THE CHICAGO RAILWAY EXPOSITION.

No. XII.

A FEW years ago the permanent way of most American railways was proverbially inferior to that found in most parts of Great Britain. The introduction of steel rails, however, has been accompanied by a great improvement, and many of the first-class American lines have as good a road bed as English railways of corresponding standing, though the great severity of the winters renders it difficult to keep the track in good condition throughout the year. One factor in the great improvement which is fast taking place in American permanent way is the system of track inspection by special cars, which are fitted with apparatus which record graphically on paper every inequality and imperfection in the surface and alignment of the rails passed over.

Professor P. H. Dudley, of 66½, Pine-street, New York, exhibited an inspection or dynagraph car of his invention, which has been used to inspect the condition of the track of the New York Central, Boston and Albany, and other leading railways. The car is attached to a locomotive fitted with the Westinghouse automatic brake, and is run over the line as a special train at a uniform speed of about eighteen or twenty miles an hour. The mechanism measures from a definite length of wheel base as a plane, the surface undulations of each line of rails, and the depression and deflection of the joints. The car weighs about 23 tons, and therefore the weight on each axle is nearly 6 tons, and the deflections caused by this weight are presumably similar to those that occur under ordinary rolling stock. The inspection car records the exact bends the rails take under the load, whereas the ordinary ganger's examination simply notes the rails as they appear to the eye when the weight is removed.

On Figs. 50 and 51 will be found copies of the diagrams given by this car. Fig. 50 represents the markings made on a sheet of paper by various pens, which are moved through a system of levers by wheels kept always in close contact with the rails. This diagram, therefore, represents each inequality in the individual rails. Fig. 51 represents the mean inequality of each mile of track, and is constructed from Fig. 50 by means of an integrating machine, as is more fully explained further on. In Fig. 50 the top line is termed the location line. The pen, if undisturbed, simply rules a straight line on the paper, but on pressing a button it makes a mark on the paper, and is therefore used to denote the situation of a mile post, culvert, or any other object passed on the road. The second line makes a mark at every 100ft., and therefore serves as a scale to measure distances, and identify the exact spot where any unusually defective joint or rail was found. The third line gives the gauge, the straight line being the normal, and the crooked line the actual gauge. In the actual diagrams the deviations from the proper width of gauge are shown full size. In the paper from which our illustration is taken, the greatest deviations from the proper gauge are $\frac{9}{10}$in. too wide and $\frac{7}{16}$in. too narrow. The fourth line shows the surface of the left-hand rail, giving its vertical inequalities. The line below this shows the cant or super-elevation, the amount of which is found by measuring from the straight line which shows the absence of cant. The sixth line shows the surface of the right-hand rail, and the seventh or bottom line gives the speed at which the dynagraph car is travelling. The distances between the marks are measured on a scale which is given on our illustration. The marks are made by a clock, which makes an electric contact at stated intervals of time. The further the paper has travelled during that time, the faster the car is going. A speed of about eighteen miles an hour is found to give the most trustworthy indications. The dynagraph car somewhat resembles in outward appearance an ordinary American passenger car, carried on two four-wheeled bogies. Internally about half of the car is taken up by a large compartment, in which is situated the table over which the diagram paper is drawn by gear driven from the wheels which are kept in contact with the track. The marking pens are mounted in a frame which spans this table. In addition to the gear which actuates the pens, the wheels are connected with a low point spotter or marker, which throws a splash of paint on the road bed near any particularly bad or slack joint. The surfacemen thus have their attention drawn to the joints which most need packing or screwing up, and the number of low joints is recorded in the dynagraph car, and forms an important item in graphically estimating the relative condition of track. Its marks are not shown on Fig. 50, but enter into the lines on Fig. 51, giving the mean condition of the track. Any excessive vertical movement of the wheel brings an adjustable stop on a vertical spindle into contact with a valve, which, when opened, permits a jet of paint to escape. The paint is contained in a cylinder in which works a piston, the upper side of which is in free communication with the main air pipe of the Westinghouse brake. The paint being thus under a pressure of about 80 lb. to the square inch, rushes out in a jet, falling on the ballast directly the valve is opened. As the stop is adjustable it can be set to indicate anything below a given standard. For instance, it may be found that every joint will give about

