable numbers are, indeed, wanted. Mr. Yarrow has told us of the numbers of boats of Russia and France; Sir Thomas Brassey adds that Germany is making seventy. As to single specimens, we know we have the Polyphemus; as a torpedo ship she is, at all events, unique; but she is but one, and what we want are small boats in fifties to hold our own. In short, as we said on March 28th last, on the discussion in the House—in this question the attack, whether by Sir John Hay and Lord H. Lennox in the House, or by Sir C. Nugent, Admiral Sir Thos. Symonds, or Mr. Yarrow out of it, is definite; it deals with paucity of ships, bad boilers, deficiency in torpedo boats, and delay in supply of armaments; and the defence does not meet it, but takes other ground, and that in so unsatisfactory a way that it leaves us more anxious than before. On this point there is too much at stake for trifling; the country should wake up to the importance of the question before war is on us and it is too late to put matters right.

### CONTINUOUS BRAKES ON THE LONDON AND NORTH-WESTERN RAILWAY.

MR. MOON, chairman of the London and North-Western Railway Company, has joined hands with Sir Edward Watkin in attacking the Westinghouse brake. At the half-yearly meeting of the London and North-Western Company on Saturday last, a shareholder alluded to the severe censure by the Board of Trade on the South-Western Company, on account of the Downton accident, and expressed a hope that the North-Western Company had no cause to apprehend a similar disaster. Mr. Moon replied that they had made every provision to prevent accidents. Finding that various companies were using the vacuum brake, they had decided it was better for them to interchange with those companies and use the same brake. Mr. Moon then went on to state the numbers of so-called failures of Westinghouse compared with vacuum brakes, as illustrated in the Board of Trade Brake Returns; and concluded by quoting from Colonel Yolland's report on the Blackburn collision which occurred in 1881. It is not our wish to discuss Colonel Yolland again; we need only say on this point that there was no evidence whatever that the brake failed, while there was abundant proof to the contrary. The evidence of several passengers given before the coroner clearly proved that the brake was in action at the time of the collision, which was found by the jury to be solely due to the faulty system of working the signals and to the recklessness of the driver. It is, however, a novel experience to find Mr. Moon quoting a Board of Trade inspector on the subject of brakes; and it is significant that this should only be done now, not to justify his own action, but to damage the reputation of an apparatus to which he and his advisers have from the first been strongly opposed. There have, in the past, been numerous communications between the Board of Trade and the North-Western Company on the subject of brakes, and innumerable allusions to the Clark-Webb chain brake are contained in the reports of the Board of Trade inspecting officers; but Mr. Moon has never thought fit to adopt their views or to refer to one of them in address to the shareholders, although it has been clearly shown that a large number of accidents on the London and North-Western Railway might have been prevented had another appliance been in use. It would take more space than we can spare to make the quotations, and perhaps, as the matter is so notorious, it is unnecessary to do so. Since Mr. Moon refers to Colonel Yolland, however, we may point out that in his report on the Blackburn collision, this inspector refers to the necessity for automatic brakes; and in reporting on a collision which occurred through a train breaking in two on the North-Western Railway, he made the following remark:—"The collision would not have taken place at all if the train had been fitted with an automatic brake." In reporting on the collision which occurred at Perth, in August of last year, Major Marindin asserts of the chain brake: "Such a machine is nothing but a trap;" and Colonel Rich, in a report just issued on a collision at the Lime-street Station, Liverpool, where the chain brake was of no use, also remarks: "The brake is not a continuous brake, but a very indifferent sectional brake; and I would strongly urge the company to adopt one of the automatic continuous brakes that have now been in use on many of the railways in the kingdom for some time, and have proved to be fairly effective." The London and North-Western Company still refuses to comply with the Board of Trade conditions.

Compared with the views of those who have never used the Westinghouse automatic brake, the recently-published statement of Mr. T. E. Harrison, the engineer-in-chief of the North-Eastern Railway—on which line the whole stock is fitted with that apparatus—is, we venture to think, conclusive. It is from first to last a complete contradiction of the statements of such assailants as Sir Edward Watkin and Mr. Moon. One brief sentence is all we need quote:—"There does not appear to be any one point in the principle and arrangement of the Westinghouse brake, as now in use, requiring alteration, and it entirely complies with all the requirements of the Board of Trade." As regards the so-called "failures" in the Board of Trade Brake Returns, these records are generally allowed to be useless for the purpose of deciding upon the positive merits of various brakes. Mr. Moon has chosen to lump together every class of incident reported—from the most trivial delay to the absolute failure which results in collision—as being all of equal value. On Mr. Moon's reasoning, the Board of Trade returns would show the Clark-Webb chain brake to be the best, since there are fewer failures reported per mile run with it than with any other system—principally, no doubt, because it is hardly ever used—but notwithstanding this, no other railway has adopted it, and the North-Western Company has now discarded it. When analysed on a correct system, the Board of Trade returns reveal the fact that in four years there were only 16 cases of what might be called failures leading to danger, for the Westinghouse brake, against 556 on the

part of the vacuum brake which Mr. Moon has now adopted.

Two terrible calamities have recently occurred, which it is certain that no non-automatic brake could prevent, and in which nothing but an automatic brake could have been of service. It should be fully understood that the North-Western Company, having at length discarded the chain brake, has, in complete disregard of the Board of Trade injunctions, now adopted what is practically the same brake as that in use on the Manchester, Sheffield, and Lincolnshire Railway, which proved so powerless to avert the catastrophe at Penistone, and which has been so frequently condemned by the Board of Trade. The only addition in the North-Western brake consists in an attempt to automatically apply a brake on the guard's van only in case of a separation of the train. Setting aside the fact that a guard's van is frequently not the last vehicle in the train, this arrangement is wholly inadequate to cope with the suddenness which has been the feature of the most serious railway accidents. But it should be also understood that in taking this course the North-Western Company has really ignored the question of uniformity altogether, and it is still just as isolated as when it used the chain brake. It is a fact that the brake on the North-Western carriages cannot be worked in connection with that of any other company, if we except the North Staffordshire. The step announced by Mr. Moon has, therefore, not been taken in the interests of uniformity. It may be interesting to know that since the fatal accident at Lockerbie, on the Caledonian Railway, to a West Coast mail train, the stock which is jointly owned by the Caledonian and North-Western Companies has been fitted with the Westinghouse brake as well as the vacuum. On the three main routes to the North, viz., the East Coast, West Coast, and Midland, the joint stock vehicles are all now fitted each with two sets of brake apparatus, and of the four different systems employed, the Westinghouse is the only one which is common to the stock of all three, and to a large portion of the country besides. It seems to us that in seeking to justify his position, and to re-assure his shareholders upon the safety of their line, by detraction of an opponent, Mr. Moon has shown the weakness of his own position.

It is a suggestive fact, however, that the London and North-Western Railway Company has at last admitted that a railway brake must be automatic; the admission has been made, it is true, in an imperfect way. Only the brake vans are to be fitted with automatic brakes, but this is a step, however inadequate, in the right direction. Mr. Moon has always assured his hearers that the brakes used by his company are the best possible, no matter what brake was used; and we do not despair of seeing the day when the whole passenger stock of the line will comply with Board of Trade requirements, and Mr. Moon will finally be able to assure his hearers that the brakes on the London and North-Western system are really perfect.

### ELECTRIC LIGHTING.

The present position of electric lighting is very curious and unsatisfactory. That houses, workshops, ships, streets, and public buildings of all kinds can be lighted with perfect success, is now beyond question. There is not a steel works in the kingdom in which arc lights are not freely employed; and engineers have shown no reluctance in substituting electricity for gas. Railway trains and railway stations are lighted by the aid of dynamos and carbons. In fact, there can be no doubt that illumination by electricity is extending. On the other hand, it is dropping out of use in certain quarters. In our streets but little of it is now to be seen. The Edison Company no longer light the Holborn district, and all the companies engaged in electric light enterprises have either gone into liquidation or reduced their capital. A very small proportion of the whole, assert that they are making a little money. But the temptations held out to capitalists to invest are evidently not sufficient, and by far the greater part of the electric lighting done is carried out by private enterprise, or by companies so small that they may almost be regarded as individuals. The cause of all this is not, we think, to be found in the light itself, but in the conditions under which alone electricity can be supplied. It is urged, for instance, that the limitation of the time during which a company can keep possession of its installation, if a corporation please to take it over, is too short; yet, when it is borne in mind that the Corporation will have to pay full value for the plant and goodwill of the ousted company, it would seem that the argument lacks force. The true difficulty seems to us to lie in the system of distribution, and not in the lamps, dynamos, or Electric Lighting Act.

In order to avoid the excessive multiplicity of dynamos and engines, it is necessary that in any town or city a considerable area should be lighted from one centre. This centre has to be wired, and in this wiring lies the great obstacle to electric lighting. When considerable currents have to be dealt with the wire soon becomes excessively hot, unless it is very large and costly, or provision is made for the removal of the heat. This, unfortunately, is just what is not done; on the contrary, the wire is insulated by a material which is a capital non-conductor of heat. The best possible precautions are indeed taken, so to speak, to bring about that very overheating which is of all things to be avoided. The obvious remedy for this trouble is to use iron wires, which are much cheaper, all things considered, than copper; and to suspend these wires uncovered in the open air. Two special advantages would be gained by this. The cooling surface of the iron wire would be greater than that of the copper wire of the same capacity by at least two to one; and in the second place, little harm would be done even though the wire were raised to a comparatively high temperature — say 500 deg. The mischief now to be dreaded is that the overheating of the wires will destroy their insulation. Thus, for example, although cotton-covered wires may never be heated enough to char the fibre, yet that covering after a time becomes brittle, and untrustworthy as an insulator. Gutta-percha is, of course, ruined by a very moderate amount of overheating. Now there are considerable difficulties in the way of hanging naked wires in large towns overhead, and the sooner electric-light engineers devote their attention to devising some method of using wires without protecting coatings the better for the electric light. We can do no more here than throw out a hint, without going into details. It might not be found impossible to place a wire or wires in a tube of metal or earthenware in such a way that it would not touch the tube at all, through which tube a current of air could be easily maintained. Let us suppose that a casing of cast iron pipe, 3in. in diameter, is employed. Down the centre of this pipe might be stretched a copper or iron wire, drawn so tight that it could touch nothing. Curves could be rounded by the aid of small glass blocks, placed in the pipe on the inside of the curve. The details necessary for putting the pipes together and stretching the wires down them could easily be worked out. The cost of the whole ought to be very much less than that of covered wire, while in any case the protecting pipe, or its equivalent, would be needed. At suitable places ventilating apparatus would be provided, so that a current of air would be caused to pass continuously through the tubes. In this way naked wires could be used below ground almost to as great advantage as above ground, and tremendous currents could be passed with safety—currents which could not be thought of if the wire were covered or insulated in the ordinary way. It would be by no means necessary to use this system save in what we may call the main arteries from the generating and distributing station. The smaller house-to-house capillaries might be insulated in the ordinary way. If the main wires are taken care of, the minor wires will, so to speak, take care of themselves.

Those who entertain any engineering doubts concerning the merits of electric lighting will do well to examine the plant and appliances at the International Health Exhibition. Nearly all the systems of electric lighting known to fame can be seen in operation; and no hesitation will, we think, be felt in admitting that the illumination of the building is a great success. The only doubtful point is the lighting of the main hall, which is effected by thirteen rows of incandescent lamps in the roof. The effect of these long lines of light is wearisome to the eye, and the illumination is so small as compared with that by the arc lamps in the other buildings, that the effect produced is one of practical darkness. On the other hand, the lighting of the dining-rooms by the incandescent light, of Mr. Taylor Smith's rooms by the same agency, and those of the Royal Pavilion, leaves absolutely nothing to be desired; it is as nearly perfect as possible. In the electric light shed will be found the finest collection of generating machinery ever got together. On Thursday, the 7th inst., Messrs. Davey, Paxman, and Co., of Colchester, gave a dinner in the Royal Pavilion, to the executive and the press. The Duke of Buckingham occupied the chair, and testified to the excellence of the arrangements made by Messrs. Davey, Paxman, and Co., who have supplied the power required to drive a large number of dynamos of almost every accepted type. No single firm has ever done so much in connection with electric lighting. There are six separate steam engines, indicating now about 1300-horse power. These engines are of different types and dimensions, so that the electrician can see for himself how fully the engineer can comply with his demands for space, shape, weight, or power. The engines have now been running night after night without any hitch of any kind. The only mischance which has occurred from the first was the breaking of a large driving belt. It speaks well for the governor-gear, devised by Mr. Paxman, that the governer acted so quickly and effectively that the normal speed of the engine, suddenly deprived of its entire load, was scarcely affected at all. The six engines drive forty-one dynamos, without counting exciters. The 1300-horse power given out, if employed solely in arc lighting would suffice, after every deduction wae made, for about 1500 lamps, each with a real power of 800 candles. The total light generated would therefore be equal to 1,200,000 candles. As, however, a large proportion af the power expended is used for incandescent lighting, the total candle power is not nearly so great as this. It is eminently creditable to the Colchester firm that this is the second year they have undertaken a work of such magnitude and importance. All the experience acquired last year has been brought into play this year, and nothing having been left to chance, the results are, as a whole, completely satisfactory. It is encouraging to find that the dynamos have been, as a whole, successful. Two only had to be removed. The first gave practically no current. For it was substituted another of the same type, with no better success; and the place of both has been taken by one of Siemens' machines, the only defect of which seems to be that it is excessively noisy. Among the arc lamps a few are not satisfactory, and should be removed. There is no excuse now for unsteady arc lighting. The sight to be witnessed in the electric light shed can hardly ever be forgotten by an intelligent observer. Those who have the least engineering knowledge can scarcely fail to be impressed by the picturesque aspect of the building, and the wonderful play of light and shade and colour to be seen within it. With such an installation as that at the Health Exhibition before us, it is impossible to believe that electric lighting can be a failure. It must grow on the public, and we would encourage engineers and electricians alike to be of good heart, to waste no time in regretting the past, but to go on continually strengthening and improving their position, so that they may render that which is now somewhat of an expensive luxury, as cheap, as common, and as accessible as gas.

### THE TREVITHICK MEMORIAL.

The Trevithick Memorial, of which we this week publish the subscription list, makes satisfactory progress, although the sum required for scholarships in engineering science is still a long way from being reached. The total subscriptions to this date amount to £1429 11s. 7½d., and if from this sum is deducted the cost of a bust in Westminster Abbey which the committee hope to be allowed to erect there, a totally insufficient sum remains for the main object of the memorial, which is to hand down to future generations the memory of Trevithick in the useful shape of scholarships bearing his name. A memorial edition of the life of Trevithick has been compiled and published by the committee, and over six thousand sent out with a draft circular and list of the subscriptions from members of committee and their friends to the members of the following societies: Institution of Civil Engineers, Institution of Mechanical Engineers, Society of Engineers, Institution of Naval Architects, and the Iron and Steel Institute. A circular, accompanied by a copy of Trevithick's life, was sent out also to all the large engineering firms in the country, and the chiefs of all the railways, asking their assistance and co-operation. Up to the present time the response to the last circulars of the committee has not been what they expected, but many of the railways and large firms of engineers are still endeavouring to help forward the movement amongst their workmen and friends, and occasionally lists are sent in, which is encouraging, as showing that the efforts made are still bearing fruit. The committee are most anxious that this movement to do honour to one of England's greatest inventors should be so successful as to enable them fully and largely to carry out the resolution passed at the meeting on April 10th, 1883, viz.:—"To raise a fund for the erection of a statue to the memory of Richard Trevithick, and further, to provide a fund for the establishment of scholarships bearing his name to aid in the technical education of young men to qualify them for the profession of mining and other engineers," and they would therefore ask all those engineers who have not yet subscribed to send their names to the honorary treasurer, Mr. Henry Chapman, Victoria-street. It is calculated that at least double the amount already subscribed will be required to enable the work designed to be properly carried out. A contemporary, writing lately on the subject of the memorial, complains that no public meeting has been held or public appeal made, and seems to think that the exertions made by the committee and the executive have relaxed; but the works of Trevithick are, unfortunately, not known to the mass of his countrymen, nor is the immense value of them appreciated even by engineers themselves. The committee have thought that by publishing a life of the great inventor, and sending it with their appeal to all the members of the societies named, the memorial would reach in a much better manner than any public meeting those who were likely to take an interest in the work. The subscriptions already received are not, as was wrongly stated by our contemporary, principally from locomotive engineers and the workmen in the factories, but include contributors from all classes in the profession of engineers. The history of the inventions of Trevithick, and the marvellous energy that he threw into his work, is well told in the "Memorial Life" which has been sent out by the committee; but it is impossible to estimate the value of his inventions to his country and the world at large; and although he himself reaped no benefit from them, being extremely deficient in commercial grasp of them, as, indeed, almost all inventors are, yet that he was fully conscious of their immense value the following paragraph, taken from a letter he wrote to his friend, Davies Gilbert, a few months before his death, proves, and knowing, as we do, the melancholy death of the writer, the letter reaches the height of pathos:—"I have been branded with folly and madness for attempting what the world calls impossibilities, and even from the great engineer, Mr. James Watt, who said to an eminent scientific character still living, that I deserved hanging for bringing into use the high-pressure engine. This so far has been my reward from the public, but should this be all, I shall be satisfied by the great secret pleasure and laudable pride that I feel in my own breast, from having been the instrument of bringing forward and maturing new principles and new arrangements of boundless value to my country. However much I may be straitened in pecuniary circumstances, the great honour of being a useful subject can never be taken from me, which to me far exceeds riches." If Trevithick had never done anything more than bring into use the high-pressure engine he would deserve as much honour and glory from his countrymen as the great names of Watt and Stephenson; but his early labours on the locomotive in 1804, his initiation in steam agriculture, steam dredging, iron shipbuilding, &c., entitle him to the highest place amongst the world's benefactors; and it will be a great pity if this praiseworthy effort to hand Trevithick's name down to posterity in the eminently useful shape of engineering scholarships is not successful. The work and labour of sending out, by means of circulars, the memorial life of Trevithick has been so great—over 30,000 circulars of different kinds having been issued, reaching about 8000 persons—that the committee will now have to rely upon the publication of the results and appeal for the tardy recognition of Trevithick's works, and we are sure, if once the value of these works is comprehended, the appeal will be generously replied to. Copies of the memorial life of Trevithick can be had from the hon. treasurer, Mr. Henry Chapman, Victoria-street; or from the hon. secretary, Major John Davis, Edinburgh-mansions, Victoria-street.

### THE STEEL RAIL TRADE.

The special return of the Board of Trade shows that the steel rail trade maintains up to the present as full an export as could be expected under the circumstances. During the last month the shipments of steel rails were to the amount of 55,872 tons, as against 64,071 tons in the corresponding month of the past year. Russia took more than in the corresponding month, Sweden and Norway less, Italy less, the United States less—but in the condition of trade in America it is satisfactory to notice that the export of steel rails was to the extent of 4135 tons, which is considerably more than the average of preceding months for the present year. Much more than in last year was sent to British North America and to the British Indies and to Australasia, but to the European countries there was a falling off, with the exception we have noticed. It is growing apparent that we have to endure now an increased competition with some of these countries in other markets, and it is not to be wondered at that one of the effects of the attempt to force up prices is to give some of our continental neighbours orders that might have come to us. Dealing, however, with the question as we find it, and remembering that what must be looked upon as minimum prices for rails have been reached, and that the world is now benefitting by a very good harvest, there ought to be some recovery in the demand for steel rails. Our home railways would find it expedient to anticipate the demand that repairs and renewals will make upon their stocks, and there ought to be large orders for extensions in India, which naturally should drift to this country. At the present time, the railway interest in the United States is much depressed, and an immediate recovery in the demand could hardly be expected there, but in that country revival is usually rapid, and when it has the advantage of a good harvest, the restoration of confidence is a plant of speedy growth. We may ship less rails for the next few months, but meantime the recuperation in the condition of the railways of America is going on, and in the end we shall benefit. The steel rail trade has now an enormous producing power, and that power may not find it easy to procure continuously full employment, but there is ground for the belief that the worst is known.

## MAKING A LARGE MARINE CRANK SHAFT WITHOUT SPECIAL TOOLS.

By MR. NORMAN W. WHEELER.

ALL the old fellows know how to do it, of course, but some of the boys may like to be told how we built up a crank shaft without special tools, and how we succeeded.*

The sketch will show the dimensions. The journals and crank pins were of steel and the web of wrought iron, the counterbalance weights being of cast iron and bolted on. The principal tool available for the work was a 72in. swing Betts lathe, which would swing the webs on the face-plate to bore the pin holes, but would not swing the cranks over the rest, nor would the tool post go in between the webs after the cranks were put together, so that we could not turn up the pins after assembling, although we could manage to trim up the journals if they should need it, as the webs would straddle the rest in way of the middle journal and allow a cut of about 1½in. without shifting the tool. Under these circumstances it behoved us to be very careful about our fits, distances, and the squareness of things generally. The webs came from the forge rough finished, and the first job was to plane them parallel on the sides—but we did not get them true enough in that way to suit, so we tried the lathe by its own face-plate, to see if it would face exactly square. We found that it would work the face plate, say ·002in. hollow, and as the head had no means of adjustment on the V's we put a jack-screw between the head and carriage and strained it to such an extent that a cut across the face plate left it exactly flat. We then mounted the crank webs on the face plate, and bored out the shaft holes, and while still clamped on, we faced up the webs so that the faces were square with the holes. We then turned up a disc to fit the shaft holes or eyes, and bolted it to the face plate with its centre distant from the centre of the face plate equal to the radius of the crank; then mounted the webs successively on the face plant, with the shaft eyes fitted upon the disc and the true side of the webs to the face plate, and bored the pin holes. While doing this we had to leave the carriage alone, for it was strained square by the jack-screw, and the gibs were set down hard to keep it in place. We got all the holes bored without taper, and hoped that they were square with the true sides of the webs, and hence parallel with each other, in which case the whole crank shaft should be true. This job fell to the lot of "Square" Perkins. The pins and shaft pieces were turned up by our surviving fitist, Chapelle, and key-ways slotted in all the holes except one of the pin holes of each pair of webs; the shaft pieces were turned for shrink fits and the pins for press fits. The pin fits were made with double seats—that is, the web was bored to two diameters, each size going half way through the web, and the pins turned to corresponding sizes, so that when the pin goes in it goes half way to place loosely, and has to be forced only half the distance it would if pin and eye were parallel the whole length of the seat; this not only saves work in assembling, but the pin is straightened up parallel with the eye from the first, and is not apt to get stuck from crooked entrance. But, boys, when you make this kind of fit you must bore out a small recess in the eye where the two sizes meet—say $\frac{1}{16}$in. by ½in.—for the oil to go in when the slight shoulder goes home.

The pin-eyes in each pair of webs were bored of slightly different sizes, so that the pin could be put in place and be pressed into both webs at once. Meanwhile the bed-plate of the engine had been fitted with the journal-boxes, which were bored out in place to fit snugly the shaft journals. Then the crank webs were shrunk and keyed upon the shaft and journal pieces, and the parts clamped firmly into their bearings by top brasses and binders, so that while so held they were assuredly in line with each other. We then rigged up our press, which consisted of two 12in. bolts and nuts, two heavy cross bars, a long wrench, a battering ram, and lots of muscle. The crank to be operated upon was turned horizontal, as in that position the binders would hold the journals most rigidly in line, the pin put in place, distance pieces fitted between the pair of webs, and then all hands went to work. The pins went to their places at last and the flat keys were driven.

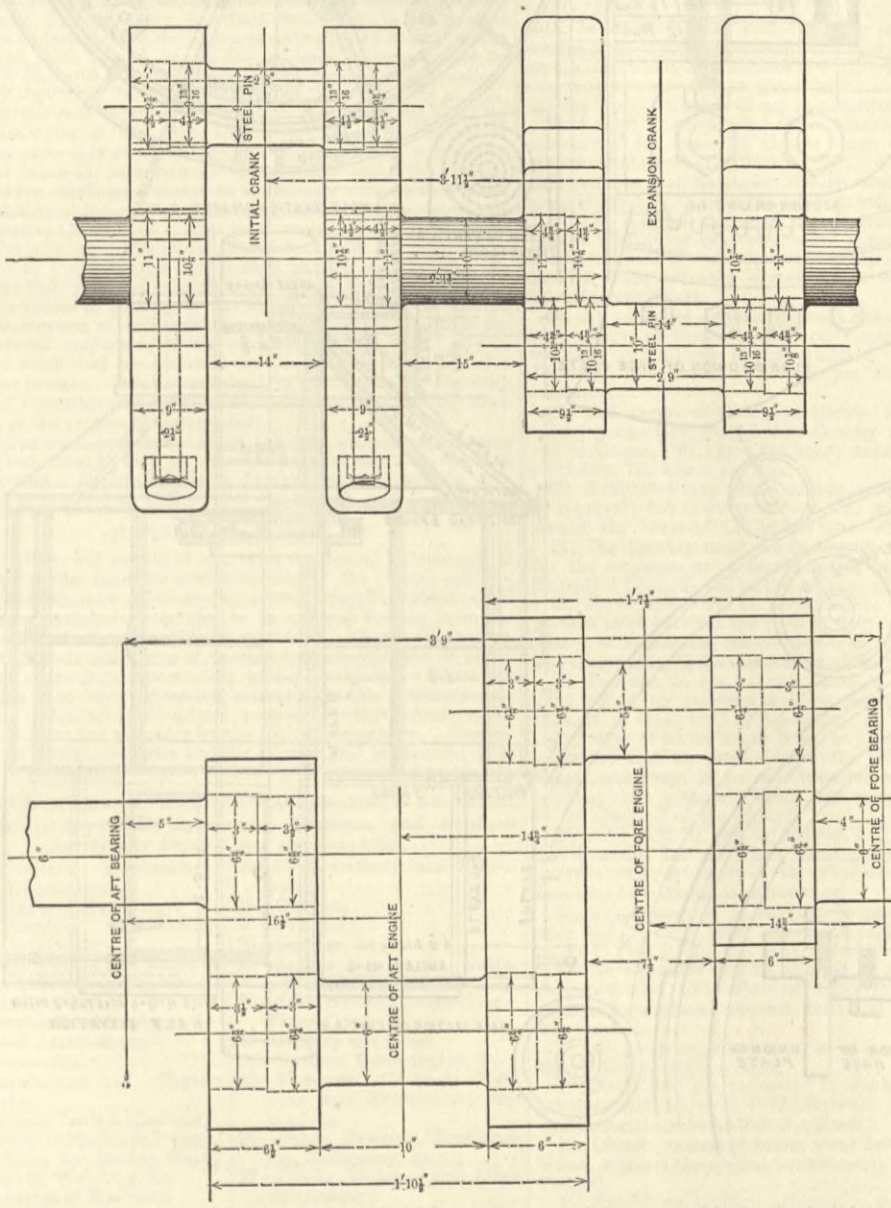
You will remember that key-ways were made in the pin-eye of only one web of a pair, so that only one web could be flat-keyed to the pin. This was because, if we attempt to locate a key-way of that kind in both webs, the slightest inaccuracy in the location of the key-ways in either pin or eye, or the slightest miss in the side fit of either key will tend strongly to force the journals out of line, and if the key does not start the web around upon the pin there will be a strong tendency that way, and that will weaken the grip in one direction, and there will be danger of the engine stress helping the key stress in throwing the crank shaft out. To avoid that we made a key-way with a drill and reamer in the web and pin seat which had no key, by drilling half in the pin and half in the web, clear through the web, and parallel with the axis of the pin; reamed the hole taper $\frac{1}{10}$in. to the foot, and drove a tapered steel key pin hard in and called it a good key. Now we wanted to find out whether we had a true crank shaft. We had no means of testing the parallelism of the crank pins, but we put a few questions to the journals in this wise: We took up the binders and top brasses, clamped a surface gauge at each end of each journal and brought the points down upon parallel touch-pieces, which rested upon the tops of the journals—in this instance the touch-pieces were pieces of writing paper—and turned the crank shaft even in its bearings, feeling of the touch-pieces as it was turned. We could feel no difference in any of the touch-pieces except at the forward end of the forward journal, and that wobbled about ·003in. to ·004in.

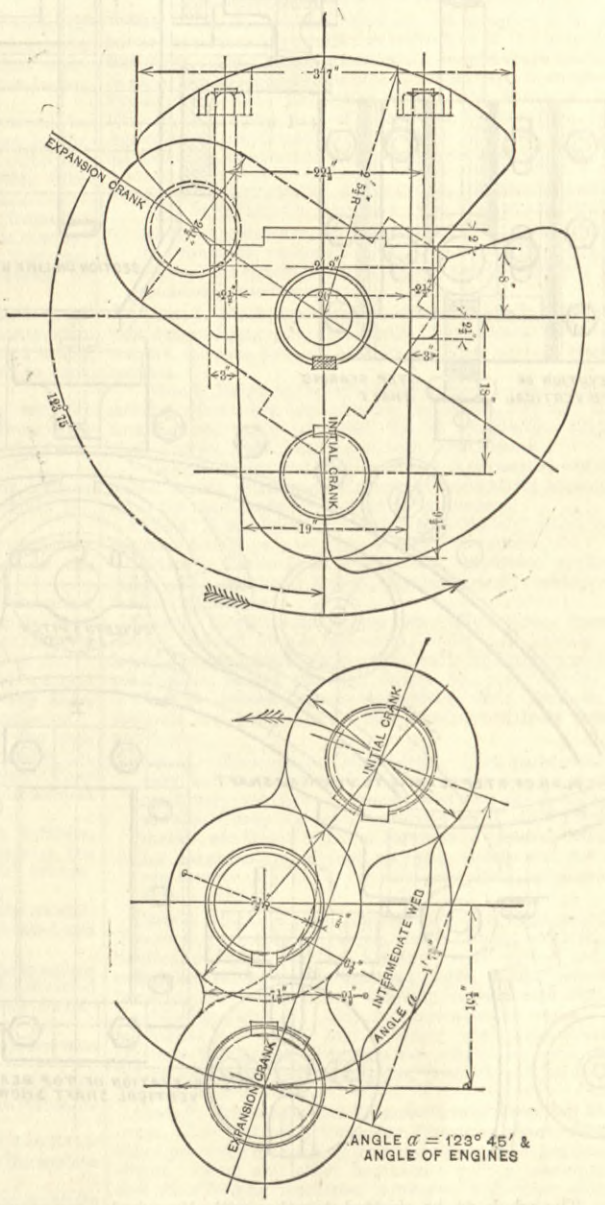
We reckoned that if we attempted to swing the complete crank shaft on centres the sidewise sag from the unequal distribution of weights in the piece—which we could not hope to counterbalance accurately—would cause more crookedness than there existed in the shaft, and that, when we had corrected the fault, the journals would not be round; and further, inasmuch the forward journal was the least important and had the lightest duty of them all—well, we concluded to call it a good shaft. Anyhow, we put it in the engine and it did not heat or pound when run at seventy-seven revolutions per minute; and we continued to call it a good crank shaft.

The other crank shaft, of which you have a sketch, is simpler and not hard to get true if you go the right way to work in designing and working it. You see by the sketch that it is a double crank with the pins nearly opposite each other, and a single intermediate web joining the two pins. You see that the intermediate web is curved, so that when the pins are shrunk into the webs the intermediate web is out of the way of a boring bar, by which the shaft-eyes may be bored out after the pins and webs are assembled and keyed.

We had a Betts boring mill with a platen large enough to take the crank. We mounted the shaft on the platen and callipered the pins true vertically with its surface; then we put in the boring bar, callipered it parallel with the platen, and then callipered the pins true horizontally with the bar, and bored the shaft-eyes. The fits are all shrink-fits, and we call that a good crank shaft. We are going to run that shaft 150 revolutions per minute, and when we do we shall find out whether it is true or not.—*Mechanical Engineer.*

* Mr. Wheeler does himself injustice in addressing the younger readers of this paper, for the method he describes is a most ingenious mechanical arrangement.—ED. E.







## LIGHTSHIP LANTERNS.

THE Trinity House Corporation invited tenders last April for lanterns for lightships. Illustrations of these lanterns, the construction of which presents much that is interesting, will be found on pages 142 and 146. The specification runs as follows:—

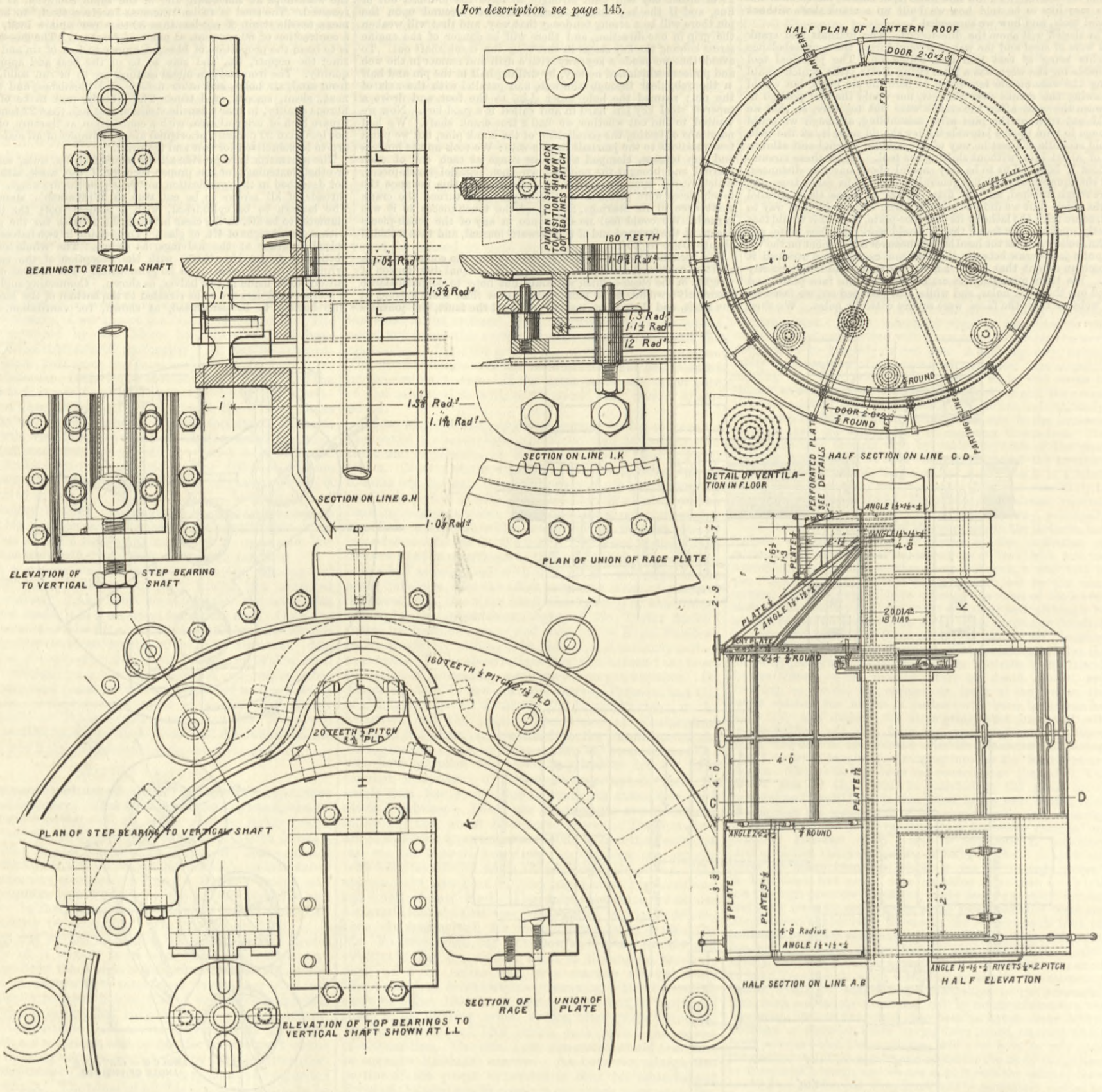
The work included in this specification is the finding of all materials, carriage, utensils, and labour employed in the construction and delivery at the Trinity Buoy Wharf, Blackwall, of six 8ft. cylindrical lanterns for floating lights, in accordance with drawings Nos. 5879, 5880, and 5881, and this specification. After the work has been approved by the engineer-in-chief to the corporation, the whole of the steel and ironwork is to be thoroughly cleansed from rust, and afterwards, with the whole of the gun-metal work, except the portions to be left bright, to be painted three good coats in pure red and white lead mixed. The different parts are to be figured or marked; and upon the contractor receiving a written order, the whole is to be carefully taken down and weighed in the presence of the superintendent. The plating, angles, and rafters of the lantern are to be made wholly of steel, the other portions as specified. All patterns for castings and templates will be furnished to the contractor by the corporation; these will be delivered to the contractor at the Trinity workshops, Blackwall, and when the work is completed they are to be returned to the workshops at Blackwall, and in the same condition as when received. The steel is to be "Siemens-Landore steel," to bear a mean tensile strain of not less than 30 tons per square inch, with a contraction of 50 per cent. at point of fracture. The gun-metal is to be in the proportion of 14 oz. of copper to 1 oz. of tin and 1 oz. zinc; the copper, tin, and zinc to be of the best and approved quality. The iron and gun-metal castings are to be run solid, free from sand, air holes, and other defects and blemishes, and to be neat, clean, smooth, and true. The wrought iron to be of fine fibrous quality, to bear a tensile strain of not less than 22 tons per square inch of original area, with a contraction at fracture of not not less than 20 per cent. of original area. Samples of all materials are to be submitted for test and approval.

The contractor is to provide all the requisite bolts, nuts, screws, or other fastenings for the proper security of the work, although not described in the specification nor shown on the drawings. The threads of all screws to be cut true to Whitworth's standard. The lantern to be cylindrical, with a conical roof; the inside diameter to be 8ft. in the clear between the rebates for the glass, with a clear height of 4ft. of glass. To be made in two halves, and bolted together at the halvings, as shown. The whole of the plating is to be ⅛in. thick, with the exception of the central cylindrical casing, which is to be $\frac{3}{16}$in. thick. The bottom of the lantern to be made in two halves, as shown. Connecting angle and T section stiffeners are to be rivetted to the bottom of the lantern. The bottom to be perforated, as shown, for ventilation. The pedestal to be made in two segments, with two plates in each segment, and to be rivetted together on single butt straps 3in. wide, ¼in. thick, with ¼in. rivets spaced 2in. apart centres, rivetted flush inside and snapped on the outside. The two segments are to be connected as shown. Two doors are to be formed in the pedestal, of the form and dimensions shown, to be hung with gun-metal hinges, and fitted with approved gun-metal latches. The openings for the doors to be stiffened with frames 1¼in. by 1½in. thick, as shown. The lower sill is to be made of angle section, 2in. by 2½in. by ¼in., rivetted to the upper edge of the pedestal plates, with ¼in. rivets spaced 2in. apart, flush rivetted on the inside and snapped on the outside. To be 20in. external diameter, made in two plates, and connected at the parting with angle section 1¾in. by 1¾in. by ¼in., and bolted together with ½in. bolts and nuts spaced 6in. apart, as shown. A semicircular channel is to be formed, also as shown, for clearing the mast and driving pinion and spindle. The casing is to be attached to the bottom plating with 1¾in. by 1¾in. by ¼in. angle section. The whole to be rivetted together with ¼in. rivets, spaced 2in. apart centres. The upper portion to be attached to the rafters by 2in. by 2in. by ¼in. angle section, as shown.

The junction angle sections for connecting the two halves of the lantern, viz., those running along the bottom, up the cylindrical casing and along the roof, are to form good close joints; to ensure this they are to be planed or filed. The upper sill is to be composed of angle section 2in. by 2½in. by ¼in., and a flanged plate $\frac{3}{16}$in. thick, as shown. The flanged plate is to be rivetted to the roof plating with ¼in. rivets spaced 2in. apart, countersunk and rivetted flush on the inside and snapped outside. The flanged plate and angle section to be rivetted together with ¼in. rivets spaced 2in. apart centre to centre, countersunk and rivetted, flush on the inside and snapped on the outside. The framing to consist of twelve vertical iron standards and one horizontal gun-metal standard running all round, as shown. The vertical standards are to be 2½in. by ⅜in. by 4ft. ⅜in. long between the upper and lower sills, into which they are to be mortised and rivetted, as shown. Filleting pieces are to be fitted in between the vertical bars and along the upper and lower sills, as shown, to form rebates for the glass; they are to be rivetted to the bars, standards, and sills in ¼in. rivets, countersunk and rivetted flush on both sides, spaced 6in. apart centre and centre. The rafters, eight in number, are to be composed of two angle sections rivetted back to back, with ¼in. rivets spaced 2in. apart centre to centre, and rivetted flush on both sides, and to be attached to the centre cylindrical casing, as shown. The roof plating is to be in four plates ⅛in. thick, with covering plates 3in. wide by ¼in. thick on the outside at the joints,

# DETAILS OF REVOLVING LANTERN FOR LIGHTSHIPS.

(*For description see page* 145.




as shown. The whole to be rivetted together with ¾in. rivets spaced 2in. apart centre to centre. A circular ventilator is to be attached to the roof, to be ⅛in. thick throughout, and perforated. A circular shield plate is to be fixed round the ventilator, as shown. The top and bottom edges are to be stiffened with 1½in. × ⅜in. half-round iron, rivetted with ¾in. rivets spaced 6in. apart, and countersunk on the outside. A throating is to be fixed inside the ventilator to exclude rain, and to be attached to the roof-plating with ¾in. rivets spaced 2in. apart, as shown. A platform, consisting of twelve radiating wrought iron brackets bolted to the pedestal, and a ⅞in. circular iron ring, 4ft. 9in. radius, is to be attached to the pedestal of the lantern for cleaning the lantern glass. The circular rail to be pinned into the brackets and connected, as shown. Two circular handrails, each ⅝in. diameter, are to be fixed inside the lantern, one at the level of each sill, each to be supported by twelve wrought iron carrying brackets, secured to the lower and upper sills with palm ends attached to the sills with one ½in. tapped bolt in each palm.

Eight cast iron rollers, turned, faced, bored, and bushed with gun-metal, and bored for lubrication, are to be truly fixed to the lantern for guiding it on the mast; four to be fixed at the bottom and four at the top, carried in cast iron carriages with turned and fitted steel pins. These rollers are to be fixed to template so as to ensure their fitting the guides on the mast. A turn-plate, race-plate, six vertical and twelve horizontal rollers, &c., are to be fixed in the position shown, and in accordance with the full size detail drawing of the same. The turn-plate to be of cast iron, and the race-plate of gun metal; to be made in two halves and bolted together, as shown. The race-plate to be internally geared, having a pitch circle of 25½in. diameter, with 160 teeth ½in. pitch; the teeth to be accurately cut and finished. The turn and race-plates are to be turned, faced, and bored, and the turn-plate accurately fitted to the centre cylindrical shaft of the lantern to which it is to be secured with ten ½in. fine threaded bolts tapped into the cylindrical casing, as shown. The six external horizontal rollers are to be 2in. and the internal ones 3in. in diameter. The vertical coned rollers are to be 3in. diameter, turned, bored, faced, and bored for lubrication, and to be carried as shown. The horizontal rollers to be of gun-metal, and the vertical ones of cast iron. The vertical rollers are to be carried by turned and fitted centre pins, and brackets attached to a steel ring, as shown. The ring to be turned, bored, and faced, and to be made in two halves, fish jointed and bolted together, as shown. The centre pins to be hardened, and the points to work against hardened washers let into the rollers, as shown. The pins for carrying the horizontal rollers are to be truly fitted and hardened. The horizontal rollers are to be of gun-metal, and the vertical rollers of wrought iron, hooped with steel welded on. The gun-metal race-plate is to have teeth fitted on its upper surface, as shown, and to be fitted with a gun-metal pinion and spindle, as also shown. The outer end of the spindle to be fitted with a cast iron grooved rope wheel. The outside face of the framing is to be fitted with a gun-metal capping for securing the glass, to which it is to be secured with ¾in. gun-metal countersunk cupped headed screws, spaced 6in. apart centre to centre. The rebates for the glass to be $\frac{7}{16}$in. in the clear. The glazing, although shown on the drawings, is not included in this specification. The frames for the glass are to be carefully adjusted to a standard template, which will be furnished to the contractor, which is to fit accurately throughout the framing. Two strong wrought iron slings for suspending the lantern are to be rivetted to the inside of the centre cylindrical shaft, as shown. The whole of the iron and steel work, with the exception of those parts finished bright, is to be thoroughly cleansed from rust, and to be coated with boiled linseed oil, and afterwards to receive two good coats of red and white lead paint, inside and out. Any detail not specified or shown on the drawings necessary to render the work complete is to be furnished by the contractor without extra cost.