Fig. 50

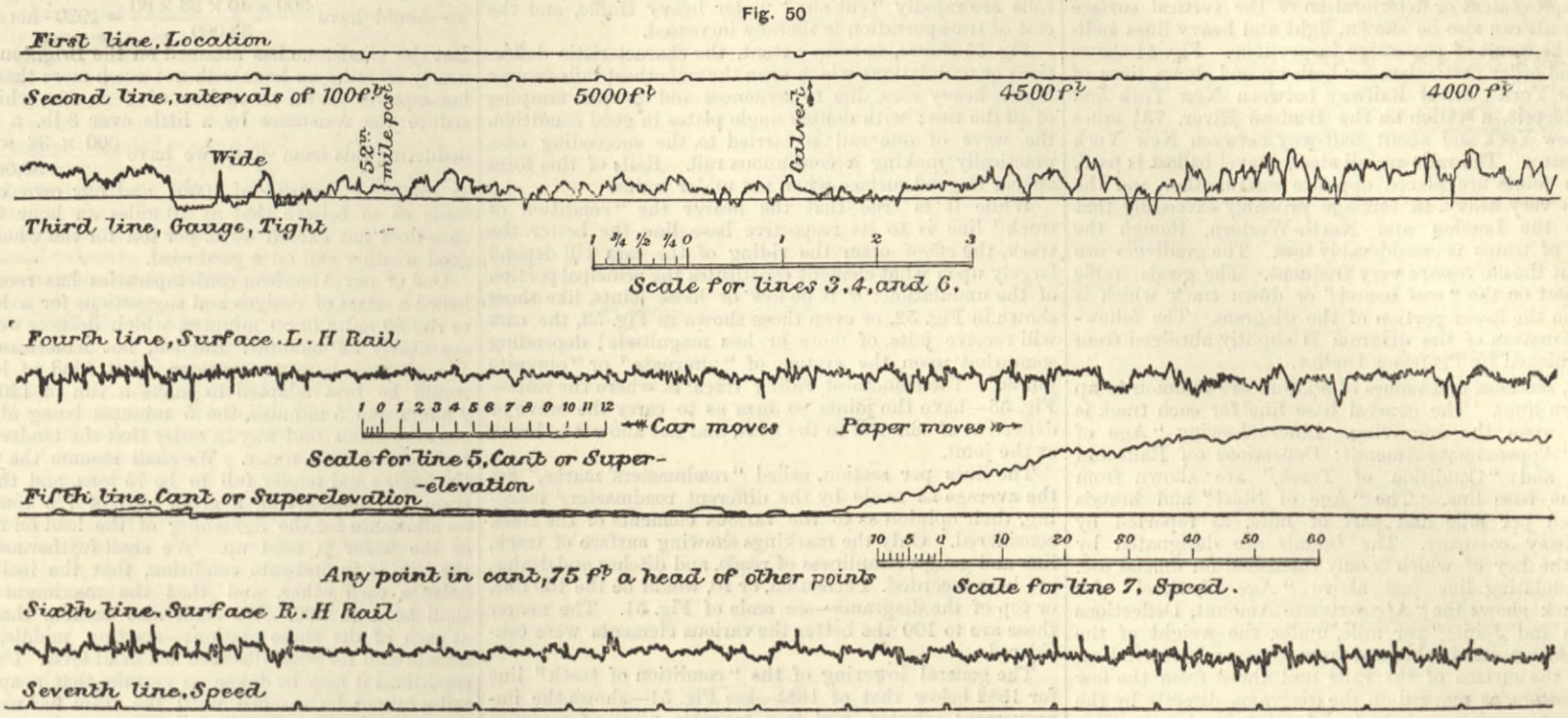
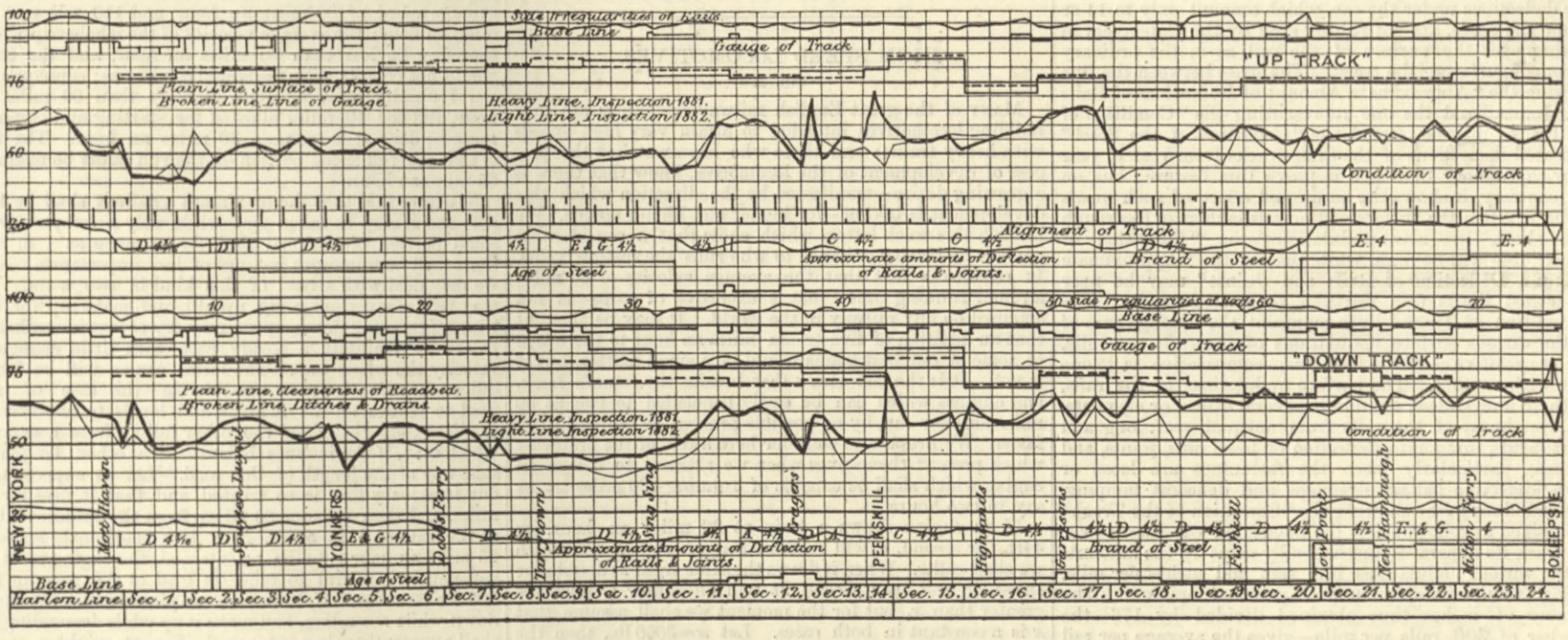