The character of the masts on which these lights will be carried will be gathered from the following specification, issued at the same time :—

*Contract for steel masts.*—The work includes the finding of all material and labour in the construction of six steel masts for light vessels, and delivering the same at the Trinity Buoy Wharf, Blackwall. The mast—which is to be wholly of steel—is to be completed on the contractor's premises, and weighed in the presence of the superintendent. Due notice is to be given to the corporation when ready for inspection, and after the same has been approved by the engineer-in-chief to the Corporation the whole of the work is to be thoroughly cleansed from rust and then painted with three good coats in pure red and white lead paint. Samples of the steel to be submitted for test and approval, to be of the best quality of Siemens' Landore steel, and to bear a mean tensile strain of 30 tons per square inch of original area, with a mean contraction of not less than 50 per cent. at the point of fracture. The rivets throughout to be of steel, to be a good fit in the rivet holes, and rivetted as hereinafter specified. The threads of all bolts and nuts to be cut true to Whitworth's standard. The mast is to measure 64ft. in length by 18in. external diameter, to be made in two plates circumferentially and six plates in height, and to be perfectly cylindrical, parallel, and true. The plates are to be $\frac{5}{16}$in. thick, double rivetted vertically on double butt straps with ⅝in. rivets spaced 3¼in. apart, the butt straps to be $\frac{5}{16}$in. thick. The horizontal joints are to be treble rivetted on single butt straps ⅝in. thick, with ⅝in. rivets spaced 3⅝in. apart, as shown. The edges of all plates are to be truly planed and close butted before being rivetted. The rivet holes are all to be punched and afterwards made perfectly true and fair by riming, and to be countersunk on the outside. At a distance of 7ft. 6in. from the heel the mast is to be doubled for a depth of 5ft., with $\frac{7}{16}$in. plate, as shown, for taking the wedging at the level of the main deck. Four lantern guide bars planed on the front and two sides are to be attached to the mast with ⅝in. rivets spaced about 4½in. apart. The rivets are to be countersunk and flush rivetted on the outside. The two front corners to be rounded, as shown.

The greatest care must be taken that the guides are fixed perfectly true and parallel to the centre line of the mast for their whole length. These are intended for lantern guides; therefore, perfect accuracy is indispensable. The heel of the mast is to be strengthened with an internal welded hoop, double rivetted to the mast with ⅝in. rivets spaced 4in. apart, countersunk and rivetted flush on the outside. The upper portion of the mast is to be strengthened with a welded band, double rivetted to the mast with ⅝in. rivets spaced about 4in. apart, countersunk and flushed rivetted inside and out. A wrought iron step is also to be fitted to the inside of the mast for carrying the topmast, which is to be rivetted to the mast with ⅝in. rivets spaced 4in. apart, countersunk and rivetted flush inside and out. The topmast is of wood. A manhole, with cover, is to be provided at the foot of the mast, and a handhole in the upper part.

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To Remove Foreign Bodies from the Eye.—Before resorting to any metallic instrument for this purpose, Dr. C. D. Agnew—*American Practitioner*, May, 1884—would advise you to use an instrument made in the following manner :—Take a splinter of soft wood, pine or cedar, and whittle it into the shape of a probe, making it about the length of an ordinary dressing probe. Then take a small, loose flock of cotton, and, laying it upon your forefinger, place the pointed end of the stick in the centre of it. Then turn the flock of cotton over the end of the stick, winding it round and round, so as to make it adhere firmly. If you will look at the end of such a probe with a 2in. lens you will see that it is quite rough, the fibres of cotton making a file-like extremity, in the midst of which are little interstices. As the material is soft, it will do no harm to the cornea when brushed over its surface. When ready to remove the foreign body, have the patient rest his head against your chest, draw the upper lid up with the forefinger of your left hand, and press the lower lid down with the middle finger, and then delicately sweep the surface in which the foreign body is imbedded, with the end of the cotton probe. When the foreign body is lodged in the centre of the cornea, it is most important not to break up the external elastic lamina; for if you do, opacity may follow, and the slightest opacity in the centre of the cornea will cause a serious diminution in the sharpness of vision.

## INTERNATIONAL INVENTIONS EXHIBITION.

It is intended to hold, in the year 1885, an International Exhibition of Inventions and of Musical Instruments in the Exhibition-buildings, Royal Horticultural-gardens, South Kensington.

### DIVISION I.—INVENTIONS.

This division will be devoted to apparatus, appliances, processes, and products invented or brought into use since 1862. The collection of inventions will, it is hoped, serve to bring vividly before the public the progress which has been made during the last quarter of a century in applying the discoveries of science to the purposes of daily life. For the practical realisation of this idea, it will be desirable not only to exhibit the apparatus by which a process is carried out—or a model or diagram of it—side by side with the resulting product, but also to show the working of, at all events, a limited number of industrial processes in their consecutive stages.

Having in view the wide range of this International Exhibition, and the limited nature of the total available area, it will be necessary to restrict as much as possible the amount of space which can be allotted even to the most important classes; and only under exceptional circumstances can applications be entertained for space for objects which have been shown in the Smoke Abatement Exhibition, 1881; the Fisheries Exhibition, 1883; or the Exhibition of Health and Education of the present year. [*The classes including such objects are marked in the annexed classification with an asterisk**] As regards agriculture, also, it is considered that the annual shows of the Royal Agricultural and kindred societies will render it unnecessary to admit more than a few typical examples of each class of the improvements effected during recent years; and these should be, as far as possible, represented by models or diagrams. It will, indeed, be preferable that inventions generally should, as far as practicable, be illustrated by models, which in the case of an entire machine may be accompanied by actual examples of the parts improved. Where the invention relates to parts only of a machine, the whole machine will not be admitted unless the improvement—in respect of which the machine is offered for exhibition—cannot be sufficiently well shown without the exhibition of the entire apparatus, or unless in the opinion of the Executive Council the exhibit is of such special interest as to render its admission desirable. Exhibitors will be required by reference to a specification and letters patent or otherwise, to show that their proposed exhibits come within the terms set forth in the conditions of Division I. As the Exhibition will be limited to the illustration of industrial processes, examples of either the raw material employed, or the finished product, will only be admitted when they are required for the full demonstration of a particular process. It is not proposed to allot space for the exhibition of manufactured goods alone, unaccompanied by any illustrations of the process of manufacture.

Intending exhibitors should fill in the accompanying application form, which must be sent to the secretary not later than the 15th of September. Applications from foreign countries and the colonies will be received up to the 1st of November.

### DIVISION II.—MUSIC.

This division will consist of examples of musical instruments of a date not earlier than the commencement of the present century; and, in addition, any machinery, apparatus, or appliances connected with their manufacture or use, or in any way bearing upon the science and art of music, will be admitted. There will, furthermore, be historic collections of musical instruments, and of paintings and engravings representing musical subjects, without any restriction as to date. Intending exhibitors in this division should fill in the special application form, supplied for the purpose, which must be sent to the secretary by the 15th of September. Applications from foreign countries and the colonies will be received up to the 1st of November.

### List of Groups under which the Classification is Arranged.

*Division I.—Apparatus, Appliances, Processes, and Products Invented or Brought into Use since* 1862.

1—Agriculture, Horticulture, and Arboriculture.
2—Mining and Metallurgy.
3—Engineering Construction and Architecture.
4—Prime Movers, and Means of Distributing their Power.
5—Railway Plant.
6—Common Road Carriages, &c.
7—Naval Architecture.
8—Aeronautics.
9—Manufacture of Textile Fabrics.
10—Machine Tools & Machinery.
11—HydraulicMachines,Presses, Machines for Raising Heavy Weights, Weighing, &c.
12—Elements of Machines.
13—Electricity.
14—Apparatus, Processes, and Appliances connected with Applied Chemistry & Physics.
15—Gas and other Illuminants.
16—Fuel, Furnaces, &c.
17—Food, Cookery, and Stimulants.
18—Clothing.
19—Jewellery.
20—Leather, &c.
21—India-rubber and Guttapercha, &c.
22—Furniture and Accessories—Fancy Goods.
23—Pottery and Glass.
24—Cutlery, Ironmongery, &c.
25—Fire-arms: Military Weapons and Equipment; Explosives.
26—Paper, Printing, Bookbinding, Stationery, &c.
27—Clocks, Watches, and other Timekeepers.
28—Philosophical Instruments and Apparatus.
29—Photography.
30—Educational Apparatus.
31—Toys, Sports, &c.

*Division II.—Music.*

32—Instruments and Appliances constructed or in use since 1800.
33—Music Engraving and Printing.
34—Historic Collections.

### REGULATIONS.

1. An International Inventions Exhibition, under the patronage of her Majesty the Queen and the presidency of his Royal Highness the Prince of Wales, will be held in London in 1885.

2. The Exhibition will be opened in May, 1885, and will continue open for a period of about six months.

3. Division I. (Inventions) will be devoted to illustrations of apparatus, appliances, processes, and products, invented or brought into use since 1862.

Division II. (Music) will consist of examples of musical instruments of a date not earlier than the commencement of the present century, and of historic collections of musical instruments and appliances, and paintings, engravings, and drawings representing musical subjects, without any restriction as to date.

4. Medals in gold, silver, and bronze, and diplomas of honour will be awarded on the recommendation of juries.

5. No charge will be made for space, but exhibitors will have to pay every expense of conveying, delivering, fixing, and removing their exhibits, and also the cost of the erection of counters when required; and they must, either personally or by their agents, superintend the dispatch, transmission, reception, unpacking, installation, and, at the close of the Exhibition, the removal of their goods; in default thereof the Executive Council reserve to themselves the right of doing whatever may be considered necessary, at the expense of the exhibitor.

6. Should any goods be deposited in the Exhibition premises during the absence of the exhibitor or his agent, the Executive Council will not be responsible for any loss or damage, from whatever cause arising.

7. Cases must be unpacked as fast as possible, and the empty cases taken away by the exhibitors or their agents. The Executive Council decline to accept any responsibility with reference to empty cases, which must be at once removed from the building at the expense of exhibitors.

8. Applications to exhibit must be made on printed forms, which will be supplied on application to the Secretary, International Inventions Exhibition, South Kensington, S.W.; these must be filled up and returned on or before the 15th September, 1884. The decision of the Council with regard to applications will be notified about the 1st of December.

9. The Council reserve to themselves the absolute right of refusing to admit any exhibit without necessarily specifying any reason for so doing.

10. Manufactured articles or products will only be admitted in so far as they may be necessary to illustrate an improved method of manufacture, or an improvement in the machine or process by which they are produced.

11. Untried and unpatented inventions will not be accepted unless recommended by a competent authority.

12. Where the invention relates to parts only of a machine, the whole machine will not be admitted unless the improvement, in respect of which the machine is offered for exhibition, cannot be sufficiently well shown without the exhibition of the entire apparatus, or unless, in the opinion of the Executive Council, the exhibit is of such special interest as to render its admission desirable.

13. Inasmuch as the scope of this Exhibition is very extensive, while the total area available is limited, it will be necessary to restrict as much as possible the space available for each exhibitor. It will, therefore, generally be preferable that inventions should, as far as practicable, be illustrated by models, which in the case of an entire machine may be accompanied by actual examples of the parts improved.

14. The classification is not to be considered as exhaustive. Where there appears to be no head under which an invention may come, the exhibitor should apply for space in the group most nearly cognate.

15. In cases where an invention may come within the scope of several distinct groups, the exhibitor is at liberty to enumerate the groups into which he considers it should come, in order that reference may be made to it in the different sections of the catalogue; but duplicate exhibits will not be admitted.

16. Except under special circumstances, no applications will be entertained for space for objects which have been shown in the Smoke Abatement Exhibition, 1881; the Fisheries Exhibition, 1883; or the Exhibition of Health and Education, 1884. The space allotted to agricultural exhibits will be very limited.

17. The Executive Council will endeavour to obtain, from the various English railway companies, special terms for the conveyance of exhibits to and from the Exhibition; and, should they succeed in doing so, such arrangements will be communicated to intending exhibitors.

18. All packages containing goods intended for exhibition must have painted on them the distinctive mark I. I. E., together with the name and address of the exhibitor. Labels, addressed to the Secretary, to be attached to packages, will be forwarded to each exhibitor.

19. All cases, counters, platforms, &c., must not, without special permission, exceed the following dimensions:—Show cases and partitions, 10ft. above the floor; counters, 3ft. above the floor; platforms, 1ft. above the floor.

20. Exhibitors may place railings around their stands, subject to approval; but in every instance the railings must be within the area of the "stand," *i.e.*, of the space allotted.

21. The flooring must not be altered, removed, or strengthened for the convenience of arrangement, except by sanction of the Executive Council, and at the expense of the exhibitor.

22. No exhibitor will be permitted to display exhibits in such a manner as to obstruct the light or impede the view along the open spaces, or to occasion inconvenience or injury to other exhibitors, or otherwise to disadvantageously affect their displays.

23. In order to ensure uniformity of decoration and general good effect, no exhibitor will be allowed to put up any flags, banners, or other kind of decoration, without special permission.

24. Signs or name-boards must be placed parallel with the main passages—that is, parallel with the frontage of the respective stands, and must in no case interfere with the lighting. They must be black with gold letters, and their position must be subject to the approval of the Council.

25. All handbills, printed matter, &c., connected with exhibits, and intended for gratuitous distribution, must first receive the approval and permission of the Executive Council, which permission may be withdrawn at any time.

26. Exhibitors will be required to provide all necessary attendance, and to keep their stands and exhibits properly cleaned and in good order during the whole period of the Exhibition.

27. No exhibitor will be allowed to transfer any allottment or portion thereof, or to allow any other than his own duly admitted exhibits to be placed thereon, except by permission of the Executive Council.

28. All goods exhibited must be in the name of the person who signed the application form.

29. Exhibitors are requested to mark the selling price of the articles exhibited, so as to facilitate the judgment of the juries, as well as for the information of visitors.

30. Objects cannot be taken away before the close of the Exhibition, without the special permission in writing of the Executive Council.

31. Exhibitors, or their attendants, may explain their exhibits to visitors, but they will in all cases be forbidden to invite visitors to purchase the goods, the Exhibition being intended for the purposes of display only, and not for those of sale. Special regulations will, however, be framed with regard to perishable articles.

32. Motive power will be supplied free of cost under certain conditions, but exhibitors will be required to pay for any gas or water that they may require. Exhibitors requiring motive power are requested to make special application to the Secretary.

33. No explosive substances, nor any substances which in the judgment of the Executive Council are dangerous, will be admitted; they may be represented by models or dummies.

34. Spirits, oils, essences, corrosive substances, and generally all substances which might spoil other articles or inconvenience the public, can only be received in substantial and suitable vessels of small size.

35. The Executive Council reserve to themselves the sole right of compiling a catalogue of the exhibits under regulations which will be duly notified. Each nation will, however, have the right to produce at its own expense a catalogue of all the objects in its own section.

36. The Council reserve to themselves the right of causing any of the exhibits to be examined, tested, or analysed for such objects as they may think fit.

37. No article exhibited may be photographed, drawn, copied, or reproduced in any manner whatsoever, without the special sanction of the exhibitor and of the Executive Council.

38. The Executive Council will not hold themselves responsible for loss or damage occurring to any exhibit from any cause whatsoever; but, while declining any responsibility, the Council intend to take such precautions as they deem necessary.

39. No goods can be sent in previous to the 1st of March without special permission; after the 15th of April no goods will be received.

40. Passes to the Exhibition will be granted to exhibitors and to a reasonable number of attendants. If these passes are used by any but those to whom they are issued, they will be immediately cancelled.

41. The right to add to, alter, amend, or expunge any of these rules is reserved by the Executive Council.

42. Both Englishmen and foreigners in becoming exhibitors signify by so doing their compliance with the whole of these regulations, together with such other regulations as the Executive Council may issue from time to time.

43. The Executive Council reserve the right to remove the objects belonging to any exhibitor who may not conform to the regulations.

44. If any damage or injury shall be caused or occasioned during the Exhibition by any exhibited machine, implement, or article to any visitor or other person, or to any officer, servant, or others then and there employed by the Executive Council of the International Inventions Exhibition, 1885, then the exhibitor to whom such machinery, implement, or article may belong shall indemnify and hold harmless the said Council from and against all actions, suits, expenses, and claims on account or in respect of any such damage or injury which may be so caused or occasioned.

*Special Rules—in addition to the above—Affecting Foreign and Colonial Exhibitors.*

45. The Foreign and Colonial Commissioners appointed by their Governments are invited to communicate with the Secretary. They will be charged with the consideration of all questions relative to the distribution of the space allotted to their respective countries; and the Executive Council will place at their disposal all information and plans that may be useful to them. Foreign and Colonial Commissioners will be required to guarantee that all exhibits in their respective sections are in accordance with the classification and with the regulations.

46. The applicants for space from countries in which no Commissioner has been nominated must appoint agents in England to act on their behalf.

47. Applications from foreign countries and colonies will be received up to the 1st of November.

48. Packages from foreign countries must have painted on them the letters I. I. E. They must all be marked in such a way as to show distinctly from whence they come, the name of the country, and the name and address of the exhibitor.

### CLASSIFICATION—UNDER REVISION.

*Note.*—The heads given below are not intended to be exhaustive, but are rather to be regarded as indicative of the proposed scope of each class. Only under exceptional circumstances can applications be entertained for space for objects which have been shown in the Smoke Abatement Exhibition, 1881; the Fisheries Exhibition, 1883; or the Exhibition of Health and Education, 1884, or for Agricultural Implements. The space allotted to those classes marked with an asterisk will therefore be very limited.

Division I.—Apparatus, Appliances, Processes, and Products Invented or Brought into Use since 1862.

*Group I.—Agriculture, Horticulture, and Arboriculture.*—(For land drainage, reclamation, &c., see Group iii.; for agricultural engines, see Group iv.; for manure, see Group xiv.; for milling machinery, see Group xvii.)

* Class 1. Field Implements:—Ploughs, drain-ploughs, cultivators, steam-diggers, harrows, drills, haymakers, horse-hoes, rakes, reapers, mowers, binders, anchors and rope porters, wagon, wagon-harness.

* Class 2. Barn and Farmyard Implements:—Thrashing machines, screens, winnowers, corn-cleaning machines, hay and straw elevators, hay and straw and fresh fodder compresors, turnip-cutters, chaff-cutters, grist mills, horse-gear, crop dryers.

* Class 3. Dairy and Poultry Farm Appliances:—Milking appliances, cream separators, churns, cheesemaking apparatus, apparatus for manufacturing butterine, incubators.

Class 4. Agricultural Construction:—Models, plans, and designs for farm buildings, oast houses, siloes, rickstands, &c.

* Class 5. Cattle Food:—Materials, processes, apparatus; seed mills, cake crushers; boilers, steamers and cooking apparatus; feeding appliances.

Class 6. Horticultural Apparatus:—Hothouses, frames, greenhouses, orchard houses, graperies, boiler and heating apparatus, lawn mowers, watering apparatus, tools and implements, pots and plant boxes, garden wirework, chairs, &c., plant labels.

Class 7. Arboriculture:—Apparatus, &c., used in forestry; methods and materials for the preservation from decay of trees and timber.

*Group II.—Mining and Metallurgy.*—(For stone-working machinery and testing machines, see Group x.; for metal-working machinery, see Group x.; for slate-sawing and dressing machines, see also Group x.; for electrolytic methods of extracting, &c., metals, see Group xiii.; for furnaces in general, see Group xvi.; for manufacture of fuel, see also Group xvi.; for explosives, see also Group xxv.; for mine-surveying apparatus, see also Group xxviii )

Class 8. Machinery and Appliances used in Mines and Quarries:—Prospecting, searching, boring, shaft sinking, exploring, working, hauling, pumping, winding, hoisting; man engines, safety catches, safety hooks, hydraulic mining; tools, drills, cutters, getters, breakers, air compressors; blasting, substitutes for explosives. Ventilating, lighting. Aids to respiration in mines. Life-saving appliances. Washing and dressing coal and other minerals, crushers, pulverisers, disintegrators, stamps, screens, riddles, separators, classifiers, jiggers, buggles, precipitators, sawing machines. Utilisation of waste.

Class 9. Production and Manufacture of Iron and Steel:—Coke ovens, blast and other furnaces; Bessemer plant, Siemens plant, other processes for making iron and steel; blast engines; hot-blast stoves; steam and other hammers; rolling machines, hydraulic and other forging machines, squeezers and other shingling apparatus; production and use of malleable cast iron; wire-making apparatus; manufacture of tin plate, utilisation of gases and of slag; alloys and artificial compounds of iron with non-metallic elements.

Class 10. Forging and Foundry Work:—Cupolas, air furnaces, pot furnaces; moulding machines, plate moulding; forges, forging machines; blowers, bellows, fans.

Class 11. Metallurgy of Metals other than Iron, with the exception of the precious metals. Alloys:—Furnaces and appliances used in the dry and wet methods of extracting and purifying copper; extraction of lead; metallurgy of zinc, tin, nickel, cobalt, bismuth, antimony, arsenic, mercury, aluminium; manufacture of sheet lead, lead pipe, Muntz's metal, sheet zinc, copper and brass tubes; bronzes, German silver and other nickel alloys; wires of copper and its alloys.

Class 12. Metallurgy of the precious metals, Gold, Silver, and Platinum: Furnaces and appliances used in the dry and wet methods of extracting the precious metals; desilverisation of lead; amalgamation in all its forms, refining gold and silver; purification, melting, and working of platinum and its alloys.

*Group III.—Engineering Construction and Architecture.*—(For railway plant, see Group v.; for launching ships, see Group vii.; for surveying instruments, see Group xxviii.)

Class 13. Roads:—Methods and materials for constructing and paving roads; cleansing roads and pavements; road-sweeping machines; rollers; apparatus for the removal of mud, snow, &c.; water-carts and other means of watering.

Class 14. Railways and Tramways:—Construction; excavators and appliances used for earthwork and tunnelling. Permanent way; rails, chairs, sleepers.

Class 15. Bridges and Viaducts: Models, plans, and designs for arched, girder, suspension, trestle, and other bridges; apparatus used in construction.

*Class 16. Docks and Harbours:—Models, plans, and designs for docks, harbours, piers, breakwaters, &c.; submarine constructions; diving apparatus; dredging machines; pile drivers, screw piles; cofferdams; graving docks, "patent" slips, caissons, pontoons, floating docks, hydraulic apparatus for working dock gates, &c., gridirons. Buoys.

* Class 17. Lighthouses:—Methods of construction; appliances used in lighthouses and in lightships, fixed and flashing light apparatus, lamps, sound signalling apparatus.

Class 18. Rivers and Canals: Conservation and improvement of rivers; construction of canals; locks, lifts, and inclines, weirs.

* Class 19. Water Supply and Sewerage:—Methods of collecting, pumping, storing, filtering, aud distributing water; appliances for detecting and preventing waste of water, water meters; water fittings, filters; sewers, sewage disposal and utilisation.

Class 20. Reclamation, Irrigation, and Drainage of Land:—Drainage (natural and artificial) of low-lying districts; embanking and warping land; irrigation works.

Class 21. Testing Apparatus:—Apparatus and instruments used in testing, iron, stone, brick, concrete cement, &c.

Class 22. Military Engineering and Fortification:—Military topography.

* Class 23. Materials used in building:—Bricks and tiles, machines for making them; concrete, artificial stone, cement, materials and appliances used in their production; asphalte; roofing felt, and other roofing materials; columns, girders, and other applications of metal in building; applications of terra-cotta to buildings; preservative and fire-resisting materials, paints, &c., for application to stone, wood, iron, &c.; methods of applying the same.

* Class 24. Building Construction:—Models and plans showing methods of construction; non-combustible constructions; labour saving and other machines and appliances used in building scaffolds, elevators; fittings and appliances used in buildings, shutters, blinds, lifts, bells, speaking tubes, &c.

* Class 25. Heating, Ventilation, House Drainage, &c.:—Sanitary appliances; ventilators; cowls for chimneys; chimney-sweeping apparatus; apparatus for heating by steam, water, air, &c.; means of cooling air.

*Group IV.—Prime Movers, and means of Distributing their Power.*—(For distribution of power by water, see also Group xi.; by electricity, see Group xiii.)

Class 26. Steam Engines and Boilers:—Stationary, portable, marine, locomotive; fireless locomotives; methods and means of preventing corrosion and incrustation; methods and appliances for preventing explosions and for testing boilers; firegrates, fire-feeders, smoke-consuming appliances; valves and valve gear; steam joints, governors, injectors, pumps; bearings, lubricators, anti-friction metals; indicators, gauges, manometers, tachometers, dynamometers.

Class 27. Gas and Air Engines, &c.:—Gas engines, hot-air engines, petroleum engines, air compressors, compressed air engines; ammonia engines, vapour engines; accessories for the above.

Class 28. Means of Utilising Natural Forces:—Turbines, water-wheels, tide mills; means of utilising wave power; hydraulic rams, water-pressure engines; windmills; solar engines.

Class 29. Means of Transmitting Power:—Driving bands, shafts, pulleys, gearing, clutches, distribution of power by water or by air.

*Group V.—Railway Plant.*—(For construction of railways and tramways, see Group iii.; for locomotives, see Group iv.; for common road locomotives, see Group vi.; for signals, see also Group xiii.)

Class 30. Rolling Stock (excepting Locomotives):—Carriages, trucks, wagons, vans; wheels, tires, axles, springs, bearings, buffers, couplings.

Class 31. Fixed and other Appliances:—Switches, signals, crossings, turntables, switch locks, communication with trains and in trains, water cranes, and other modes of tender supply.

Class 32. Brakes, Hand and Automatic:—Screw, chain, compressed air, vacuum, steam, electrical.

Class 33. Tramways:—Rolling and fixed plant.

Class 34. Atmospheric Railways, Portable Railways, &c.:—Rope railways, pneumatic dispatch.

*Group VI.—Common Road Carriages, &c.*—(For farm wagons, &c., see Group i.)

Class 35. Carriages for Common Roads:—Steam, &c., carriages; pleasure and travelling carriages; cabs, omnibuses, hearses, trucks, carts, bath chairs, perambulators, ambulance carriages; machinery used in carriage, &c., construction; indicators, carriage lamps, carriage furniture and fittings; methods and means of propulsion.

Class 36. Bicycles and Tricycles:—"Cycles" of every description, and fittings for the same.

Class 37. Saddlery and Harness:—Horse-clothing, whips, spurs; means and methods of breaking in horses; disengaging runaway horses.

Class 38. Farriery:—Veterinary apparatus and material; medicines for horses, cattle, &c.; horseshoes, machinery for making horseshoes and horse nails; methods of roughing horses; horse-clippers; grooming apparatus.

*Group VII.—Naval Architecture.*—(For floating docks and dredging apparatus, see Group iii.; for engines and marine engines, see Group iv.; for nautical instruments, see Group xxvii.)

* Class 39. Ship and Boat Building:—Construction and materials; sheathing, armour-plating, launching; cleaning ships' bottoms, preventing fouling; raising sunken vessels, leak-stoppers, lifeboats, life-rafts and fittings, life-saving apparatus; light-ships; submarine boats, torpedo boats; loading and discharging cargo.

* Class 40. Ships' Fittings:—Masts, sails, rigging, &c.; materials for sails; wire rigging; self-reefing sails; use of steam power for working sails; anchors, and chain cables; means for weighing anchor; steam winches, capstans; lowering ships' boats; pumping and ventilating arrangements.

Class 41. Marine Propulsion (including Steering):—Screw propellers, paddles, hydraulic propellers, river and canal propulsion, chain towing; hand, steam, and hydraulic steering gear.

*Group VIII.—Aeronautics.*—(For observing instruments, see Group xxviii.; for apparatus for balloon photography, see Group xxix.)

Class 42. Balloons:—Material for balloons; methods of constructing and inflating; manufacture and transport of gas for the purpose; fittings; military and captive balloons; balloon equipment for field and siege purposes; fire-balloons; parachutes.

Class 43. Aeronautic Apparatus:—Flying machines; propelling and steering apparatus for such machines.

*Group IX.—Manufacture of Textile Fabrics.*—(For dyes, mordants, &c., see Group xiv.)

Class 44. Treating Raw Material:—Cotton—picking, ginning, seed-cleaning, baleing, pressing, opening. Flax, jute, rheea, &c.—retting and its substitutes, breaking, scutching, heckling. Wool—clipping, sorting, washing, drying, heckling. Silk—rearing and feeding of silkworms, reeling, winding, loading, conditioning.

Class 45. Preparing for Spinning:—Combing and carding fibrous materials; manufacture of combs and cards.

Class 46. Spinning:—Drawing, slubbing, roving, spinning, twisting, doubling, throwing, spooling, reeling, balling, &c. Making sewing and darning thread; reels, cops, and cop tubes.

Class 47. Preparing for Weaving:—Sizing, warping, beaming, &c., yarns.

Class 48. Weaving:—Weaving plain, figured, damask, and double fabrics; weaving carpets, velvets, and other pile and terry fabrics; weaving ribbons, tapes, &c., hose for water, sacks, sail-cloth, hair; jacquards and apparatus for making jacquard cards, electrical and other substitutes; temples, pickers, including pneumatic and modes of "handling" shuttles; harness, healds and reeds, weft and other stoppers.

Class 49. Rug and Mat Making:—Cocoa-nut and other fibre.

Class 50. Lace-making, &c.:—Manufacture of lace, knitted fabrics, hosiery, &c., net and meshed fabrics, nets, fringes, chenille, braid and plaited fabrics, elastic fabrics.

Class 51. Dressing and Finishing:—Drying, stretching, ageing, dressing, finishing, singeing, shearing, folding, fulling, calendering, measuring, packing, and otherwise preparing for market.

Class 52. Felt-making:—Manufacture of felted fabrics.

Class 53. Bleaching and Tissue Printing:—Machines and appliances used in bleaching, dyeing, and printing fibres, yarns, and fabrics; mixtures used in bleaching and washing, dyeing patterns; resist and discharge printing; printing rollers and blocks. Dyeing materials and colours; thickeners.

Class 54. Rope-making:—Manufacture of twine, cord, rope, safety fuses; materials used in the manufacture.

Class 55. Utilisation of Second-hand Materials and Waste Products:—Mungo, shoddy, tow, oakum, waste silk, waste cotton.

*Group X.—Machine Tools and Machinery.*—(For steam hammers and forging machinery used in iron and steel making, see Group ii.; for machines for making horseshoes and horse nails, see also Group vi.)

Class 56. Metal-working Machines:—Lathes; planers; machines for punching, shearing, sawing, drilling, boring, slotting, shaping, milling, wheel-cutting, screw-cutting, rolling and bending, corrugating, stamping, coining, pressing, rivetting, forging; emery wheels, grinding machines; rivet, nail, bolt, and screw-making machinery.

Class 57. Wood-working Machinery:—Lathes (including lathes for ornamental turning); machines for sawing, planing, moulding, mortising, carving, veneering, cask-making, wheel-making, cork-cutting, &c.

Class 58. Stone-working Machinery:—Machines for sawing, planing, turning, dressing, polishing, grinding, breaking and crushing stone and slate.

*Group XI.—Hydraulic Machines, Presses, Machines for Raising Heavy Weights, Weighing, &c.*—(For hay and straw elevators, see Group i.; for elevators used in building, see Group iii.; for hydraulic rams, see Group iv.; for grain elevators, see Group xvii.; for chemical, &c., balances, see Group xxviii.)

Class 59. Pumps, Hand, Steam, Rotary, Centrifugal:—Ships' pumps, pumps for corrosive fluids; hydropult; syphons; methods of raising water; methods of obtaining, distributing, and equalising hydraulic power; accumulators.

* Class 60. Fire Engines:—Fire-extinguishing apparatus; automatic apparatus for indicating and extinguishing fires; fire-escapes, ladders, fire hose, accessory fittings and appliances; hydrants.

Class 61. Cranes and other Lifting Apparatus:—Hand, steam, and hydraulic cranes; travellers; elevators, jacks, capstans, windlasses, crabs, hoists, blocks, pulleys, derricks.

Class 62. Hydraulic and other Presses.

Class 63. Weighing Machines (for commercial purposes):—Steelyards; platform weighing machines; commercial balances, scales, weights, &c.; registering weighing machines; spring balances.

*Group XII.—Elements of Machines.*

Class 64. Mechanical Movements.

Class 65. Separate Parts of Machines.

*Group XIII.—Electricity.*—(For railway signals, see Group v.; for photometers, see Groups xv. and xxviii.; for scientific apparatus used in electrical research, see Group xxviii.)

Class 66. Generators:—Dynamos, primary and secondary batteries, thermo-electric batteries.

Class 67. Conductors:—Submarine cables and apparatus for laying them; aerial wires and underground cables; insulators and poles, insulating and coating materials; joints and connections; underground conduits; pipes, tubes, troughs, &c., electric light leads.

Class 68.—Testing and Measuring Apparatus:—Galvanometers, magnetometers, dynamometers, volt-meters, current meters, methods of testing.

Class 69. Telegraphic and Telephonic Apparatus:—Needle instruments, A B C instruments, Morse instruments, type-printers, relays, duplex and quadruplex apparatus, keys, recording instruments, automatic transmitters, electric bells, indicators, telephones, microphones, lightning protectors.

Class 70. Electric Lighting Apparatus:—Lamps, resistance coils, cut-outs, safety catches, switches. Fittings for glow and other lamps.

Class 71. Electro-metallurgy and Electro-chemistry:—Methods of depositing and coating various metals. Electrotyping, galvanoplasty. Vats, cleaning and polishing apparatus, materials, tools, and appliances.

Class 72. Distribution and Utilisation of Power:—Electric railways, electric motors, electrically driven boats, tricycles, and other conveyances; systems of distribution.

Class 73. Electric Signalling:—Fire and burglar alarms, railway, ship, and time signals, water level and wind indicators, tell-tales, electric clocks, chronoscopes, &c.

Class 74. Lightning Conductors.

Class 75. Electro-Medical Apparatus.

Class 76. Electrolytic Methods of Extracting and Purifying Metals:—Copper, zinc, lead, iron, refining the precious metals.

Class 77. Electro-thermic Apparatus:—Electrical apparatus for war, mining, blasting, and other purposes.

*Group XIV.—Apparatus, Processes, and Appliances connected with Applied Chemistry and Physics.*—(For chemical apparatus used in scientific research, see Group xxviii.)

Class 78. Inorganic Products, and means used in obtaining them:—Sulphuric and other acids, ammonia and other alkalies, bleaching agents, dyes and dye-stuffs, salts, white lead, paints and pigments, phosphorus, lucifer matches, disinfectants.

Class 79. Organic and Synthetical Products, and the means used in obtaining them:—Coal-tar products, oils, soaps, and detergents, lubricating agents, candles, perfumery, paraffine, varnishes, manures.

Class 80. Apparatus and Appliances for Compressing and Liquefying Gases, and applications thereof.

*Group XV.—Gas and other Illuminants.*—(For electric lighting, see Group xiii.; for gas stoves, see Group xvi.; for photometrical apparatus, see also Group xxviii.)

Class 81. Coal Gas:—Manufacture, purification, storage, and distribution of gas; treatment of residues.

Class 82. Water Gas, Oil Gas, Carburetting Air, &c.

Class 83. Tests and Photometrical Apparatus:—Chemical tests; standards of light; measurement of light.

Class 84. Burners, and Means of Utilising and Applying Gas:—Gas fittings; burners for illuminating gas; devices for imparting luminosity to flame; gas meters; methods of lighting gas; methods of increasing illuminating power of gas.

Class 85. Mineral and other Oils:—Methods of obtaining; distilling and refining, testing.

Class 86. Candles, &c.:—Candles of wax, tallow, sperm, paraffine, &c.; night-lights; appliances used in the manufacture.

Class 87. Lamps for Oil and Spirits, Holders for Candles, &c.

*Group XVI.—Fuel, Furnaces, &c.*—(For coke ovens and metallurgical furnaces, see Group ii.; for glass, &c., furnaces, see Group xxiii.)

Class 88. Manufacture of Fuel:—Materials and processes for the manufacture of artificial fuel; preparation and use of liquid fuel; preparation of peat; charcoal burning.

Class 89. Furnaces for Manufacturing Purposes:—Furnaces for burning solid, pulverised, liquid and gaseous fuel.

* Class 90. Stoves for Coal, for Gas, for Oil, &c.:—Cooking stoves and kitchen ranges; domestic fireplaces; gas cookers; gas burners for heating and cooking; petroleum and other stoves for heating and cooking.

*Group XVII.—Food, Cookery, and Stimulants.*—(For the cooking of cattle food, see Group i.)

Class 91. Machinery for Treating Grain and Flour:—Machines for preparing and grinding corn and dressing flour, and other mill machinery; mill-stone dressers, roll turners, and similar machines; machines for milling and polishing rice; grain elevators; apparatus for drying grain; granary fittings.

* Class 92. Manufacturing Articles of Food:—Apparatus for manufacturing and refining sugar; confectioners' machinery; machines and appliances for preparing mustard, spice, pepper, &c.; manufacture of salt.

* Class 93. Preserving Food:—Methods, materials, and processes for preserving animal and vegetable food; machines for producing cold.

* Class 94. Bread and Biscuit Making:—Kneading machines, biscuit and bread-making machines; ovens; processes for making bread.

* Class 95. Cooking Apparatus:—Culinary utensils, chopping and mincing machines; apparatus for paring and slicing fruit and vegetables, cleaning fruit, washing and cleaning vegetables.

Class 96. Brewing, Distilling, and Wine-making:—Machines and appliances connected with the manufacture and use of alcoholic drinks.

* Class 97. Manufacture of Aërated Waters:—Machinery, materials, &c., used for the purpose; stoppers and other appliances.

* Class 98. Infusions:—Apparatus, &c., used in the preparation and use of tea, coffee, chocolate, &c.

* Class 99. Tobacco:—Machinery, appliances, and processes for treating and using tobacco.

*Group XVIII.—Clothing.*—(For textile machinery, see Group ix.; for jewellery, &c., see Group xix.; for waterproof clothing, see Group xxi.)

* Class 100. Fabrics:—Specimens of new materials, or materials recently applied to the manufacture of clothing.

* Class 101. Articles of Clothing:—Specimens of clothing of novel construction.

* Class 102. Machinery and Apparatus:—Machinery, &c., used in the production of articles of dress, sewing machines, knitting machines; machinery for the manufacture of boots, hats, gloves, &c.; needles, and machinery employed in making them.

* Class 103. Cleaning Clothing:—Washing and wringing machines, mangling, &c., machines; boot-cleaning machines; machines and processes for cleaning other articles of clothing.

* Class 104. Dress Fastenings, &c.:—Buttons, pins, hooks and eyes, machinery employed in their manufacture.

*Group XIX.—Jewellery.*

Class 105. Jewellery and Personal Ornaments:—Materials, apparatus for manufacture, &c.

*Group XX.—Leather, &c.*—(For saddlery, see Group vi.; for boots and shoes, see Group xviii.)

Class 106. Manufacture of Leather:—Materials, processes, and appliances for cleaning, curing, preserving, unhairing, drying, tanning, dyeing, splitting, dressing, and otherwise preparing skins and hides; specimens of leather prepared by new processes; manufacture of parchment.

Class 107. Treatment and Application of Leather (exclusive of Saddlery and of Boots and Shoes):—Methods of ornamenting, painting, polishing, staining, waterproofing, &c., leather.

Class 108. Artificial Leather, &c.:—Imitation leather, waterproof canvas, and tarpaulin.

*Group XXI.—India-rubber and Gutta-percha, &c.*—(For use of gutta-percha, &c., in electrical insulation, see Group xiii.; for artificial leather, see Group xx.; for kamptulicon, see Group xxi.)

Class 109. Machinery for treating India-rubber and Gutta-percha:—Washing machines, rasps, masticators, mixing machines, vulcanisers, spreading machines, threadmaking machines, wire-covering machines; machines for manufacturing rubber goods, pressers, moulds, &c.; appliances for stereotyping in rubber.

Class 110. Applications of India-rubber and Gutta-percha:—Waterproof goods; elastic webbing; articles of unvulcanised and vulcanised rubber and gutta-percha, and fabrics prepared therewith; ebonite, vulcanite, and articles made therefrom; complex or insertion goods; kamptulicon, &c.; cements; grinding wheels; bottle-stoppers; printing rollers.

Class 111. Substitutes for India-rubber and Gutta-percha, Materials used in their Treatment, &c.:—Natural substances available as substitutes; artificial substitutes; combinations of rubber or gutta-percha with other materials; rubber, &c., from new sources of supply; pigments, solvents, &c., used in the manufacture; celluloid and other preparations of nitrated cellulose.

*Group XXII.—Furniture and Accessories—Fancy Goods.*—(For bronzes and alloys, see Group ii.; for household fixtures, see also Group iii.; for manufacture of carpets, see Group ix.; for rug and mat making, see also Group ix.; for glass and china, see Group xxiii.; for paper hangings, see Group xxvi.)

* Class 112. Furniture and Upholstery.—Articles of furniture; machinery and processes used in their production; frames for pictures and mirrors; safes.

* Class 113. Floor-coverings and Wall-coverings (other than Paper-hangings).—Oilcloth; linoleum; kamptulicon; mats and matting; material, appliances, and processes used in their manufacture.

Class 114. Artistic and Ornamental Metal Work:—Goldsmiths' and silversmiths' work; electro-plate; ornamental bronzes; appliances used in the manufacture.

Class 115. Trunks, Portmanteaus, &c.:—Dressing bags and cases; ivory, horn, and bone goods; travelling equipments.

Class 116. Basket-work:—Appliances for use in the manufacture.

Class 117. Brushes:—Materials, machines, and appliances used in the manufacture; methods of brush-making.

Class 118. Umbrellas, Parasols, and Walking-sticks:—Machinery, &c., used in their manufacture.

*Group XXIII.—Pottery and Glass.*—(For optical glass see Group xxviii.; for glass apparatus, see Group xxviii.)

Class 119. Kilns and Furnaces.

Class 120. Bricks, Tiles, Earthenware, &c.:—Terra-cotta; architectural pottery; fire-clay goods; crucibles; drain pipes; chemical and similar stoneware; materials, machinery, and apparatus.

Class 121. Porcelain, Majolica, and Artistic Pottery:—Biscuit ware, faience; Parian; materials, machinery, and apparatus.

Class 122. Crown, Sheet, and Plate Glass:—Window-glass, mirrors, stained glass; glass mosaic; materials, machinery, and apparatus.

Class 123. Bottles, Table Glass, Toughened Glass, &c.:—Materials, machinery, and apparatus.

*Group XXIV.—Cutlery, Ironmongery, &c.*—(For nail and screw-making machinery, see Section x.)

Class 124. Cutlery and Tools:—Engineers' carpenters', joiners, &c., tools.

Class 125. Surgical Instruments and Appliances.

Class 126. Files and Rasps:—File-cutting machines.

Class 127. Hardware:—Hollow-ware; ornamental castings; locks and bolts.

Class 128. Screws, Nails, &c.:—Spikes, hinges; furniture fittings.

*Group XXV.—Fire-arms, Military Weapons and Equipment; Explosives.**—(For fortification, see Group iii.; for torpedo boats, see Group vii.; for special articles mentioned under "military equipments" see also respective classes.)

Class 129. Ordnance:—Heavy guns and means of working them; carriages and accessories; naval, siege, field, and mountain guns; machine guns; mitrailleuses; shells, and apparatus for their manufacture; apparatus used in testing, in measuring velocity, pressures, recoil, &c.

Class 130. Fuses, Detonators:—Appliances for firing guns, and for exploding shells, signal lights, war and signal rockets, life-saving rockets.

Class 131. Guns, Rifles, Pistols:—Military and sporting guns and rifles; revolvers; magazine guns; harpoon guns; air guns; machinery used in the manufacture of small arms; proving apparatus; targets.

Class 132. Swords, Bayonets, Sappers' Tools, &c.:—Entrenching tools; shields; lances; dirks.

Class 133. Gunpowder and Ammunition:—Explosives generally, and apparatus used in their manufacture and testing; cartridges; cartridge cases.

Class 134. Torpedoes:—Submarine and subterranean torpedoes

* Explosive substances will under no circumstances be admitted. They must be represented by dummies or models.

and mines, methods of laying, firing, and removing the same; naval torpedoes, means of carrying, projecting, and firing the same.

Class 135. Telemeters:—Range-finders for artillery and submarine mine service.

* Class 136. Military Equipment:—Photographic, telegraphic, pontoon, mining, signalling, hospital equipment; transport service.

*Group XXVI.—Paper, Printing, Bookbinding, Stationery, &c.*—(For applications of photography to printing, see also Group xxix.)

Class 137. Machines and Processes for the Manufacture of Paper, Pasteboard, and Papier-maché:—Materials; manufacture of "half stuff;" washing, beating, and bleaching engines; agitators, strainers, moulds; methods, &c., of glazing and planishing; methods of treating waste paper; appliances, &c., for treating and moulding papier-maché; manufacture of artificial parchment; recovery of waste products, and preventing the pollution of streams.

Class 138. Machines, &c., for Cutting, Folding, and Ornamenting Paper:—Stamping; embossing; envelope and bag making; manufacture of playing cards; chromo-lithography; paper box machines; marbling; perforating; ruling; waterproofing; enamelling.

Class 139. Paper-hangings:—Printing machines; apparatus for engraving printing rollers; materials; tests for injurious materials.