Fig. 51



Horizontal scale, 1 mile between the vertical lines.

Vertical scales.—In the original—which is twice the size of our cut—the horizontal rulings are 30 per inch; each 5th and 25th lines being heavier for convenience in counting.

To show "condition of track" and "approximate amounts of deflection of rails and joints," each horizontal space represents 1-100 of 1in.

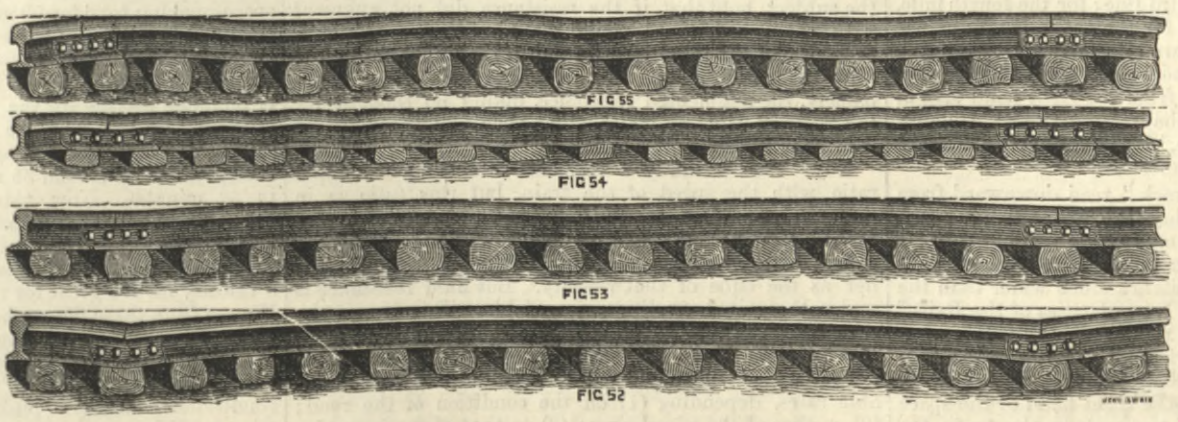
To show "age of steel," each horizontal space represents one year of service.