Class 140. Letter-press and other Printing:—Printing machines and presses; glazing and hot-pressing apparatus; apparatus, &c., for type-founding; lithographic machinery, materials, &c.; stereotyping apparatus, &c.; methods of anastatic printing; process blocks from autographic drawings; wood blocks; engraving machines; machines for cutting wood letter; type-setting machines, numbering machines, printers' furniture, and locking-up appliances; production of printing surfaces; methods of printing cheques, bank-notes, &c.

Class 141. Bookbinding, Manufacture of Portfolios, &c., Applications of Papier Mache:—Materials; bookbinding machines, wire-stitching machines, cutting presses, rounding machines, backing machines, arming presses; account books, desks, cases, &c., for stationery, &c.; purses.

Class 142. Artists' Implements and Materials:—Pencils, brushes, colours and varnishes, easels, crayons, palettes, palette knives, drawing boards, drawing instruments, pencil sharpeners.

Class 143. Writing Materials and Appliances:—Type-writers; manifold writers; copying presses and processes; processes for multiplying copies of MS.; pens; ink; penholders; inkstands; sealing-wax; stationery.

*Group XXVII.—Clocks, Watches, and other Timekeepers.*—(For electrical clocks, see also Group xiii.)

Class 144. Clocks:—Timepieces and other domestic clocks; regulators and astronomical clocks; watchman's, calendar, turret, electrical and pneumatic clocks; hour glasses, sun-dials, water-clocks.

Class 145. Time Signals, &c.:—Methods of controlling and synchronising clocks; apparatus for the distribution and signalling of time; also for the determination of time by astronomical observations.

Class 146. Watches and Chronometers:—Examples illustrative of stages of manufacture and of the different types of watches and of chronometers; keyless, chronograph, repeating, calendar, and other forms of watches.

Class 147. Tools, &c.:—Lathes and mandrils; wheel-cutting engines; machine tools for producing the several parts of watches on the "interchangeable" system; various hand-tools used in the manufacture and repair of clocks and watches; gauges and templates; appliances used in case making.

*Group XXVIII.—Philosophical Instruments and Apparatus.*—(For testing machinery, see Group iii.; for commercial weighing apparatus, see Group xi.; for practical applications of electrical apparatus, see Group xiii.; for industrial applications of chemistry, see Group xiv.)

Class 148. Optical:—Lenses, prisms, telescopes, microscopes and accessories, spectroscopes, polariscopes, polarimeters, stereoscopes, photographic lenses, spectacle, eye-glasses, optical glass.

Class 149. Astronomical:—Telescopes (astronomical), transit instruments, equatorials, mural circles, driving clocks, siderostats, heliostats, altazimuths, methods of fitting observatories and mounting instruments.

Class 150. Physical:—Acoustic apparatus, tuning forks, sirens, phonautographs, phonographs; apparatus connected with molecular physics, air pumps, manometers, radiometers; apparatus for measuring, &c., heat, thermometers, pyrometers, calorimeters, photometers; kinematic, static, and dynamical apparatus; mechanics.

Class 151. Electrical:—Friction and induction machines, batteries and other sources of electricity, Leyden jars, condensers, electroscopes, electro-meters, galvanometers, voltameters, dynamometers, magnetometers, rheostats, resistances, electrical units, induction coils, thermopiles, vacuum tubes.

Class 152. Chemical:—Thermometers, hydrometers, pyrometers, furnaces, blow-pipe apparatus, assaying apparatus, apparatus for organic and inorganic analysis, for gas analysis, and for volumetric analysis, laboratory fittings and apparatus generally, balances, reagents.

Class 153. Mathematical:—Calculating machines, indicating and registering apparatus, pedometers, counting machines, slide rules, planimeters, drawing instruments, ellipsographs, straight-edges, gauges, surface planes, dividing engines, pantographs, eidographs.

* Class 154. Meteorological:—Barometers, thermometers, rain gauges, manometers, hygrometers, aneroids, anemometers, ozonometers, storm signalling apparatus.

Class 155. Geographical:—Surveying apparatus, theodolites, chains, levels; underground surveying apparatus; apparatus for hydrographic surveying, and for marine investigations and observations; hypsometrical instruments, tide gauges; seismographical apparatus; projections, maps, charts, models, and globes.

* Class 156. Nautical:—Sextants, quadrants, sounding apparatus, logs, compasses.

Class 157. Weighing and Measuring:—Weights, scales, balances; measures of length, graduated scales, verniers, steel tapes; measures of capacity; instruments for angular measurement, clinometers, goniometers.

Class 158. Biological:—Apparatus for anatomical research; physiological apparatus; apparatus for collecting and preserving natural history specimens.

*Group XXIX.—Photography.*—(For applications of photography to printing, see also Group xvvi.; for photographic lenses, see Group xxviii.)

Class 159. Processes and their results:—Methods of gelatino-bromide plate-making, apparatus for making emulsion, apparatus far separating the sensitive constituent, coating, drying, and packing machines; emulsion and other processes; printing processes, silver, carbon, Woodbury-type, platinotype, gelatino-bromide, collodio-chloride of silver, &c.; apparatus for washing, &c.; prints and negatives; methods for making photographic lantern slides.

Class 160. Apparatus (excluding Lenses):—Cameras, shutters, changing-boxes, slides, tents, lamps; apparatus for making enlaagements and for micro-photography.

Class 161. Application of Photography to various purposes, Typography, Ceramics, Relief Moulds, &c.:—Method of producing printing surfaces; photographic enamels, photographic printing on pottery; photographic reliefs. Use of photography in self-recording apparatus, in scientific observations, &c.

*Group XXX.—Educational Apparatus.*

* Class 162. Models and Apparatus:—Appliances used in primary, scientific, technical, and artistic instruction.

*Group XXXI.—Toys, Sports, &c.*—(For sporting guns, see Group xxv.)

Class 163. Toys, Games, and Exercises:—Outdoor games; gymnastic apparatus; skates, artificial skating surfaces; indoor games; billiard tables.

* Class 164. Field Sports:—Apparatus used in hunting, fishing, shooting, &c.; traps for animals, birds, vermin, &c.

Class 165. Scenic and Dramatic Effects:—Theatrical fittings and apparatus; optical (magic) lanterns and apparatus for illuminating them.

DIVISION II.—MUSIC.

*Group XXXII.—Instruments and Appliances Constructed or in use since* 1800.

Class 166. Organs:—Details of construction; machines for blowing, hydraulic or otherwise; details of mechanism and the construction of pipes; pneumatic apparatus for keyboards and couplers, electric appliances, designs for organs, designs for organ cases.

Class 167. Harmoniums:—American organs, vocalions, concertinas, accordions, varieties of reeds and air channels, details of construction.

Class 168. Wind Orchestral Instruments:—(*a*) Wood; (*b*) Brass.

Class 169. Pianofortes (Grand, Square, and Upright):—Models of framings, castings, models of actions, pedal appliances, mechanical devices for tuning and transposing, wire and other material used in construction, designs for cases.

Class 170. Violins, and Instruments of the Violin Family:—Bows, strings, and inventions connected with these instruments.

Class 171. Harps.

Class 172. Automatic and Barrel Instruments.

Class 173. Drums, Cymbals, and other Instruments of Percussion.

Class 174. Bells and Carillons.

Class 175. National Instruments of all countries not ordinarily used in orchestras.

Class 176. Sirens, Tuning Forks, Pitch Pipes, Tonometers, and appliances for the determination of pitch.

Class 177. Miscellaneous Musical Appliances:—Metronomes, desks, seats, appliances for forming the hand; instruments for recording improvisation.

*Group XXXIII.—Music Engraving and Printing.*

Class 178. Printed and Engraved Music, and Machines and Appliances for its Production.

*Group XXXIV.—Historic Collections.*

Class 179. Musical Instruments and Appliances.

Class 180. Pictures, Engravings, and Drawings of Musical Subjects.

## THE ECONOMY OF ARC LIGHTING.

So much has been said by interested parties to make it appear that the arc light, as applied to street illumination, is expensive and even extravagant, that it is eminently desirable to get at figures which grow out of actual experience, and learn the lesson which they teach. Fortunately, just such figures are obtainable from the city of Hartford, in Connecticut, where the arc light has now been in use for some time, although on a limited scale up to the present time. It should be premised that the electric light was first introduced into Hartford about a year ago, and that it has stoutly held its own, notwithstanding the violent and almost virulent opposition of the gas company, which has done its best to bring it into disfavour and disrepute, and to oppose its introduction at every possible point. At last its turn seems to have come, for the authorities are loud in its favour, and in deciding to very materially increase the number of electric lights, report that each light in use actually displaces six and one-half street gas-burners, giving at the same time at least ten times as much light. Now, each street gas lamp costs the city 35 dols. per annum, the lamps burning 326 nights in the year. Six and one-half of these lamps, at 35 dols. per year, cost the city 227.50 dols. per annum. On the other hand, one electric light, which displaces these six and one-half gas lamps, costs the city 65c. per night for 326 nights, or 211.90 dols. per annum—a saving of 15.60 dols. effected by each electric light per annum. Supposing Hartford to use 100 arc lamps in its streets—and it is certain that the number in use will be increased to that figure within a very few months—the annual cash saving by displacing 650 gas lamps will be over 1500 dols., besides the cost of lighting and extinguishing, and the light furnished will not only be ten times as great in volume, but of a far better and pleasanter quality.

It will naturally be asked how it is that in Hartford one electric light displaces six and one-half gas burners, while it was reported not long since that in Boston each arc light replaced but three and one-half gas burners. The answer is that in Boston many gas lights were kept burning so near the electric lights that their flames actually cast a shadow on the sidewalk, and that in perhaps a majority of instances the electric lights were not so placed as to render the greatest possible service. Whatever the cause may have been, it is very certain that certain influences were at work in Boston to throw disfavour on the electric light, and that it was not difficult for those in authority to so "cook" the returns as to make the worse appear the better cause. But the reports that come from Hartford are those of persons who, at the outset, were bitterly opposed to the electric light, but who now, seeing its numerous advantages, and fully convinced by their own experience of its superior economy, advocate its general introduction for street illumination.

For ourselves, we can say that we have never for a moment doubted the permanent use of the arc light for all purposes, including street lighting, where large spaces are to be illuminated. As we have already said, ten years hence we expect to see ten and perhaps twenty arc lights in use in this and every city where one now burns, and we expect to see such improvements as will render it cheaper, more simple, and far better than it is to-day. We are going to get far more electricity for the same expenditure of power, and far more power for the same expenditure of money. The incandescent light is invaluable in its place, but so, too, is the arc light in its place, and it has come to stay.—*Electrical Review.*

## AMERICAN NOTES.

(*From our own Correspondent.*)

NEW YORK, August 9th.

AMERICAN railway managers are beginning to recognise the superiority of British railway management, in many respects. Railway securities are experiencing the consequences of bad management, and several of the leading lines of securities are still drooping. The average cost of the railways built within the past three years has been very little in excess of 30,000 dols. per mile, but they have been bonded on a basis of about 70,000 dols. per mile, and have a fictitious value on the Stock Exchange, equal to about 80,000 dols., if railways statistics mean anything. Railway construction has received a check, and this year's mileage will be the least of any year, for five. Steel rails are a drug at 28 dols. It is rumoured here that a syndicate is being formed to purchase rails at 27 dols. to 27.50 dols. in view of a probable advance in price, in case some of the mills which cannot make rails at that price are driven into a suspension. Some of our railway managers are studying the English system of cheap fares. They observe that the third-class cars of great Britain are crowded, while the second and first are not patronised to anything like the same extent. The point to be learned here is, to how low a point fares can be reduced so as to produce the largest net earnings. Railway rivalry will soon develope some enterprise in this direction.

The commissioners appointed by the President, under the National Electrical Commission Act, met on Thursday in Philadelphia, and organised for the purpose of prosecuting scientific investigations, in connection with the coming Exhibition, which opens September 2nd.

The rapid decline in the Treasury gold fund since January 1st is causing some apprehension in financial circles. Since January 1st the gold in the Treasury not covered by outstanding certificates fell from 155,529,600 to 119,048,070 dols., the lowest figure reached for four years. Nearly 20,000,000 have been lost during the past month, due mainly to exportation. This depletion has created a change in the sentiment regarding silver certificates. It is proposed to utilise a large amount of silver now lying idle in the vaults, by accepting certificates in settlement of balances.

The Lord O'Neill reached Philadelphia on Thursday from Barrow. She is 342ft. in length; her register 1800 tons.

From latest reports, the iron and steel industry throughout the country is in a still worse condition than a week or two ago. The blast furnace capacity has been reduced within three months, at the rate of 300,000 tons per annum; a telegram from Pittsburgh to-day states that 7000 iron-workers are idle at that point. Besides this 7000 coal miners are idle. The outlook for the fall trade is extremely dull. The concessions which are being offered are not attracting buyers, and even railway builders, who need rails for construction during the winter months, are waiting to see for how much less steels rails can be had. Large quantities of bridge iron have been contracted for. The railway companies are taking advantage of the low prices to improve their roadway, and erect bridges, stations, shops, and in many cases, to increase their rolling stock.

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

(*From our own Correspondent.*)

THE best position at the present time in the South Staffordshire iron trade appears to be occupied by the best sheet makers. These at the meeting of the trade this week brought in the healthiest reports. From them, working up and stamping sheets are alike being demanded in great quantities. Export and home consumers are expressing their wants freely, with the result that certain exceptional makers are so busy that they find themselves this week compelled to refuse further orders for early delivery. Canada, and Australia, and Germany are the most satisfactory export consumers at date, but numbers of other shipping markets are also buying. Prices for such iron are well maintained upon the basis of the quotations given in my report last week.

Ordinary merchant and galvanising sheet makers complain rather on the score of price than concerning the actual amount of work doing. They, however, do not find specifications under old contracts by any means easy to get in, and galvanisers are not in such a position as to need to place many new orders at present. Competition for orders is keen, and manufacturers are compelled to accept prices which they would not have negotiated a few months ago. Their desire is to keep customers together, and to avoid the heavy expense that would be occasioned by a stoppage of works. Merchant singles are moving off at £6 15s. to £7 a ton; doubles are £7 10s., and lattens £8 10s.

Bridge and girder iron is selling fairly, but the competition of the North of England and other districts is severe. The plates mills have nothing like as much to do as they would prefer. Boiler plates are £8 to £8 10s., and up to £9.

Orders for bars are here and there a little better, and foreign merchants are buying average parcels of marked bars. But the chief hope of the makers for the future is centred in the bounteous harvest now being ingathered. Until there is more money in the hands of native consumers it is felt that no settled revival can be anticipated. As prices now stand, makers declare that when the orders are executed there is little or no profit, and that they cannot continue this course very much longer without getting relief from somewhere.

The more importance, therefore, attaches to the meeting of the Iron Trade Wages Board, which will be held in Birmingham on September 1st, before Alderman Avery, who is to arbitrate upon the masters' claim for a drop, and the counter claim of the iron-workers for an advance. Earl Dudley's price for bars remains at £8 2s. 6d. nominal. Other best firms are willing to accept £7. Common bars are £5 12s. 6d. up to £6. Gas tube strip is £5 12s. 6d. as a minimum, and export hoops are £6 to £6 10s., according to repute of maker.

The native pig iron trade does not improve. Sales of best qualities, especially, are difficult to make in lots of any size. To avoid further increase of stocks, Messrs. Grazebrook and Aston have determined to at once damp down one of their furnaces. Neither Derbyshire pigs for foundry purposes nor Northampton or Lincolnshire pigs for forge purposes are selling at all briskly. Owing to some serious annoyance occasioned by the revision of the railway rates in the Northampton and Derbyshire districts, it is probable that the whole question will have to be reconsidered by the railway companies. This, therefore, keeps buyers unsettled. Best all-mine native pigs are 60s. nominal, and second quality, 57s. 6d. to 55s. Part-mines are 42s. 6d., and cinder pigs 40s. to 37s. 6d. and even 35s. Prices of foreign pigs, in the absence of business, are nominal.

The gasometer trade registers a slight impetus this week. The bridge, roofing, and girder trades are keeping on pretty well. One firm which has employed its hands with regularity for the last two years, has of late, it boasts secured additional contracts, which now total a sufficient employment for two years more. One of the contracts is an extensive order for Japan.

The export trade in hardwares is still unsatisfactory. To the Brazils and other ports of South America and to Australia, however, rather better shipments are being made of some goods. India, too, is taking fair quantities of miscellaneous hardwares. Cheapness continues to be the characteristic feature of the demand, alike native and export. Manufacturers are again complaining that it is no use turning out best goods now, since there is practically no sale for them.

The colliery owners are still resolved to resist the demand of the colliers for the old rate of wages. According to Mr. James Bissell, of the Sandwell Park Colliery Company, the masters fear that it will be a protracted struggle. Speaking at the annual meeting of the company this week, he said: The strike already had been costly, and the employers knew that they must suffer, but they were resolved to resist the demand of men who refused to obey an arbitrator. They were compelled to adopt this course if they were to realise anything for their outlay of capital. The men on strike are about to memorialise the Earl and Countess of Dudley to use "their powerful influence in securing for the miners what they consider their just rights." The memorialists state that the masters are disunited, and that thousands of their fellow workers are employed at the old rate. It is believed that this memorial will not have much effect upon the strike, since, as is well known, Lord Dudley, owing to the state of his health, leaves such matters to the discretion of his agent, Mr. E. Fisher-Smith. It is estimated that up to the present time £2000 has been subscribed towards the support of the miners.

The operative nut and bolt makers appear determined to uphold the present rate of wages at any cost. A report has this week been circulated that an employer had informed his men that it was his intention to ask for a reduction, and a meeting of the men was thereupon held. It was decided that, if the report turned out to be correct, the operatives should resist it to the uttermost, as "they were determined not to allow any single employer to take upon himself to reduce prices."

Among the most important matters for discussion by the Associated Chambers of Commerce at their annual session in Wolverhampton on September 30th and October 1st is the introduction of commercial arbitration throughout all branches of trade. There are in all no fewer than twenty-eight resolutions from various chambers to be dealt with upon almost as many different subjects

of trade importance. Among them are the following:—Commercial law, Spanish tariff, foreign bounties, foreign export regulations, Canadian preference claims, Spanish and Portuguese quarantine and light dues, conference on the silver question, minister of commerce, the Bankruptcy Act, the *locus standi* of Chambers of Commerce and of Agriculture in railway bills, telephone communication, canal communication, parcels post insurance, &c. This year's conference will probably be more important than many that have preceded it, and should be fruitful in results of business advantage to many of the country's staple industries.

The Board of Trade have officially intimated to the local authorities that they have revoked the "Dudley Electric Lighting Order, 1883," as confirmed by the Electric Lighting Orders Confirmation Act of the same year. The revocation takes place from the 11th inst.

In the North Staffordshire iron trade prices are still low, and such is the condition of business, that Messrs. Robert Heath and Sons have given a fortnight's notice to close their new ironworks at Tunstall, whilst the Cliff Vale Ironworks, of Messrs. J. Ball and Sons, are to be closed *pro tem.*

The distress in South Shropshire, consequent upon the depression in the lead trade, is still very great, but it is not even yet at its worst. On the 23rd inst. the Snailbeach mine, owned by the Marquis of Bath, is to be closed. Funds have been established in the county for the amelioration of the distress, the amounts raised being distributed by a relief committee, composed of the leading residents in the neighbourhood.

Important new departures are taking place just now in the production of manufactures of flint glass in the Midlands. Recently one firm manufactured a very handsome drawing-room suite in such glass, richly cut; and the same firm are now constructing a massive and elaborate billiard table in the same material of the largest size and finest workmanship.

## NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

*Manchester.*—Business throughout the iron trade of this district continues from week to week in much the same depressed condition, and so far as the immediate future is concerned, a despondent tone generally prevails in the market. There is not so much "bear" speculation going on for forward delivery, and this may be taken as an indication that prices are now so low that any further downward movement is regarded as improbable; but low prices do not bring forward any increased volume of buying, consumers apparently being satisfied that although they may not be able to buy at very much lower figures, there is no present probability of their having to pay any higher prices, and they give out orders simply from hand-to-mouth. Where business of any weight is done it is mostly under some special conditions, and in the ordinary run of trade it is very exceptional where there is any buying beyond very small quantities, and these only at the very minimum rates.

The Manchester iron market on Tuesday was moderately well attended, but the business reported was again very limited. In pig iron a few moderate transactions are reported, but the trade doing, taking it all through, is extremely slow, and for local and district brands the basis of prices remains at about 41s. to 42s., less 2½, delivered equal to Manchester. In some instances makers are not disposed to come quite so low as this, but it is only in a few very special cases that they are able to realise anything above these figures on actual sales. For outside brands of pig iron there is only a very small inquiry. Good brands of Middlesbrough iron are to be got at about 42s. 10d. for forge to 44s. 4d. for foundry net cash, delivered equal to Manchester, with inferior brands offering at 3d. to 6d. per ton less. Some special brands of Scotch iron have been slightly raised in price, but values generally are unchanged.

Hematites still meet with only a very slow sale, and the nominal price for good foundry brands delivered into this district may be quoted at about 55s. to 55s. 6d. less 2½ per cent.

One or two of the leading manufactured iron makers in the district report that they are able to keep their forges well employed, and that, if anything, the weight of orders coming forward is increasing. Generally, however, trade continues very dull, and in most cases makers are short of work. For good ordinary qualities of Lancashire and North Staffordshire bars delivered here £5 12s. 6d. is about the maximum price that is being got, and for good specifications there is in many cases a disposition to make some concession, whilst there are local bars to be bought at as low as £5 10s. per ton. Lancashire made hoops average about £6 to £6 2s. 6d., and ordinary sheets £7 to £7 2s. 6d. per ton.

Machine tool-makers are beginning to complain that orders are falling off, and this is especially the case so far as this branch of trade is affected by the requirements for tools for general railway plant. The depreciation in the traffic receipts has had a tendency towards a curtailment of expenditure on nearly all the English railway systems, and this has necessarily involved retrenchment in the laying down of new plant. There is also a cessation in the giving out of orders for locomotives, and although the large locomotive builders in this district are being kept well employed with orders for India and the colonies, they are getting very little new work from the English railway companies.

The question of the excessive railway charges for the carriage of heavy goods into or out of this district, as compared with the rates paid in other districts over similar distances, is being taken up by some of the leading iron firms in this neighbourhood, and I understand that strong efforts are being made to secure some revision of the rates, which on their present basis are, it is alleged, in many cases seriously handicapping the trade of the district.

The Manchester Technical School has now completed the first year of its operations, and although every department is not yet in full working order, the results so far have been very satisfactory. Fairly liberal support has been given to the school by the manufacturing industry in the district, donations to the amount of £6000 having been received, whilst some sections of the school have been fitted up free of cost with the requisite plant and machinery. Messrs. Dobson and Barton, of Bolton, have given a complete set of spinning machinery; several looms have been given by other firms; and a 4½-horse power Otto gas engine by Messrs. Crossley Bros. The school may now be said to have got over the preliminary financial difficulties incident to its establishment on a proper footing, and next session it will reopen fully equipped in every department. The mechanical engineering department has not been quite so successful as was at first anticipated. It has, of course, been necessary to fit up this section with somewhat costly tools, such as lathes, planing machine, drilling machine, vices, gauges, &c., whilst the provision of the material upon which the students work entails considerable expense. This has necessitated a proportionately high scale of fees, which probably has had some effect upon the number of students who have entered. The results which have been obtained are, however, highly satisfactory, as during the past year no less than five Whitworth scholarships have been gained by the school, and one of these the highest, viz., £200; whilst the grants obtained from the Government for the several departments of the school have amounted to £1000.

The promoters of the Manchester Ship Canal have been so heartily supported in their decision to continue their efforts to secure an adequate means of direct water transit from Manchester to the sea, that it may be regarded almost as certain that the project, so revised as to be independent altogether of the tidal estuary of the Mersey, will be brought forward during the next or the ensuing session of Parliament. The rejection of the original scheme seems to have drawn forth supporters from quarters where assistance was not previously being rendered, and I understand that there is an earnest intention on the part of the Manchester Corporation, and other municipal authorities directly interested in the proposed canal, to become joint promoters in the scheme. The promoters have every confidence that ultimately they will succeed in carrying out a substantial scheme which will avoid the objection that proved fatal to the original project; but before anything definite can be arrived at, fresh surveys will have to be made, and estimates prepared upon which to base most advantageously the revised scheme, and the engineers are now at work on several alternative schemes which will determine what course the promoters will adopt.

In the coal trade business continues at a dull summer level, with pits working about three to four days a week and stocks still accumulating. House fire coals meet with an extremely small demand, and common round coals move off only slowly, requirements for steam and forge purposes having been somewhat curtailed recently owing to the stoppage of works as the result of the exceptionally hot weather, and in some cases the scarcity of water. For engine fuel there is a moderate inquiry, but burgy is plentiful; and notwithstanding the small quantity of round coal at present being screened, supplies of slack continue generally ample. For temporary sales very low prices are being taken, and coal from Yorkshire and Derbyshire is coming into this district at extremely low figures; but in the rates quoted at the Lancashire collieries there is no material change. Best coal at the pit mouth averages 8s. 6d. to 9s.; seconds, 6s. 6d. to 7s.; common house fire coal, 5s. to 5s. 6d.; steam and forge coal, 5s. to 5s. 6d.; burgy, 4s. 6d. to 5s.; best slack, 4s. to 4s. 3d.; and common sorts, 3s. 3d. to 3s. 6d. per ton.

In the shipping trade there has been only a moderate business doing, and prices are low. Lancashire steam coal delivered at the Garston Dock or at the high level, Liverpool, not averaging more than 7s. to 7s. 3d. per ton.

*Barrow.*—I have still to report only a very small and restricted business doing in the hematite pig iron trade of this district. There was only a small gathering on 'Change, and very little disposition to do business was noticeable. The orders to hand from home and foreign consumers are inconsiderable and inextensive, and only sufficient for immediate wants. The restriction of the output has not produced any material effect upon the market, buyers still being very indifferent about placing out orders. Prices are quotably unchanged, No. 1 Bessemer samples remaining at about 46s. per ton f.o.b.; No. 2, at 45s.; and No. 3, 44s. 6d. The weight of metal now stocked at warehouse is considerable. Pig iron remains without change. There is a continued absence of improvement in the steel trade, and prices are so low that very little profit is realised on transactions. Rails are quoted about 95s. per ton net at works. Shipbuilding remains in the same dull state, and at present prospects are anything but bright. The coal and coke trades have been dull as a whole. Shipping quiet, as freights are low.

## THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

Our South Yorkshire miners are holding meetings at present, which appear everywhere to be but thinly attended. The double object with which they are held is to urge all colliers to join the Yorkshire Miners' Association, "in order to maintain the present rate of wages," and to pass a further resolution approving of the policy of the Government in passing the Franchise Bill through the House of Commons, and disapproving the action of the Lords in rejecting the measure. There is a feeling among many miners that they have no business to identify themselves with any political party, particularly as in this neighbourhood their best friends are not confined to any section; and this consideration may account in some measure for the paucity of interest taken in the proceedings. This has always been the mistake of South Yorkshire union officials. The miners of Orgreave, Treeton, Woodhouse, Hollinsend, Woodthorpe Manor, Nunnery, Brightside, and Tinsley Park were invited the other day to meet for this double object, as well as to pass a resolution agreeing to support the men now out on strike in South Staffordshire and Derbyshire, resisting a reduction of 10 per cent. This they did, but the attendance at the meeting was so thin, there is no prospect of the miners in South Staffordshire and Derbyshire receiving much support from the miners at the collieries mentioned.

The stoppage of the Hull and Barnsley Railway Works has caused much distress among the navvies and others employed on the undertaking. A large number of men have been thrown out of employment, and though the most of them have left the district, those who remain are in straits for the necessities of life. The telegraph wires along almost the entire length of the line to near Cudworth are completed. In order that the contractors—Messrs. Lucas and Aird—may be able to give an estimate of the cost of the works still necessary to complete the line, the works have now been measured up. It is earnestly hoped that arrangements may be made for finishing the line at an early date, a consummation most devoutly to be wished by the South and West Yorkshire coalowners, who, during the present year, have sent an average of over 102,000 tons of coal per month to London.

Germany, Belgium, and other industrial centres of the Continent, appear to be well off for work at present. The representative of one of the richest firms in the steel, spring, tool steel, and kindred trades, who has just returned from his continental journey, states that the German houses were nearly all busy, and, what is not comforting to hear, most of them were busy on orders for England.

The condition of the steel trade in Sheffield excites a good deal of anxiety. A Sheffield manufacturer, whose name is known the world over for his specialities in cast steel, attributes a good deal of our decadence in steel to the fact that whilst we have been standing still, our competitors have been progressing by adopting the newest, latest, and best known appliances in every branch of trade. Crucible steel, he says, was first made by Huntsman, at Attercliffe, Sheffield, in 1773, and, with few exceptions, for the highest classes of steel the process is practically the same to-day as it was 111 years ago; "just as if science and metallurgy had never made one single advance." "Fancy," he adds, "the steel melter going at six in the morning, putting his pots in the furnace, and getting 60 lb. out the first round by 10.30, the second round of 40 lb. four hours later, and the third round of 36 lb. later still; total, 136 lb. per pot per day, and using three tons of coke, costing over 40s., to get this result. How can this steel maker compete with rivals who are making steel with coal at a cost of 5s. per ton, and get out twice the weight? The barbarous, old-fashioned process of making steel in crucibles will," he thinks, "soon be extinct."

I think I have already mentioned that Mr. John Greenhough, of Clinnock Works, Milton-street, Sheffield, has been awarded the gold medal for his exhibit of spring cutlery at the Crystal Palace International Exhibition. It is only fair to say, as Messrs. Joseph Rogers and Sons have been mentioned as exhibitors, that that famous firm did not compete. Some of their goods were on show, but they formed portion of stock supplied to Messrs. Deane and Co., of Ludgate Hill, who are old customers of the firm, and the exhibit was Messrs. Deane and Co.'s private property.

An accident on the Midland line at Ecclesall station, about two miles from Sheffield, caused some consternation to the passengers on Monday. The Bradway tunnel, which extends from near Dronfield to Dore and Totley station, is one of the largest in England. Shortly after entering the tunnel from the south the express reaches the summit, and is enabled to run down without steam to Sheffield at a rate of 40 to 50 miles an hour. A fast train from Derby to Leeds was doing this when the side rod of the engine snapped. Fortunately, the driver was able to draw up the train in something like its own length, and beyond the damage to the engine and the slight delay till another engine could be procured from Sheffield, there is nothing more serious to report. The place where the accident occurred is not far from the Heeley Station, where the Pullman express, due in Sheffield at 1.5, was "spread-eagled" a few years ago.

## THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

On account of Stockton races, which have long been considered a valid excuse for a week's holiday in the Cleveland district, there was but a poor attendance at the Middlesbrough Iron Market on Tuesday last. Blast furnaces, being unable to stop for trifles, have all continued at work; but rolling mills, foundries, and engine and bridge-building works, have for the most part been idle since Monday. Many employers were away on the Moors or elsewhere, and the Royal festivities in progress at Newcastle prevented others from attending. Notwithstanding all this, a certain amount of business has recently taken place in pig iron; the price is, however, undoubtedly weaker. Combination makers still stick to their nominal figure of 37s. for No. 3 g.m.b., but it appears certain that they do not consider themselves bound as to forge, or even foundry, pig iron. Sales were made on Tuesday by makers for the lower qualities at prices which are equivalent to 35s. for No. 3 g.m.b. It is therefore thought that the combination cannot be maintained much longer for No. 3, but will break down, as it has already virtually broken down, for other numbers. A general fall in pig iron, though unfortunate for the smelters, would be an immense relief to the manufacturers and consumers generally. Many of these are working at a loss, and their operations will become more and more contracted unless they can get their materials at lower prices proportionate to the fall they have sustained in selling prices.

Shipments of pig iron for August have been so far but moderate, and scarcely equal to those for July, or to the corresponding period in 1883.

Warrants are practically unsaleable. The stock in Connal's Middlesbrough stores has, however, declined, though only 77 tons, during the week. It is now 56,434 tons.

Prices in the finished iron trade are steady, at the same level as they have been for several weeks. Plates are £5 to £5 5s., angles £4 17s. 6d., bars £5 2s. 6d.—all at makers' works, less 2½ per cent. discount.

The steel trade remains inanimate. The Eston Works are idle, and though the North-Eastern Steel Works are for the moment actively employed, it is thought that they will not continue so very much longer.

The success of the Simon-Carvé oven for making coke, which has been adopted by Messrs. Pease and partners, seems now, after some two years' trial, to be well assured. Messrs. Pease have fifty ovens at work. The Bear Park Colliery Company is building other fifty, at a cost of about £9000. This seems a large sum to expend, but the advantages have been found to be equivalent to a saving of 6s. per ton of coke made, which also is worth more than ordinary coke by about 9d. per ton. It is in great demand, chiefly for foundry purposes, and as yet there has been none to spare for smelting. The saving in cost of production arises partly from the greater percentage of the coal used, which is obtained as marketable coke, and partly from the value of bye-products. The coke made is about 77 per cent. of the coal put into the ovens. Messrs. Pease and Co.'s ovens yield each about 7 tons per week, but those under construction by the Bear Park Company are larger, and will yield 10 tons per week. Should this system become largely extended, a great fall in the value of coke may be expected, and with it a fall in the cost of production of pig, and therefore of all other kinds of iron and steel. What might not this lead to? Surely it is yet another direction in which we may look for relief from the present bad condition of things, and take fresh courage.

Mr. A. J. Dorman is better, but even if his recovery is as rapid as his medical advisers hope and expect, it will be long before he is able to take an active part in business again.

The Bowesfield patent furnace dispute has had a somewhat curious sequel. After two sittings, at both of which animated discussions took place, the committee of the Board of Arbitration decided not to deviate from previous decisions, whereby 1s. per ton had been fixed as the extra to be paid to puddlers working at the furnaces in question. Two members of the committee dissented from this decision. The Bowesfield Company then determined to cease working the patent furnaces altogether, rather than pay more than it could afford under existing circumstances. Having a large stock of puddled bar on hand, and being able to buy more almost as cheaply as it could manufacture, it was most favourably situated for taking an independent position. But it had no need to contest the point very long. When the operatives immediately concerned perceived that the furnaces would be kept standing indefinitely, unless some considerable concession were made by them, they gave the go-by to the committee's decision, entirely favourable as it was to themselves. They seem to have concluded that it was to be classed among desirable but unattainable things. They sent forthwith a deputation to the manager, and offered to work, first at 6d. per ton extra, and then when that offer was declined, at 3d. per ton extra. This, after some hesitation, was accepted by the company, and the furnaces were again set to work. At the Standing Committee meeting held on Thursday last, at Darlington, a mutual agreement between the company and its patent furnace puddlers, embodying the above terms, was submitted and confirmed. This, however, was not done until after a rather smart passage of arms between those who thought the committee's decision had been impolitic and unwise, and was properly ignored, and those who considered it should have been acted upon regardless of consequences and with advantages to both.

Some excellent results have been obtained from the triple expansion engines recently made by Messrs. Blair and Co., of Stockton, for the s.s. Burgos. The initial pressure of steam supplied to these engines is no less than 160 lb. per square inch. It is not more than twenty-five years ago since 30 lb. was the highest in use at sea. The Burgos has made a voyage carrying a cargo weighing 2450 tons. She averaged nearly 9 knots per hour on a consumption of 9 tons 6 cwt. of North-country coals per day. A sister ship called the Eros, built in the same yard and upon the same model, was furnished with ordinary compound engines of the same power, by Messrs. Blair and Co. The initial pressure in this case was 80 lb. per square inch, and the speed obtained was 8½ knots per hour on a consumption of 13 tons per day. The saving effected will be found to be rather more than 28 per cent. If further experience should prove as favourable as this, it can scarcely be doubted that we are on the eve of another revolution in marine engineering as complete and universal as was the substitution of compound for simple engines. During the next few years we may expect to see triple engines put into all new steamers, and substituted for existing compound ones in many now afloat. For it is evident that the one kind may be worked with a profit, when the other would be attended with none at all or with a loss.

The new pumping engines required by the Stockton and Middlesbrough Water Board have at last been ordered. The competing firms were Messrs. Simpson, of Pimlico; Messrs. J. C. Stevenson and Co., of Preston; and Messrs. Yates and Co., of Blackburn. The last-named was the successful firm. It is to be noted that Mr. J. C. Stevenson, an engineer of well-known ability in the North of England, now belongs to the firm of Yates and Co., and not to that which bears his name. The decision finally turned on the question of consumption of fuel guaranteed. Messrs. Yates and Co. stipulated that they should be allowed three months after starting for getting all into working order. Then for another three months, they undertook for every hundredweight of coal burnt to produce 83 millions of foot-pounds. The coal to be used is the same as that now supplied by three or four firms to the water board, at an average price of 6s. 6d. delivered. This will be found to work out to 2·7 lb. per indicated horse-power per hour, or nearly double what is being done by the best triple expansion marine engines. Surely Messrs. Yates and Co. will fulfil their guarantee, and, indeed, exceed it with the greatest ease. It is, of course, understood that they will supply boilers as well as engines. The only uncertainty which can possibly affect them is the quality of coal. But 6s. 6d. per ton delivered at Darlington ought to secure coal of a very fair quality for steam-raising purposes; though, of course, not so good as the best Welsh, or Newcastle Hartley coals with which the triple compound engines would probably be supplied. It is understood that Messrs. Simpson and Co. were willing to guarantee at least as good a duty, but desired that

the test should be a comparatively brief one, after which they were to be relieved of responsibility.

## NOTES FROM SCOTLAND.

*(From our own Correspondent.)*

THE speculative department of the Glasgow iron market has been very quiet in the course of the week, and the business done has not been of very much importance. Warrants have fluctuated only to a small extent. There is, however, a brisker demand for some of the special brands, with the result that their quotations are materially higher than they were a week ago. Better shipments have taken place to the United States, Canada, Italy, and Germany, but the past week's exports as a whole were scarcely satisfactory, amounting as they did to 11,484 tons, compared with 14,884 in the corresponding week of 1883. There is a reduction of about 390 tons since last report in the stock of Scotch pig iron in the Glasgow warrant stores. One furnace has been put out at Gartsherrie Ironworks, and there are now 94 in blast, compared with 114 last year.

Business was done in the warrant market on Friday at 41s. 6d. to 41s. 6½d. and 41s. 5½d. cash, and on Monday transactions took place at 41s. 5d. to 41s. 5½d. Tuesday's market was firm at 41s. 6d. to 41s. 6½d. On Wednesday transactions occurred at 41s. 5½d. to 41s. 7d. cash. To-day—Thursday—the market was steady at 41s. 6½d. to 41s. 7d. cash and 41s. 8½d. to 41s. 9d. one month.

The following are the current prices of makers' iron:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 52s. 6d.; No. 3, 50s. 3d.; Coltness, 59s. and 51s. 6d.; Langloan, 55s. and 51s. 6d.; Summerlee, 52s. and 47s. 3d.; Calder, 52s. and 47s.; Carnbroe, 50s. 6d. and 47s.; Clyde, 48s. and 45s.; Monkland, 43s. 9d. and 40s. 9d.; Quarter, 42s. and 40s. 3d.; Govan, at Broomielaw, 43s. and 40s. 9d.; Shotts, at Leith, 52s. 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.; Eglinton, 44s. 3d. and 41s.; Dalmellington, 47s. and 43s.

The total imports of Cleveland pig iron into Scotland for the present year to date are 156,349 tons, being considerably less than last year.

Makers of malleable iron are doing a little better owing to the booking of orders, which had been kept back by merchants, along with a few in connection with the shipbuilding trade. The downward course of prices has been stopped for the present, but it is not easy to see how the rates current can be remunerative.

In the coal trade there has been rather less doing, the shipments being smaller at some of the ports, and the home demand quiet. The total shipments up to date are 1,893,651 tons, as compared with 2,111,444 in the same period of 1883, showing a decrease for the present year of 217,793 tons. The week's shipments at Grangemouth were 11,105 tons. Rather better rates are reported at Burntisland, the f.o.b. figures being 6s. 9d., 7s., and 7s. 3d. per ton. Stocks are low, and the miners are working fairly well. The impression is that the increase in the prices at the Fife ports may have the effect of increasing the export trade on the other side of the Firth of Forth, to which very large quantities of coals are brought by rail from the Hamilton mineral field.

Much discussion has been occasioned by the policy of the Glasgow and South-Western Railway in reducing the rates for carrying coal from Lanarkshire to the Ayrshire ports. The Ayrshire coalmasters are protesting vehemently against the reduction, not, they declare, because it benefits their competitors in the county of Lanark, but rather on account of the railway company continuing to charge much higher rates from them for greatly shorter distances. The Ayrshire colliery proprietors appear to be in earnest on this question, and they declare that unless they get equal justice with those of Lanarkshire they will appeal to the Railway Commissioners.

At a meeting of the Executive Board of the Fife and Clackmannan Miners' Association at Dunfermline on Saturday, Mr. Jas. Innes of Cowdenheath in the chair, regret was expressed that the employers could not see their way to adopt the basis for a sliding scale suggested by the miners, and it was resolved further, "That in consideration of the improvement which has taken place in the state of trade, and the advance in the price of coal, the secretary be instructed to ask the employers to concede an increase of wages to the extent of 15 per cent."

Good progress has been made with the erection of the Champfleurie Oil Works, which are situated about two miles to the east of Linlithgow. So far as the sinking operations have proceeded, the shale is found to be of superior quality and satisfactory thickness. The necessary railway works are to be proceeded with as soon as possible.

Orders have this week been received on the Clyde to build a large number of the boats required by the Government for the Nile expedition. They must be ready within a few weeks.

## WALES & ADJOINING COUNTIES.

*(From our own Correspondent.)*

THERE is considerable expectation in some quarters about the autumnal and winter coal trade. I was speaking with one of the largest coalowners this week, and he gives it confidently. The general trade of the country has been depressed for a long time, and yet with it all the Welsh coal trade has been buoyant. Now with a slight lifting of the cloud from our iron industry, and the naval movements which may be expected to occur in September and November, he calculates upon increased vitality. There is certainly an improving tone about small, steam, and house coal, but apart from the large steamship contracts on hand, we have now the usual quietness which prevails during the end of August and early part of September.

The Barry Docks are to be begun forthwith. The initiatory steps have already been taken. I am glad to see that arrangements have been completed for the working of the new line to Newport from Rhondda by the Taff Vale. There was a hitch, consequent upon the action of the Great Western Railway, but all has passed satisfactorily.

There is no movement of account in the iron and steel trade, but tin-plates maintain their firmness, especially the best brands.

## 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.

*12th August*, 1884.

11,160. ELECTRIC LIGHTING, P. O. Whitehead, Old Trafford.
11,161. SULPHIDE of SODIUM, T. Macfarlane, London.
11,162. GAS GLOBES, M. Dempster and H. B. Creeke, Halifax.
11,163. MEASURING, &c., RAINFALL, A. Jacob, Salford.
11,164. VELOCIPEDE APPLIANCES, W. Morgan, Birmingham.
11,165. DRIVING BELTS, A. C. Wells and A. Jepson, London.
11,166. PERAMBULATOR CARRIAGES, P. Blee, London.
11,167. DRYING and DRESSING YARNS, H. McE. Ward, Liverpool.
11,168. LINK-MOTION for STEAM ENGINES, W. P. Thompson.—(*H. Fleming, U.S.*)
11,169. CUTTING RETORT CARBON, J. Rettie, London.
11,170. EXTRACTING METALS from CARBON, A. E. Scott, London.
11,171. DRIVING GEAR of VELOCIPEDES, W. E. Hurrell and W. Spence, London.
11,172. HORSES' COLLARS, &c., H. Thompson, Waterdown, Ontario.
11,173. ROLLER-BLIND FURNITURE, T. Horton, Birmingham.
11,174. WINDOW FITTINGS, G. Smart and J. S. Parker, Birmingham.
11,175. ATTACHMENT for GAS BURNERS, C. Pietz, London.
11,176. BUILDING WALLS, F. J. Kellow and J. C. Rodger, Southampton.
11,177. RAG ENGINES for PAPER MAKING, J. H. Johnson.—(*J. Hoyt, U.S.*)
11,178. CORKS, &c., H. G. Jacobsen, Glasgow.
11,179. STRAIN INDICATOR, E. C. Stromeyer, London.
11,180. FOOTSTEPS of MULES, &c., G. Pickford and E. Jagger, London.
11,181. OIL CANS, G. Pickford, Oldham.
11,182. RIVET JOINT for BOILER SHELLS, A. T. Orr, London.
11,183. WHEELS for RAILWAY CARS, P. U. Askham, Sheffield.
11,184. AUTOMATIC REVERSING APPARATUS, J. Conlong, London.
11,185. FURNACES for CONSUMING REFUSE, E. Burton, London.
11,186. STORING DUST, &c., E. Burton, London.
11,187. TRACTION WHEELS, D. M. Osborne, London.
11,188. TELEPHONE RECEIVER, S. Williams, Newport.
11,189. ALARM GUN, W. Burgess, Worcestershire.
11,190. OBTAINING MOTIVE POWER, F. B. Hill, London.
11,191. FERTILISERS, O. Imray.—(*F. L. Harris, U.S.*)
11,192. METALLIC CARTRIDGE CASES, C. D. Abel.—(*E. Martin, Paris.*)
11,193. DREDGING MACHINES, E. Chaquette, San Francisco, U.S.
11,194. VALVE for APPARATUS for INHALING OXYGEN, E. Barlow, London.
11,195. COPYING-PRESS, E. de Pass.—(*A. V. Marcelin, Paris.*)
11,196. STEEL and CAST IRON, H. E. Newton.—(*J. E. Verdié, Paris.*)
11,197. CARS, &c., H. E. Newton.—(*G. McD. Traylor, U.S.*)
11,198. WHEELS, H. Ringwood and R. Holmes, London.
11,199. SEWING BUTTON HOLES, H. H. Lake.—(*N. Wheeler, U.S.*)
11,200. BARBED WIRE for FENCES, H. H. Lake.—(*L. E. Sunderland, U.S.*)
11,201. REPEATING FIRE-ARMS, H. H. Lake.—(*A. Chuchu, Brazil.*)
11,202. EXTRACTING BENZOLE from GASES, J. Coates, London.
11,203. LIFTS, A. M. Clark.—(*C. W. Hays, U.S.*)
11,204. MECHANICAL MOVEMENT, A. M. Clark.—(*J. H. Carrington, U.S.*)
11,205. KILNS, J. H. Cohrs, Germany.
11,206. COMBS, P. Jensen.—(*F. Thormann and L. von Bouhorst, Wiesbaden.*)

*13th August*, 1884.