To show "alignment of track," each horizontal space represents 10 per cent. of the mile.

To show "roadmaster's average marking," each horizontal space represent 1-10 of a unit.

To show "side irregularities of rails" and "gauge of track," each horizontal space represents 1-10 of 1in.

To show "profile of line," each horizontal space represents 5ft.



¼in., and therefore if the stop is set at $\frac{5}{10}$in. it will only indicate those joints that are worse than the average. Fig. 51 seems somewhat complicated, but it will repay the careful study of those who are interested in the condition of permanent way, as it affords in a small compass complete information as to the condition of the track, the relative surface given in wear by different brands of rails, and affords space for the "road-master's marks" on the conditions of the ditches and fences, cleanliness of road bed, and other items which can only be estimated by eye. Any improvement or deterioration of the vertical surface of the rails can also be shown, light and heavy lines indicating the result of successive inspections. Fig. 51 shows these and other particulars for both up and down lines of the New York Central Railway between New York and Poughkeepsie, a station on the Hudson River, 73½ miles from New York and about half-way between New York and Albany. The rails are all steel, gravel ballast is used, the fish joints are placed opposite one another, and the traffic is very heavy, in tonnage probably exceeding that of even the London and North-Western, though the number of trains is considerably less. The gradients are good, but the curves are very frequent. The goods traffic is heaviest on the "east bound" or down track which is shown on the lower portion of the diagram. The following explanation of the diagram is slightly abridged from that furnished by Professor Dudley.

Miles, sections, and names of stations are common to up and down lines. The general base line for each track is marked upon the engraving. Lines showing "Age of Steel," "Approximate Amount: Deflections on Rails and Joints," and "Condition of Track," are shown from the same base line. The "Age of Steel" and brands are given per mile and part of mile, as reported by the railway company. The brands are designated by letters, the key of which is only furnished for official use. The undulating line just above "Age of Steel" for each track shows the "Approximate Amount, Deflections of Rails and Joints" per mile, under the weight of the inspection car, and is obtained from the combined indications of the surface of the rails and those from the low point spotters, as marked on the diagrams directly by the instruments, giving each rail and joint in detail. This line shows the theoretical possible improvement which could be made in the surface of the track by labour, ballast, new joint fastenings, and sleepers, sufficient to remove all deflections under the trains. The best practical results so far found only lower this line to 14 or 16 of the scale. When it rises above this, the "Condition of Track" line may be lowered by labour or material, as above stated. The deflections under the car, which amount only to 14 or 16 on the scale, are not readily seen by the platelayers in looking over the surface of the rail, as in the ordinary custom of surfacing the track. The space between the line showing the "Approximate Amount of Deflections of Rails and Joints," and the one representing the "Condition of the Track," may be termed the "Condition of the Steel." Repeated inspections of the same tracks from year to year show that labour does not improve this feature; but, on the contrary, it shows the additional effect of each year's traffic. When the surface of the rails is more or less rough —in short, irregular undulations—the "Condition of Track" line will be high, while that of the "Approximate Amount, Deflection of Rails and Joints" may be near its lowest limits (see thirtieth to sixtieth mile). The "Condition of Track" lines represent the average sum of all the various surface undulations of the rails per mile, and are relative as to the base line—comparative as to one mile with another. The surface undulations of the rails, or their unevenness, are due to several causes or elements, viz., roughness of the rails from unequal wear, long and short bends, low joints, deflection of loose rails, joints, and sleepers, particularly when the fastenings are loose or worn, defective ballast, drainage, and deficient tamping. The undulating line showing the "Condition of the Track" is obtained as follows:—As the inspection car passes over the track its apparatus mechanically sums up the amounts of the various undulations into feet and inches per mile, giving results independently of personal opinion. The number of inches thus obtained divided by 176—the number of 30ft. rails per mile—gives the average per rail for each line. When there is a difference between the two rails per mile, the mean is taken. For example:—On the up track, first mile from New York, the mean average undulation per rail was $\frac{6\frac{3}{4}}{100}$in.; for the second mile, $\frac{6\frac{6}{8}}{100}$in.; for the third mile, $\frac{6\frac{1}{2}}{100}$in.; and for the fourth mile, $\frac{5\frac{3}{8}}{100}$in. In like manner the average results are found for both lines of rails for the entire road. To plot the figures of the "Condition of the Track," as shown in Fig. 51, each horizontal line above the base line represents $\frac{1}{100}$in.; therefore, for the up track, first mile, we take the sixty-second line above the base; for the second mile, the sixty-sixth line; for the third mile, the sixty-third line; for the fourth mile, the fifty-third line; and so on for the entire length of the railway. The various points are all connected by a heavy line, the upper side giving the reading, the average condition of the mile being read from the right-hand side of the space. The line showing the "Approximate Amount, Deflections of Rails in Joints," is plotted and read in the same manner as the line just described.