11,207. FOUR-WHEELED VELOCIPEDES, I. Frost, London.
11,208. SAFETY and ALARM TILL, J. W. Blakey, London.
11,209. SEWING MACHINES, W. Beecroft, London.
11,210. CHECKING CASH and ACCOUNTS, J. Shaw, Carnforth.
11,211. FINISHING FUSTIANS, J. T. Kenworthy, Manchester.
11,212. PHOTOGRAPHIC CAMERAS, J. V. Robinson, Dublin.
11,213. TURNSTILES, J. L. Edwards and E. Needham, Manchester.
11,214. BRAKES, J. Smith, London.
11,215. GAS-HEATED WASHING MACHINES, J. Heselwood, Leeds.
11,216. HORSE-RAKES, W. N. Nicholson and W. Mather, London.
11,217. ROTARY MOTOR ENGINES, W. Macilwraith, Cork.
11,218. TRICYCLES, &c., J. B. Adams, London.
11,219. ADJUSTABLE TRIVET, E. Page, Birmingham.
11,220. CONTINUOUS RAILWAY BRAKES, G. Jackson, London.
11,221. TRAMWAY SLEEPER, C. H. G. Smith, London.
11,222. AMMONIUM CHLORIDE, W. P. Cochrane, Redcar, and W. Bramley, Middlesbrough-on-Tees.
11,223. GAS ENGINES, W. H. Watkinson, Haworth.
11,224. SECURING, &c., WINDOW SASHES, H. A. Williams, Stratford.
11,225. TOOL-HOLDER, C. J. Galloway and J. Burton, London.
11,226. LOCKS, S. W. Johnson, London.
11,227. STUFF and METAL BUTTON, E. Weyerbusch, Germany.
11,228. HEEL TIP for BOOTS and SHOES, A. H. Pope, London.
11,229. BANJOS, F. J. Miller, London.
11,230. PRODUCING, &c., MOTIVE POWER, C. J. Eyre, London.
11,231. DYEING MACHINES, J. De Lahunty, Pennsylvania, U.S.
11,232. PUMPING WATER, G. Page and E. C. Gee, London.
11,233. PERPETUAL CALENDAR, H. J. Haddan.—(*L. von Orth, Charlottenburg.*)
11,234. TARGETS for SALOON GUNS, H. J. Haddan.—(*L. G. Laridan, Paris.*)
11,235. MOULDINGS in WOOD, &c., H. J. Haddan.—(*A. Morin, Raincy.*)
11,236. SIGNALLING TARGET, L. A. Groth.—(*P. Ceroni, Firenza, and G. Bregoli, Finale Emilia.*)
11,237. WARMING STOVE, L. A. Groth.—(*G. Boretti, Ardenza.*)
11,238. WRITING CABINET, J. Fletcher, London.
11,239. VELOCIPEDES, J. White and J. Asbury, London.
11,240. HOLDERS for PAPER in the ROLL, M. Farmer, London.
11,241. HEATING FEED-WATER, J. Kirkaldy, London.
11,242. WATER HEATERS for BATHS, J. Kirkaldy, London.
11,243. CAPS or STOPPERS for BOTTLES, G. V. de Luca, London.
11,244. DYNAMO-ELECTRIC MACHINES, G. Forbes, London.
11,245. WIRE ROPES, H. H. Lake.—(*C. C. Colby, Canada.*)
11,246. PROPELLING VEHICLES, K. Degener, London.
11,247. GRAB BUCKETS for DREDGING, &c., H. J. Coles, London.
11,248. COMBINED BEDSTEAD and FIRE-ESCAPE, H. Tooth, London.

*14th August*, 1884.

11,249. OPENING VACUUM VALVES, J. H. Riley and J. Downham, Manchester.
11,250. EXTRACTING TAR and AMMONIA from GASES, J. Dempster, Halifax.
11,251. TIEING BRICKS, &c., TOGETHER, T. and W. Garforth, Mirfield.
11,252. ARRANGEMENT, &c., of HEATING APPARATUS, H. C. Board, Bristol.
11,253. SELF-CLEANING RAZOR STROP, &c., J. C. Edwards, Salford.
11,254. BRAKE for PULLEY BLOCKS, T. Kirkland, jun., Mansfield.
11,255. SEWING MACHINES, W. Jones, Guide Bridge, near Manchester.
11,256. HOLDING GLASS GLOBES, &c., J. Hargrave, Leeds.
11,257. CHEST EXPANDER, W. P. Scott, Manchester.
11,258. CRANK AXLE for ENGINES, &c., W. Corteen, Sheffield.
11,259. APPARATUS for CONDENSING, &c., H. Hocking, London.
11,260. TRICYCLES, F. Bosshardt.—(*A. Mas, Béziersin.*)
11,261. VELOCIPEDES, P. Adie, London.
11,262. CIGARETTES, R. Barkof, London.
11,263. RENDERING LEATHER WATERPROOF, T. Church and W. P. Sherwood, London.
11,264. INTERLOCKING RIBBON for ORDNANCE, T. Wilson, J. Sample, and W. M. Ward, London.
11,265. MILLS, R. C. Robinson, London.
11,266. STEAM BOILER TUBES, W. Taylor, Hornsey.
11,267. SEPARATING COPPER, &c., by ELECTRICITY, H. and H. A. Wiggin, and A. S. Johnstone, and W. W. Wiggin, London.
11,268. HOISTS, G. C. Marks, London.
11,269. MOTIVE POWER, B. P. Stockman, London.
11,270. METALLIC PLATES for BOOTS, D. Lloyd and S. Burge, London.
11,271. LIFTING JACK, D. Lloyd and S. Burge, London.
11,272. VESSELS for LIQUIDS, D. Lloyd and S. Burge, London.
11,273. DOUBLE DOVETAILING, M. Underwood, Devonport.
11,274. CHANGING BOXES for PHOTOGRAPHIC PLATES, J. B. B. Wellington, London.
11,275. TIRES, R. Pickin, Birmingham.
11,276. WEIGHTS for SASHES, W. Ayres, London.
11,277. STEAM-CONDENSING ENGINES, H. Edwards, London.
11,278. BREECH-LOADING FIRE-ARMS, H. Gardner.—(*J. P. Pieri, Paris.*)
11,279. WRITING APPIANCES, G. R. Willis, London.
11,280. REFLECTORS, G. Mills, London.
11,281. LOCOMOTIVE ENGINES, G. M. and S. B. Garrard, London.
11,282. ARRANGING GARMENTS, J. G. Ramsey, London.
11,283. APPARATUS for LIFTING INGOTS, J. Cook and D. Atkinson, London.
11,284. A HYDRO-AEROSTATIC LOG, P. Jensen.—(*O. Hult, Carlskrona.*)
11,285. PETROLEUM LAMPS, H. H. Lake.—(*MM. Lempereur and Bernard, Liege.*)
11,286. APPARATUS for SCOURING WOOLLEN YARN, H. H. Lake.—(*C. Larisch, Jaegerndorf.*)
11,287. LADIES' RIDING-HABITS, J. Busvine, London.
11,288. APPARATUS for TANNING HIDES, A. M. Clarke.—(*E. de Solminihac, Hénant.*)
11,289. SLIDING SASHES, W. H. Sleep, London.
11,290. AIR VALVES, R. Stevens, Cornwall.
11,291. CAP SPINNING, J. H. Clapham, Shipley, and T. W. Wheelwright, Bradford.
11,292. CEMENT, A. M. Clark.—(*G. von Koch and R. Adamy, Darmstadt.*)

*15th August*, 1884.

11,293. SPRINGS, L. Sterne, Glasgow.
11,294. LIDS for DAIRY MILK BOTTLES, L. Redpath and F. Gill, Sunderland.
11,295. CHURNING BUTTER, E. Sorfleet, Spilsby.
11,296. CONTACT ROLLERS for DYNAMO, &c., MACHINES, G. Hookham, Birmingham.
11,297. NON-INTOXICATING BEER, T. Etty, Liverpool.
11,298. CASH, &c., CARRIERS, J. Burns, Liverpool.
11,299. LOWERING COFFINS into GRAVES, J. Burns, Liverpool.
11,300. COFFINS, H. Matthews, Norden.
11,301. AUTOMATIC AERIAL BATTERY, F. A. Gower, London.
11,302. CRANK AXLES, J. B. & S. E. Howell, Sheffield.
11,303. BLOCKS, &c., for ARMOUR, &c., J. B. and S. E. Howell, Sheffield.
11,304. CONTROL APPARATUS for PUBLIC VEHICLES, G. Prölss, Dresden.
11,305. SOAP COMPOUNDS, S. N. Dimbleby, London.
11,306. FLOATS for FISHING NETS, G. C. Alder, London.
11,307. ELECTRIC TELEPHONY, J. G. Lorrain, London.
11,308. CARRIAGE BODIES, W. Wainwright, London.
11,309. UNSTOPPERING BOTTLES, &c., H. Hopkins, Birmingham.
11,310. AUTO-DYNAMIC ENGINE, C. F. D. F. de Livet, London.
11,311. BUTTER TUBS, &c., H. F. Coombs, Charlottetown, Canada.
11,312. PREPARING MEDICAL COMPOUNDS for use as PLASTERS, F. Peyton, London.
11,313. FANS for VENTILATING, G. T. Harrap and F. C. Hawtin, London.
11,314. BINDING BOOKS, W. T. H. Carman.—(*H. G. Thompson, U.S.*)
11,315. CONTROLLING the SUPPLY of WATER, G. H. and S. Jennings, & J. Morley, London.—28*th June*, 1884.
11,316. MINERAL OIL LAMPS, B. Redwood, London.
11,317. TROUSERS, C. Abel.—(*V. Tiring und Brüder, Vienna.*)
11,318. BOTTLE STOPPERS, M. Emanuel, London.
11,319. GLOVE FASTENINGS, H. J. Haddan.—(*E. J. Kraetzer, U.S.*)
11,320. DARNING ATTACHMENT for SEWING MACHINES, A. M. Clark.—(*W. Opel, Frankfort-on-the-Main.*)
11,321. DECANTING LIQUIDS, W. R. Thomson, Glasgow.
11,322. PRODUCING VEGETABLE CARBON, A. F. Westerlund, London.—21*st May*, 1884.
11,323. TELEPHONES, W. E. Irish, London.
11,324. TELEPHONE TRANSMITTERS, W. E. Irish, London.
11,325. AUTOMATICALLY RECORDING ARTICULATED SPEECH, &c., W. E. Irish, London.
11,326. DISTRIBUTING, &c., GRAIN in GRANARIES, F. E. Duckham, London.

*16th August*, 1884.

11,327. INDIA-RUBBER BALLS, W. H. Collins and A. J. Wyley, London.
11,328. TREATING WOOL and other FIBRE, W. and J. Terry, Halifax.
11,329. TOILET or HAIR PINS, F. Iles, Birmingham.
11,330. HANDLES and LIDS for BOXES, &c., E. Hall, Sheffield.
11,331. EXTRA HARD YARNS, S. H. Stott, Manchester.
11,332. WINDOW BLINDS, W. Triffitt, Bradford.
11,333. APPLYING CHLORIDE of LIME for BLEACHING, &c., PURPOSES, G. Lunge, Zurich.
11,334. SELF-RAISING FLOUR, G. T. Carter, Reading.
11,335. HEATING, M. Cahen, Liverpool.
11,336. DISSOLVING LIME, M. Cahen, Liverpool.
11,337. PHOSPHORIC ACID, &c., M. Cahen, Liverpool.
11,338. MONEY TILLS, A. J. Johnston, Liverpool.
11,339. BURGLAR and FIRE-ALARM APPARATUS, T. Wright, Liverpool.
11,340. ADJUSTABLE FOLD-UP CARTRIDGE EXTRACTOR, W. Reynolds, London.
11,341. STEEL, J. Haldeman, London.
11,342. MULTITUBULAR STEAM BOILERS, A. J. Bell, Manchester.
11,343. AUTOMATIC SELF-CLOSING VALVES, J. S. Warburton, London.
11,344. ADJUSTABLE HOLDING and REGULATING CRAMP, W. Carron, Birmingham.
11,345. COMBINATION WHEEL, B. Poole, Birmingham.
11,346. ADJUSTABLE CAMERA STAND, J. Ashford, Birmingham.
11,347. WHITE CRYSTALLINE SUGAR, C. Steffen, Vienna.
11,348. VENETIAN BLINDS, J. Harris, London.
11,349. SAFETY WINDOW-SASH APPLIANCE, J. Hill, London.
11,350. STONEWARE FEET-WARMERS, J. M. Walker, Kilbourne.
11,351. UNITING METALS, &c., by ELECTRICITY, W. B. Brain, London.
11,352. TRANSMITTING MOTIVE POWER, J. E. Holloway, London.
11,353. RUBBER WATERPROOF CLOAKS, A. F. L. and W. L. Hepton, London
11,354. TAPS, W. Morrison, Glasgow.
11,355. PUNCHING or DRAWING TUBES, &c., A. W. L. Reddie.—(*Schneider et Cie., Creusot.*)
11,356. DRAWPLATES or DIES, A. W. L. Reddie.—(*Schneider et Cie., Cruesot.*)
11,357. BAG, A. E. Da Costa, London.
11,358. PACKING CASE or BOX, S. E. Kemp, London.
11,359. PIANOFORTE ACTIONS, A. Craig, Belfast.
11,360. GALVANIC BATTERIES, J. W. Rogers and G. K. Cooke, London.
11,361. AUTOMATIC GAS MOTORS, P. M. Justice.—(*T. Buckeljau, Malmes.*)
11,362. MATERIALS for PROTECTING and INSULATING PURPOSES, A. Parkes, London.
11,363. TELEPHONES, A. J. Boult.—(*S. de Kraft, U.S.*)
11,364. CASTING METAL PIPES, &c., A. G. Brookes.—(*R. S. Kirkpatrick, Brussels.*)
11,365. BEVERAGE COMPOUND, M. P. Fischer, London.
11,366. STEAM BOILERS, J. McG. McCulloch, Garston.
11,367. FILTERS, A. Angell and W. B. G. Bennett, London.
11,368. KILNS, S. De La G. Williams and J. A. B. Bennett, London.
11,369. MAGAZINE FIRE-ARMS, H. H. Lake.—(*Dr. A. R. J. von Wehrstedt, Schloss Puchberg, and F. J. Petry, Vienna.*)

*18th August*, 1884.

11,370. VENTILATING TENT, &c., J. M. Fletcher, Cheadle.
11,371. CLUTCH GEAR, W. W. Brereton, Dublin.
11,372. DRAWING BOARD, A. Hills, Cheam.
11,373. TREATMENT of VAT WASTE, D. B. Hewitt, Manchester.
11,374. TREATMENT of VAT WASTE, D. B. Hewitt, Manchester.
11,375. TREATING LEATHER, S. H. Hadley, Liverpool.
11,376. BUCKLES for BRACES, &c., T. Evans and W. Fereday, Birmingham.
11,377. SYRINGES, J. Pumphrey, Birmingham.
11,378. FINS of ARTIFICIAL MINNOWS, &c., H. Terry, Redditch.
11,379. SPINNING, &c., COTTON, &c., W. E. Heys.—(*J. Ballantyne, Canada.*)
11,380. LACE FASTENERS, W. Gay.—(*F. M. Munroe, U.S.*)
11,381. LOCOMOTIVES, H. Hancock, London.
11,382. INTERCEPTING BLOCK SAFETY for GUN LOCKS, E. Harrison and F. Beesley, London.
11,383. BELT FASTENERS, J. Moxon, London.
11,384. FLANGES for WARPERS' BEAMS, J. Bond and T. Parkinson, London.
11,385. COILS for the PRODUCTION of CURRENTS of ELECTRICITY, L. Gaulard and J. D. Gibbs, London.
11,386. REGULATING, &c., GAS in BURNERS, C. W. Morley, London.
11,387. COLLETS for AXLES, E. Partridge, London.
11,388. HARMONIUMS, &c., J. Robinson, Swansea.
11,389. CUTTING WOOD into LAMINATED PIECES, G. Fry, A. Ransom, and T. J. Wilkie, London.
11,390. FILTERS, G. Cheavin, London.
11,391. VELOCIPEDES, T. Lawson, London.
11,392. SAVING PERSONS from DEATH by DROWNING, D. Macpherson, London.
11,393. ARMATURES for DYNAMO-ELECTRIC MACHINES, R. P. and J. S. Sellon, London.
11,394. BREAD, L. Dathis, jun., London.
11,395. RUSTIC DECORATION of FANCY ARTICLES, J. Addison and J. Fyffe, London.
11,396. ANCHOR, H. McMinn, London.
11,397. TAKING the THRUST of SHAFTING in MOTION, L. B. Wells, London.
11,398. ORNAMENTING GLASS ARTICLES, F. Heckert, London.
11,399. EQUALISING the POWER REQUIRED for OPERATING LOOMS, H. J. Haddan.—(*L. L'Hermite, Reus.*)
11,400. TASSEL and STRING HOLDERS, A. Mechnig, London.
11,401. STOVES for SINGEING HOGS, W. A. Barlow.—(*J. H. and J. D. Koopman, Hamburg.*)
11,402. JEWELLERY, H. H. Lake.—(*C. Siebenpfeiffer, Phorzheim.*)
11,403. EXTRACTING OIL from FLAX, &c., H. H. Lake.—(*G. G. B. Casero, St. Etienne.*)
11,404. LOCK-NUTS, S. Arnold, London.
11,405. BELT FASTENERS, A. M. Clark.—(*G. W. Southwick, U.S.*)
11,406. SLIDING SEATS for ROW-BOATS, A. M. Clark.—(*J. J. Turpel, Nova Scotia.*)
11,407. TREATING LIGNEOUS SUBSTANCES, H. H. Lake.—(*A. F. Le Myé and W. de Peyster, Paris.*)
11,408. VENTILATORS for RAILWAY CARRIAGES, H. Howard, London.

## ABSTRACTS OF SPECIFICATIONS.

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

5058. APPARATUS for SIFTING BALLAST, *R. and G. Neal and C. R. Whitmee, London.*—24*th October*, 1883. 6*d.*

Consists of an arrangement of hopper and screens or sieves of different gauges, hung from a fixed frame or equivalent support, in such a way as to be capable of receiving an oscillatory movement.

5430. USING STEAM and HOT AIR COMBINED, and CONSTRUCTION of ENGINES in CONNECTION THEREWITH, *W. Turnbull, New Hampton.*—17*th November*, 1883. 6*d.*

Relates to the general construction of the engines.

5543. CONSTRUCTION of GAS ENGINES, &c., *L. H. Nash, Brooklyn.*—27*th November*, 1883.—(*Complete.*) 8*d.*

The invention is directed to the saving of the heat abstracted by the use of a circulation of water usually employed to cool the working cylinder, and also to effect a partial saving of the heat expelled by the waste gases. This saving is effected by utilising the compressed working fluid of the engine after compression to cool the heated portions of the engine on its way to the working cylinder, while the saving of the heat lost in the waste gases is effected by provision, which allows of a high degree of compression of the charge, and consequently of a greater expansion.

5565. TUBE and CARRIAGE for the LAUNCHING of FISH TORPEDOES by MEANS of GUNPOWDER, &c., *A. Sauvée, London.*—29*th November*, 1883.—(*A communication from J. B. G. A. Canet, Paris.*)—(*Complete.*) 8*d.*

Relates principally to the mode of discharging the fish torpedo with gunpowder or similar explosive by means of mechanism in combination with a percussion or electrical fuse.

5747. ANCHORS, *G. Tyzack, South Shields.*—15*th December*, 1883. 6*d.*

Relates to the substitution, in lieu of a crown pin, of a curved toggle bolt connected and working with the arm or fluke.

5776. CABINET CASES, &c., *H. J. Allison, London.*—18*th December*, 1883.—(*A communication from M. J. Wine, Washington.*) 8*d.*

Relates to a cabinet case for filing away documents, files, letters, and papers generally, either in open or folded form.

5788. Treating Ores to Purify and Prepare them for Smelting, *W. R. Lake, London.*—18*th December*, 1883.—(*A communication from C. Cherry, Chicago, U.S.*) 8*d*.

Relates to the means of heating the ores, and to the construction of the retort.

5790. Electrical Conductors, &c., *H. H. Lake, London.*—18*th December*, 1883.—(*A communication from C. H. Goebel and G. W. Bratton, Philadelphia, Penn, U.S.A.*) 8*d*.

This relates to electrical conductors, to underground conduits, and to devices for use with the same. The conduit consists of three tubes, the first forming the curb, the second the gutter, and the third a portion of the street adjacent to the gutter. Each tube is independent of the other, and each is provided with a separate lid or cover, the conductors being carried on a series of hooks formed within the tube. Each conductor is enclosed in a series of articulated blocks of vulcanite or other suitable material. Splicing is effected by means of threaded sleeves fitting within the blocks.