Lines marked "Gauge of Track" read downward from the base line just above, and show the amount the track is out of gauge, each horizontal space representing $\frac{1}{10}$in.; a point projecting below the general average indicates that on some curves two or three rails are much wider than the rest. The lines marked "Side Irregularities of the Rails," just above base line described, represents the side irregularities of the rails, each horizontal space representing $\frac{1}{10}$in. This line reads like the "Condition of Track" lines, from the highest point on the right-hand of the space for the mile. The surfaces of the rails in the track are found in a definite forms, due to their permanent bends, directly traceable to carelessness in manufacture or to the sleepers being unequally packed or supported by the ballast. They can be classified under three principal primary forms, represented by Figs. No. 52 to 54; there are often combinations of the forms shown in Figs. 52 and 54 and Figs. 53 and 54. Wear produces distinct forms, though, when the steel is not homogeneous, one form appears on the surface somewhat like Fig. No. 54.

The form shown on Fig. 54 represents on an exaggerated scale badly surfaced rails as they sometimes come from the rolling mills. Under traffic they gradually assume the form shown on Fig. 53. Rails of the form shown in Fig. 52 have generally worn, bent, or broken fishplates, and rest loosely on the joint sleepers. This is the worst form the rails can assume, as the receiving ends of the rails are rapidly "cut out" under heavy traffic, and the cost of transportation is thereby increased.

Fig. 55 shows, to some extent, the characteristic deflections or undulations which even the smoothest rails assume under heavy cars, due to looseness and unequal tamping of all the ties; with double angle plates in good condition, the wave of one rail is carried to the succeeding one, practically making a continuous rail. Rails of this form appear in good surface when not under trains.

While it is true that the nearer the "condition of track" line is to its respective base line the better the track, the effect upon the riding of the cars will depend largely upon what element constitutes the principal portion of the undulation; if it be low or loose joints, like those shown in Fig. 52, or even those shown in Fig. 53, the cars will receive jolts of more or less magnitude; depending somewhat upon the system of "alternate" or "opposite joints." The smoothest riding track is where the rails—Fig. 55—have the joints so firm as to carry the wave or deflection of one rail to the next, and not allow it to break at the joint.

The lines per section, called "roadmasters' marks," are the average as made by the different roadmasters' marking, their opinion as to the various elements of the track considered. Only the markings showing surface of track, line and gauge, cleanliness of roads, and ditches and drains, are here recorded. Perfection, or 10, would be the 100 line, or top of the diagrams—see scale of Fig. 51. The nearer these are to 100 the better the various elements were considered.

The general lowering of the "condition of track" line for 1882 below that of 1881—see Fig. 51—shows the improvement effected, and is a tangible piece of evidence which should be more satisfactory to those connected with the track than the usual vague personal opinions as to the roughness or smoothness of the road.

The Exposition contained many interesting exhibits of points, crossings, rails, and permanent way tools, the illustration and description of which must be deferred to a succeeding article.

HIGH SPEED LOCOMOTIVES.

No. I.

Many of the great English railway companies are now building locomotives intended to attain very high speeds with heavy trains; and those who have watched the process of development of the locomotive, know that there is a growing desire—manifested by the direction which this development is taking—for higher and higher speeds. We publish this week letters which show that a considerable amount of rivalry exists as to who runs the fastest trains. It remains a fact that the average velocity of 60 miles an hour running time—that is exclusive of stops—is not attained on any railway in the world. It may be thought that an addition of five or six miles an hour to the speed of some of our best trains would be a small matter, but it is not. It is the last straw that breaks the camel's back, and engines which can be easily persuaded to run at 50 miles an hour can, by no possible process, be induced to go faster. We propose to consider here a few of the problems which present themselves when we attempt to design an engine which shall be capable of running 120 miles let us say, in two hours.

If an engine draws a train at 30 miles an hour, or 44ft. per second, it will encounter a given resistance which we shall call x. When it draws the same train at double the speed, or 88ft. per second, it will encounter a reistance greater than x, but for the moment we shall assume that x is a constant in both cases. Let $x=3000$ lb., then the work done by the engine in the first case will be $\frac{3000\times44\times60}{33{,}000}$ = 240-H.P. When the speed becomes 60 miles an hour we have $\frac{3000\times88\times60}{33{,}000}$ = 480-H.P. We see from this that the resistance remaining constant, we must double the power of the engine. To increase the speed from 50 miles an hour to 60 miles an hour will render necessary the exertion of 6-horse power where 5 sufficed. We find it necessary to insist on this point, because not a few engineers, who have not given sufficient thought to the subject, hold that if the resistance did not augment with the speed, there would be no increase of power needed; and the mischievous result is that in attempting to provide for high speeds they deal with only one element, namely, the augmented resistance, taking no thought for the reduced time in which what they call the constant resistance has to be overcome.

Now x is certainly a coefficint increasing in a rapid ratio with the speed of the train, but this ratio is in no sense a constant. It the case of a ship we can say that within certain limits her resistance will augment as the square of her velocity, and the power required to propel her as the cube of that velocity. But fluid resistance is under the stated conditions invariable. This is not the case with the resistances encountered by railway trains. For the moment we shall disregard gradients. On a level the resistance will augment faster than the speed at variable rates, depending (1) on the condition of the road; (2) on that of the wheel tires; (3) on that of the journals; (4) on the wind; (5) on the form of the coaches composing the train; atmospheric resistance depending more on the bulk of the train than on its width or height. The better the road the less rapidly will the resistance augment. Mr. Towers' experiments on friction show that at very high speeds efficient lubrication of axle journals is of much more importance than is generally supposed. Various experiments have been carried out to test train resistances at various speeds. None of them give results quite satisfactory, because we cannot be certain that the results obtained on any one day with one train will be applicable to another train on another day and a different road. It seems, rightly or wrongly, to be accepted by locomotive superintendents that the resistance at 60 miles an hour is 40 lb. per ton on a dead level. There is reason to believe that is an erroneous estimate. For a gross load of 300 tons we should have $\frac{300\times40\times88\times60}{33{,}000}$ = 1920-horse power. But the Gladstone has attained on the Brighton Railway nearly 60 miles an hour with not much more than half this horse-power down an incline of 1 in 264, which would reduce the resistance by a little over 8 lb. a ton only; deducting this from 40 lb. we have $\frac{300\times32\times88\times60}{33{,}000}$ = 1536-H.P. instead of 1000; and our own experience leads us to believe that at 70 miles an hour the resistance does not exceed 40 lb. per ton for the whole train in good weather and on a good road.

One of our American contemporaries has recently published a series of designs and suggestions for a locomotive to run 80 miles in 80 minutes, which designs we may add are nearly all modified English, not American engines. We propose here to consider what kind of locomotive would be best adapted to make a run of 120 miles in 2 hours and 5 minutes, the 5 minutes being allowed for one stop about mid-way in order that the tender might be replenished with water. We shall assume the weight of the engine and tender full to be 75 tons, and that of the train 100 tons, giving a gross load of 175 tons, making no allowance for the lightening of the load on the tender as the water is used up. We shall further assume that the road is in first-rate condition, that the inclines shall balance each other, and that the maximum gradient shall be 1 in 260. We shall also assume that the line at each of the three stations—starting, middle, and terminal—and for some distance is a dead level. Under these conditions it may be taken as certain that a speed of 60 miles cannot be reached until the train has run 3 miles. Consequently the train will make after starting 3 miles at an average speed of 30 miles an hour. It will start twice, once from the terminus and once from the middle station; therefore, 6 miles will be made at 30 miles an hour. It will stop twice, once at the middle and once at the terminal station, and allowing 2 miles for slowing down at each, we shall have 4 miles at 30 miles an hour; and the whole trip would be run as follows—10 miles would be run at an average speed of 30 miles an hour, and 110 miles at 60 miles an hour; the average velocity of the whole trip would therefore be less than 60 miles an hour, and the train would not comply with the stated conditions; consequently the 110 miles must be done at more than 60 miles an hour, and the 10 miles allowed for starting and stopping must be done at more than 30 miles an hour. The fact is that the full speed portion of the run must be made at 65 miles an hour.