5791. Middlings Purifiers, *W. R. Lake, London.*—18*th December*, 1883.—(*A communication from J. T. Walter, Gaston, U.S.*) 8*d*.

Relates to middlings purifiers which comprise a housing or casing, one or more inclined vibrating screens contained therein, and means for inducing an air current through the screens.

5813. Heating Steam Generators by Means of Electric Currents, *F. C. Glaser, Berlin.*—19*th December*, 1883.—(*A communication from H. Hempel, Leipsic.*)—(*Not proceeded with.*) 6*d*.

This relates particularly to the heating of locomotive boilers by electricity, the necessary current being produced by dynamo-electric generators driven from the axles. To enable the engine to start the train the boiler of the locomotive is charged with steam to the requisite extent from stationary boilers placed at either end of the line.

5832. Lighting by Hydrocarbon Vapour—Storing Inflammable Liquids, *N. L. Pouschkareff, Moscow.*—21*st December*, 1883. 6*d*.

Relates to the construction of apparatus or candle for burning vapours of light hydrocarbon liquids for the purpose of illumination, consisting of a tube closed at one end and there provided with small holes or perforations, in which tube is provided a wick or charge of capillary or absorbent material in such manner that a free space is left at the closed end of the tube, in which space the light hydrocarbon vapours are generated, while the wick or charge of capillary material does not take part in the combustion.

5853. Pile Fabrics, *J. Sillavan, Manchester.*—24*th December*, 1883.—(*A communication from D. Marcon, Paris.*) 10*d*.

This relates to the production of a double pile fabric united by the threads which form a revolving circular knife traversed by mechanism near the taking-up beam or beams. An improved letting-off motion; an improved picking motion; and mechanism for guiding, inserting, and withdrawing the wire in and from the shed are described. Two warp beams are used, one supplying the warp for the back of both pieces, and the other the yarn for the pile for both pieces.

5856. Electric Batteries, *W. P. Thompson, Liverpool.*—24*th December*, 1883.—(*A communication from Ida C. Himmer, New York, U.S.A.*) 6*d*.

Relates to a carbon and zinc primary battery, the parts whereof are so connected together and to the outer circuit as to avoid all corrosion of the parts, and also to preserve the amalgamation of the zinc element.

5861. Sinking or Fixing Colours, &c., into or on Marble, Wood, Ivory, and other Materials, *G. Hand-Smith, London.*—26*th December*, 1883. 8*d*.

The colours are applied to the material by printing, dipping, or other suitable method, and the object is subjected to the action of heat and atmospheric air to which moisture has been imparted, the operation being carried on in suitable apparatus.

5862. Manufacture of White Lead, *G. Hand-Smith, London.*—26*th December*, 1883. 6*d*.

This relates to the manufacture of white lead from metallic or blue lead, by submitting metallic lead within a suitable chamber to the corroding action of acid vapours and air prepared in a saturating chamber, and introduced under pressure into and allowed to expand within such chamber.

5867. Baskets, Skeleton Barrels, or Crates for Carrying Acid Carboys, &c., *H. Brunner, Widnes.*—27*th December*, 1883.—(*A communication from C. Garneri, Paris.*) 6*d*.

This relates to an improved machine for making skeleton barrels or crates.

5869. Musical Instruments, *A. Dunlop, Glasgow.*—27*th December*, 1883. 6*d*.

This consists in constructing musical instruments having fixed sounds—that is, sounds not being capable of variation at will by the performer like the sounds producible from violins and trombones—to play in eight major keys and their relative minors with only about fifteen, sixteen, or seventeen perfectly tuned non-tempered sounds in every octave, and not requiring more than one very simple keyboard and only a few more finger keys than usual in tempered instruments, and little complication.

5873. Obtaining Oils and Gas from Minerals, &c., *N. Mc.F. Henderson, Linlithgow.*—27*th December*, 1883. 6*d*.

The minerals are treated at different stages in contiguous retorts, and through the fresh minerals at their first stage the matters proceeding from the partly spent minerals at their second stage are passed, each charge successively subjected to the first and second stages of treatment in the same retort.

5877. Night Lights, *S. Clarke, Child's-hill.*—27*th December*, 1883. 6*d*.

A mould or block of fatty material with a central wick is made of smaller diameter at the base than at the upper end, and a wrapper of paper being applied round the mould, the bottom is filled in with plaster of Paris, so as to form a base and thin casing around the sides of the block.

5880. Sewing Machines, *A. Greenwood and S. Keats, Leeds.*—27*th December*, 1883. 10*d*.

This relates to machines in which two waxed threads are used to produce a stitch suitable for welt sewing, the object being chiefly to supersede the use of a reciprocating looper. The feed is effected by the hooked needle, the needle bar receiving for this purpose an oscillating motion in addition to its vertical motion. A reciprocating bar held down to the work by a spring presser, and which in the case of welt sewing acts as a guide, assists the feed action. A stationary sewing plate, besides acting as a guide and support for the work, serves the purpose of a looper.

5883. Knitting Machinery, &c., *F. Keywood, Nottingham.*—28*th December*, 1883. 8*d*.

Mechanism is used to alter the working angle and leverage of suitable jacks. A moving falling bar produces warping length of loops. Sinkers with an additional neb each produce two loops, and sinkers with one neb and a wide catch are also used, both sinkers having an opening for the passage of thread carriers, to which swinging, rising, falling, and shagging movements are imparted. A sliding apparatus enables needles or points to be pressed, elevated, supported, or selected as required. By these means loops may be removed in any part of the fabric, and the stiffness or size of the loops is automatically regulated in any part without interfering with the stiffness of any other part.

5885. Indicating or Signalling Time by Electricity, *A. G. Brookes, London.*—28*th December*, 1883.—(*A communication from L. N. Downs, Boston, Mass., U.S.A.*) 8*d*.

This relates to a method and apparatus for reporting time to the subscribers of a telephone system by means of a single standard clock and signals repeated in constant succession throughout all the minutes of the day, the signals conveying the information by means of the variations of the intervals between them.

5887. Expansion Wrenches, Mandrils, Reamers, and Arbors, *H. J. Haddan, London.*—28*th December*, 1883.—(*A communication from A. E. Lytle, Chicago, U.S.*) 6*d*.

A hollow shell provided with loose dogs is used in combination with a movable expanding plug, and means for drawing this plug in or out to expand or contract the dogs.

5892. Sewing Machines, *A. Greenwood, Leeds.*—28*th December*, 1883. 6*d*.

This relates to a mode of driving the rotary shuttles of sewing machines, and giving them the requisite "dwell" without requiring a reciprocating motion to bring them to their normal or starting position. This is effected by the combined action of two rotary cams upon rock levers connected with a crank pin of the shuttle driver spindle.

5897. Creating Currents of Air or Gases for Ventilating Purposes, &c., *R. Lofthouse, Manchester.*—28*th December*, 1883. 6*d*.

The apparatus in one form consists of an archimedian screw fixed on a spindle and surrounded by a cylinder revolving therewith. The cylinder has external blades, arranged so that when revolving in a tube the outer blades will blow and the inner ones exhaust, or *vice versâ*. Several modifications are described.

5901. Apparatus for Imparting Step-by-step Motion to Parts of Mechanism, *O. W. F. Hill, Norbiton.*—28*th December*, 1883. 6*d*.

A wheel mounted on an axis carries a circle of pins, which are acted upon by a pair of levers, mounted so that they can move in a plane at right angles to the axis. One lever has two acting surfaces at right angles, one surface acting on one of the pins during the forward movement, so as to rotate until the next pin comes against the other face. The second lever faces the former and its spring urges it forwards, this lever also having two acting surfaces. The two levers act alternately.

5907. Steam Boilers and their Furnaces, *G. Stevenson, Airdrie, N.B.*—29*th December*, 1883. 6*d*.

In one form the boiler consists of an upper horizontal cylindrical shell for the separation and collection of steam, the water level being at about the middle, and the principal heating surface consisting of tubes with water inside, and which are attached to the sides of the cylinder and extend down in inclined directions, crossing each other beneath the cylinder in a heating chamber. Each tube is provided with an inner circulating pipe. A special feeding apparatus for supplying fuel to the furnace is also described.

5918. Saddles for Bicycles, Tricyles, &c., *J. A. Lamplugh, Birmingham.*—29*th December*, 1883. 6*d*.

This relates to an elastic saddle with tightening appliances for regulating the tension of the leather foundation.

5919. Rotary Blowers, Exhausters, and Pumps, *W. Allday, jun., and E. Allday, Birmingham.*—29*th December*, 1883. 6*d*.

A case of nearly oval section contains two rotating diaphragms. These diaphragms consist of skeleton frames covered with sheet metal.

5921. Machinery for Cutting Sheets of Steel and other Metals, *W. T. Beesley, Sheffield.*—29*th December*, 1883. 6*d*.

The object is to cut the metal into strips of any required width, and it consists in mounting in a frame two or more pairs of spindles one above the other, each pair geared together to revolve in opposite directions. The whole nest of spindles are also geared together. On each spindle a revolving cutter is mounted, the cutting edges being close enough to cut the metal which is passed between them.

5922. Compound Steam Engines, *J. and J. Saxon, Openshaw.*—29*th December*, 1883.—(*Not proceeded with.*) 2*d*.

The object is to prevent compound engines running away, and consists in admitting air into the low-pressure cylinder or into the air pump or its connections with the cylinder, so as to destroy the vacuum. For this purpose the governor is caused to open suitable cocks when a certain speed is attained.

5926. Dynamo-electric Machines and Electric Meters, *S. Z. de Ferranti, London.*—29*th December*, 1883. 1*s*. 6*d*.

This relates to a dynamo-electric generator in which a continuous current is produced, without the use of a commutator. A disc of copper rotates between two annular poles of an electro-magnet, and the current is carried off from the periphery by a film of mercury. In the meter a column of mercury, carried in an annular trough, imparts, when the current is passed radially through it, a rotary motion to the axis of a counter, by means of vanes projecting from the axis and dipping into the mercury.

5967. Barrel Forming Machines, *P. M. Justice, London.*—31*st December*, 1883.—(*A communication from F. Myers, Hamburg.*) 8*d*.

The discs upon which the staves are arranged do not turn, but are stationary, and have a groove into which the staves are pushed through a notch in the outer rim of the groove and pushed around in the grooves to make the form. Prior to entering the grooves the staves are pushed over a bulging device to give the bend. From the bulger the staves pass over a ring between the discs that press the staves outward. The ring is released from its support when about two-thirds of the barrel form is around the ring, the ring being then retained by the staves already on, and spring between it and the flanges of the disc until the other staves are pushed on.

5971. Dressing, Ornamenting, or Polishing Stone, Concrete, &c., *W. and T. Brindle, Upholland, Lancashire.*—31*st December*, 1883. 6*d*.

A reciprocating rubbing surface of iron or steel is caused to alternately bear against the surface to be dressed, and then parted from it sufficiently to receive a layer of fresh sand or water between the two surfaces.

5972. Busts for Displaying Articles of Dress, *F. McIlvenna, Manchester.*—31*st December*, 1883. 6*d*.

This relates to improvements on patent No. 4811, A.D. 1881, and consists of a spring catch for adjusting the height of the bust, and which can also be used for shop-window reachers. The skirts of the bust are made collapsible.

5978. Manufacture of Carbons for Incandescent Electric Lamps, *J. W. Swan, Bromley, Kent.*—31*st December*, 1883. 6*d*.

To ensure that the filament shall be of a homogeneous and solid texture, and that its section should be uniform throughout, it is constructed by forcing a mixture of nitro-cellulose and acetic acid through a die, and the filament so formed is subsequently deoxidised and carbonised.

5979. Regenerative Coke Furnaces, *A. J. Boult, London.*—31*st December*, 1883.—(*A communication from Schlesiche Kohlen und Koks Werke, Germany.*) 6*d*.

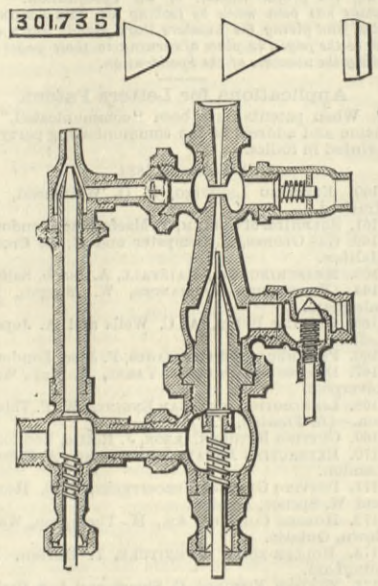
This consists in the combination of an ordinary coke furnace with a Siemens' regenerative furnace, by means of which a higher temperature may be obtained, and also the tar and ammoniacal liquor, which are set free, recovered. Three chambers are employed, two at the base and one above, the latter being heated to redness, and then filled with coal. The gases generated pass to a receiver, where the tar settles, and then pass to one of the regenerating chambers at the base, becoming heated, rise to a combustion space beneath the top chamber, to which air is admitted. The burning gas passes to a series of chambers formed by partitions, and then to the regenerators in the base, and heat bricks piled loosely therein.

## SELECTED AMERICAN PATENTS.

*From the United States' Patent Office Official Gazette.*

301,735. Injector, *William B. Mack, Boston, Mass.*—*Filed January* 19*th*, 1884.

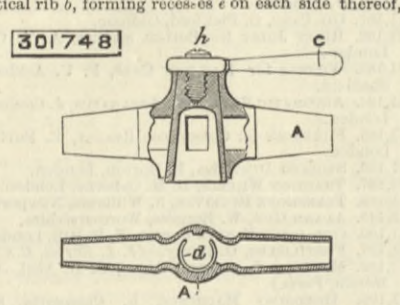
*Claim.*—(1) An injector of the class described, provided with an ejector communicating with the water spaces in the injector and adapted to exhaust air therefrom, and a valve whereby communication




between the ejector and injector is automatically cut off when the ejector ceases to act, as set forth. (2) In an injector, a water valve having a salient extension, substantially as and for the purpose specified.

301,748. Combination Stop-cock, *Hattie C. Park, Norwich, Conn., Executrix of Webster Park, deceased.*—*Filed September* 20*th*, 1883.

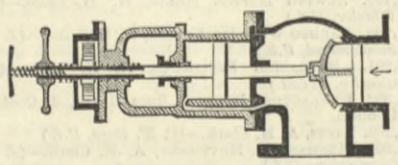
*Claim.*—The combination stop-cock herein described, consisting of the body A, having valve seat formed upon one side, as shown, and upon the other side the vertical rib *b*, forming recesses *c* on each side thereof,




the cone-shaped valve *d*, engaging the valve seat and supported by the rib, and the screw *h*, for regulating the valve and securing the operating handle C, as shown and described.

301,774. Governor Valve, *James Tate, Bradford, England.*—*Filed September* 18*th*, 1883.

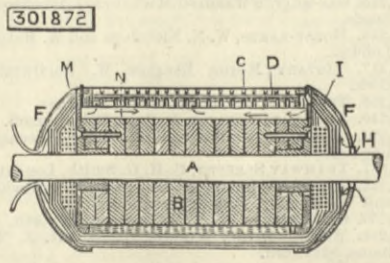
*Claim.*—The combination of a valve and a piston




controlling the same, a steam cylinder in which the piston works, steam inlet and an outlet pipe U, valve therefor, weight R, and armature P, all substantially as set forth.

301,872. Armature for Dynamo-electric Machines, *Edgar A. Edwards, Cincinnati.*—*Filed October* 18*th*, 1883.

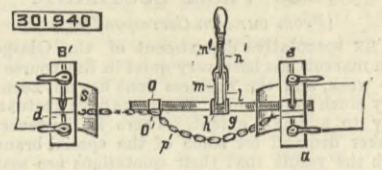
*Claim.*—(1) An armature composed of a series of rings D, having air spaces *c*, in combination with air spaces N and M between the rings and coils and core, for conducting currents of air endwise into the interior of the armature and discharging it radially outward, substantially as herein set forth. (2) A dynamo or magneto-electric machine provided with discs F, inclosing the ends of the armature, having air orifices H at or near the axis, and with air passages N and M between the rings or coils and core for carrying the air




through the armature coils and discharging it radially outward through spaces *c*, substantially as herein set forth. (3) An armature composed of the diamagnetic core B, having air spaces N, arranged longitudinally along periphery of the core B and between the rings or coils and core, in combination with the rings D, having air spaces *c* between them, and the discs F, inclosing the ends of coils I, with the air orifices H near the axis A, substantially as herein set forth. (4) In an armature for a dynamo or magneto-electric machine, the metallic discs F, inclosing the ends of the coils of the armature, provided with the radial seam G, for preventing the circulation of the induced currents, substantially as herein set forth.

301,940. Belt Tightener, *Robt. C. Wall, Allegheny, Pa.*—*Filed December* 28*th*, 1883.

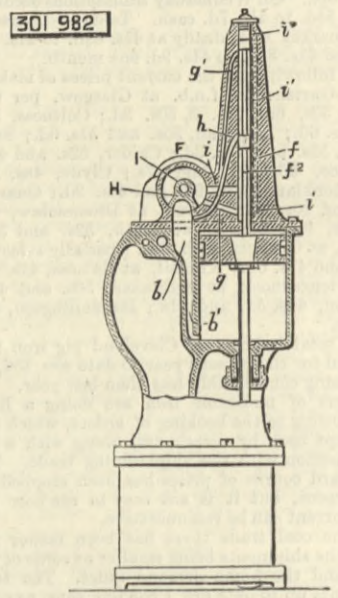
*Claim.*—(1) In a belt-tightening device, the plates *a*, having suitable slots, in combination with the threaded bolt *d*, the cam lever *e*, pivotted thereto, and the nut $e^1$, having the ribs $e^2$, substantially as set forth. (2) In a belt-tightening device, the rod *g*, having oppositely-threaded ends, and the ratchet *h*, formed integral therewith, in combination with the lever *l*, the double pawl *m*, and the reversible handle *n*, having the spring $n^2$, substantially as set forth. (3) In a belt tightener, the clamps B $B_1$, having hooks *s*, in combination with the rod *g*, having oppositely-threaded ends, the nut *o*, having a hook $o^1$, the chain *p*, and mechanism for rotating the rod *g*, substantially as set forth. (4) The rod having oppositely-threaded ends, and the ratchet *h*, in combination with the lever *l*, the double pawl *m*, pivotted to said lever, and the detachable and reversible handle *n*, having the spring $n^2$, substantially as set forth. (5) The ratchet *h*, in combination with the lever *l*, having recesses at its end, as described, the




double pawl *m*, pivotted in a slot in said lever, the detachable and reversible handle *n*, having the prongs $n^1$, adapted to fit in the recesses of the lever and forming a wrench socket, as described, and the spring $n^2$, substantially as described.

301,982. Steam-actuated Valve, *Mellen S. Harlow, Hoboken, N.J.*—*Filed February* 20*th*, 1884.

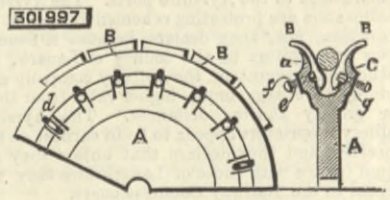
*Claim.*—The combination, with the main cylinder and piston, the auxiliary cylinder and piston, and main valve of a direct-acting pump, of an auxiliary valve-bore extending axially from the main cylinder, and an auxiliary valve consisting of a rod or stem rigidly attached to the main piston and working in said bore, substantially as herein described. The combination, with the main cylinder and piston of a direct-acting pump, of the auxiliary cylinder F, con-




structed with the cushion ports *e* $e^1$, the main ports *b* $b^1$ $b^2$, and the ports *g* $g^1$, of the auxiliary piston and main valve, and an auxiliary valve attached to and moving with the main piston for controlling the alternate exhaust from the ends of the auxiliary cylinder, substantially as herein described. The combination, with the main cylinder and piston, of the auxiliary valve chest or casing E, and auxiliary cylinder F, constructed with ports and passages *b* $b^1$ $b^2$ *e* $e^1$ *g* $g^1$ *h* *i* $i^1$ $i^2$, the main valve H, and auxiliary piston I, and the auxiliary valve consisting of the rod or stem *f* and heads or small pistons $f^2$, substantially at herein described.

301,997. Grip Pulley, *Oswald Jackson, Carrollton, Ill.*—*Filed February* 26*th*, 1884.

*Claim.*—The combination, with the pulley A, having




a grooved periphery *a*, provided with *b b* and slots *d d*, of the pivotted spring jaws B B, having ribs or lugs *c c*, the bolts *e e*, springs *f f*, and washers *g g*, substantially as described.

## CONTENTS.

THE ENGINEER, August 22nd, 1884.


| | PAGE |
|---|---|
| Sheaf-binding Reaping Machines. No. I. | 135 |
| Notes on the Excursions to Works by the Institution of Mechanical Engineers | 135 |
| Railway Matters | 137 |
| Notes and Memoranda | 137 |
| Miscellanea | 137 |
| Railway and Road Bridge, Cologne. (Illustrated.) | 138 |
| The St. Gothard Telegraphs. (Illustrated.) | 138 |
| Andersen's Electro-magnetic Cut-out. (Illustrated.) | 139 |
| Letters to the Editor— | |
| Stress Diagrams | 140 |
| Water-tube Boilers | 140 |
| Prospects of Young Engineers | 140 |
| Mr. Moon on Continuous Brakes | 141 |
| The New Patent Act | 141 |
| Railway Speeds | 141 |
| Railways of New South Wales | 141 |
| Mechanical Stokers | 141 |
| Liquid Fuel | 141 |
| Revolving Lantern for Lightships. (Illustrated.) | 142 |
| Leading Articles— | |
| Sir T. Brassey on the Navy | 143 |
| Continuous Brakes on the London and North-Western Railway | 143 |
| Electric Lighting | 144 |
| The Trevithick Memorial | 144 |
| The Steel Rail Trade | 144 |
| Making Crank Shafts without Special Tools. (Illustrated.) | 145 |
| Lightship Lanterns | 145 |
| International Inventions Exhibition | 147 |
| Economy of Arc Lighting | 149 |
| American Notes | 149 |
| The Iron, Coal, and General Trades of Birmingham, Wolverhampton, and District | 149 |
| Notes from Lancashire | 150 |
| Notes from Sheffield | 150 |
| Notes from the North of England | 150 |
| Notes from Scotland | 151 |
| Notes from Wales and Adjoining Counties | 151 |
| The Patent Journal | 151 |
| Abstracts of Patent Specifications. (Illus.) | 151 |
| Abstracts of Patent American Specifications. | 152 |
| Paragraphs— | |
| Naval Engineer Appointments | 136 |
| University College, Bristol | 136 |
| To Remove Foreign Bodies from the Eye | 146 |