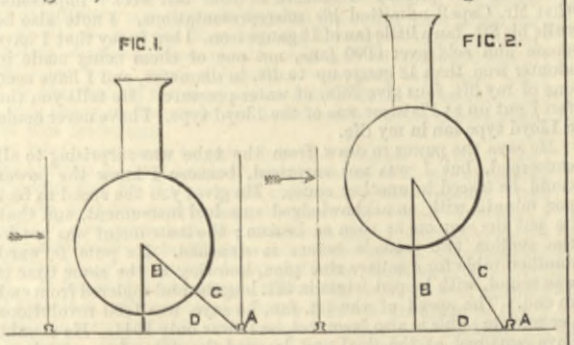
We have said that the maximum gradient shall be 1 in 260, and it may be taken that while only a comparatively small portion of the road shall be as steep as 1 in 260, there will be numerous inclines of less importance. Now we may deal with a road of this kind in two ways. We may reduce speed in going up hill, and make up for lost time when going down, or we may try to provide sufficient power to maintain a steady pace with little change of velocity the whole way. The latter course will be found quite essential. It is possible in the case of any road to reduce all the inclines and levels to two average gradients, one rising and the other falling from a summit which may, if the inclines balance each other, be placed mid-way of the length of the road. Let us suppose that our imaginary line is so treated, and that it rises for 60 miles, and then falls for 60 miles from the middle station at the rate of 1 in 500. Now if a continuous speed of 65 miles an hour is to be maintained, the engine must be sufficiently powerful to take its load at this pace up 1 in 500 for 60 miles. If, however, we please to let the speed down while ascending, and make it up while descending, we shall apparently gain a great deal. Thus we might go up one incline at the rate of 45 miles an hour, and the run to the middle station would then occupy 80 minutes, while the remainder of the run down hill must be done in 40 minutes, or at the rate of 90 miles an hour. A simple calculation, however, will show that no great reduction of speed is possible, save for very limited periods, as when a very short and steep incline has to be surmounted. Let us suppose, for example, that one-half the whole run, or 60 miles, shall be made at 50 miles an hour. Deducting 5 miles for starting and stopping, we have 55 miles at 50 per hour, and 5 miles at half speed = 10 miles at full speed, making total for 50 miles per hour = 65 miles. Now, 50 per hour = 1·2 minute per mile; therefore 65 miles will be done in $65\times1{\cdot}2=78{\cdot}0$ minutes. Out, then, of the 120 minutes 78 have been used for the first half of the journey, or 60 miles, leaving for the second 60 miles $120-78=42$ minutes. Of this 60 miles again 55 have to be done at maximum speed, and 5 at an average of half speed; so that the speed on the second 55 miles must be equal to 65 miles in 42 minutes. Now, this will give 0·646 minute per mile, so that the 55 miles must be done in $55\times0{\cdot}646=35{\cdot}53$ minutes, and the 5 miles at ends in 6·4605 minutes. The maximum speed then is $60\div0{\cdot}645=93$ miles per hour, a velocity far too great for us to contemplate its adoption. We see from these figures how important is the part played by steady running over long distances, and how great are the delays entailed by stopping and starting. Indeed, it may be safely said that it would be essential under the conditions to employ a pushing engine at the tail of the train in all cases to get up the speed if possible within a mile, and continuous brakes should be used to save time in stopping. The inclines, however, remain to be dealt with, and as some allowance must be made for retardation, it follows that we must not reckon on travelling 120 miles in two hours unless a velocity of quite 75 miles an hour is sometimes attained.

It matters nothing whether all the inclines are concentrated as we have supposed, or whether they are scattered along the road with levels between. The principal and important fact remains, that if an average velocity of 60 miles an hour is to be maintained, our engine must be suitable for a speed of 75 miles an hour. The first point to be secured is that the engine shall not run off the road at this tremendous velocity; because, no matter how powerful or how excellent it might be in other respects, it could not be used unless it was safe. We have therefore to regard it first as a carriage, or vehicle. But we cannot quite do this and neglect other considerations. Professor Osborne Reynolds has fully considered in our pages the abstract questions which concern limits to speed; and we have fully dealt also with the strains on coupling rods. We need not repeat what has there been said. Taking various points which present themselves for consideration, we believe that an engine intended to run steadily and safely at 75 miles an hour must have a single pair of drivers only, and these would be best if made 9ft. in diameter. To advocate so enormous a wheel requires some courage; but it must not be forgotten that we have to provide for an altogether exceptional velocity. It is extremely doubtful if a speed of 75 miles an hour has ever been attained save for a mile or two by any locomotive; 72 miles an hour is the highest velocity of which we have any personal experience, and this was attained by the Grosvenor, a celebrated express engine, on the Brighton Railway, the velocity being checked by a Stroudley speed indicator on the foot plate and a Westinghouse recorder in the guard's van. We have travelled at 71 miles an hour on the Great Northern and nearly as fast on the Midland, but only for short distances. We are contemplating the case of an engine which may have to run 60 miles or more per day at the rate of 75 miles an hour, and for this speed we believe, as we have said, that a 9ft. wheel will be found indispensable; at 75 miles an hour this wheel will make 229 revolutions per minute, corresponding, with a piston stroke of 2·25ft. to 1030ft. of piston speed per minute, which is quite fast enough.

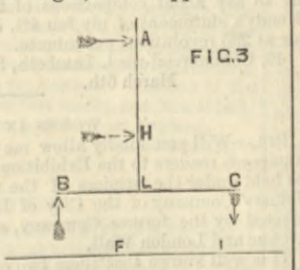
A 9ft. wheel entails outside cylinders as a matter of course, and even with these the centre of gravity of a narrow gauge—4ft. 8½in—engine must be raised considerably. We may point out, however, that the London and North-Western engine Cornwall ran with great success for many years with 9ft. driving wheels. Mr. Pearson used them on the Bristol and Exeter Railway, but as this line was then 7ft. gauge, his practice will, perhaps, not be allowed to count.

For reasons which we shall set forth fully further on, the diameter of the barrel of the boiler of our high-speed engine must be of large diameter—as large, indeed, as it can possibly be. The bottom of the shell cannot safely be hung lower than 8in. above the centre of the driving axle, and this will bring the middle line of the boiler about 7ft. 5in. above the rails. The centre of gravity of the engine will of course be far below this; but comparisons between engines are usually based on the height of the middle lines of the boiler shells, and the figures given above are not excessive. We may go further than this, and ask what are the objections to a high centre of gravity in a locomotive? There is not an instance on record of a locomotive upsetting while the permanent way remained able to carry an engine at all; and we may dismiss the notion that any risk can be incurred in this way as a result of a high centre of gravity. As regards easy running, on the other hand, it will be found that a high centre of gravity promotes it. There is, however, more risk that springs will be broken. We can, we think, make this quite intelligible in a few words, although certain writers have found it necessary to invest it with what is to some an appalling array of figures and formulæ.

We have to deal with lateral strains. The engine may oscillate from right to left alternately, or it may from a straight run on to a curve. Let us suppose that in the accompanying diagrams, Figs. 1 and 2, we have end views of two engines, one with a low the other with a high centre



of gravity. The arrows show the direction of the overturning force. It will be seen at a glance that this force will of necessity be nearer the rails in Fig. 1 than in Fig. 2. B B are the overturning moments, while D D represent the bursting effort on the rail. The inclined line C shows the direction into which this bursting strain will be resolved, and it is evident that it is much more unfavourably directed in Fig. 2 than in Fig. 1. We have further to consider that the engine is not rigid, it is supported on springs; and the higher the centre of gravity, the greater may be the load put on the outer spring, as shown by the line C, Fig. 2; and the less in proportion the lateral strain on the rail. In Fig. 3, let A be the position of the centre of gravity in the high engine, B and C the points where the dead weight is transferred to the springs, and E the rail level. The tendency is to turn the whole engine over about the point I, under the tread of the wheels. The spring C will be compressed and B relaxed, because that part of the engine

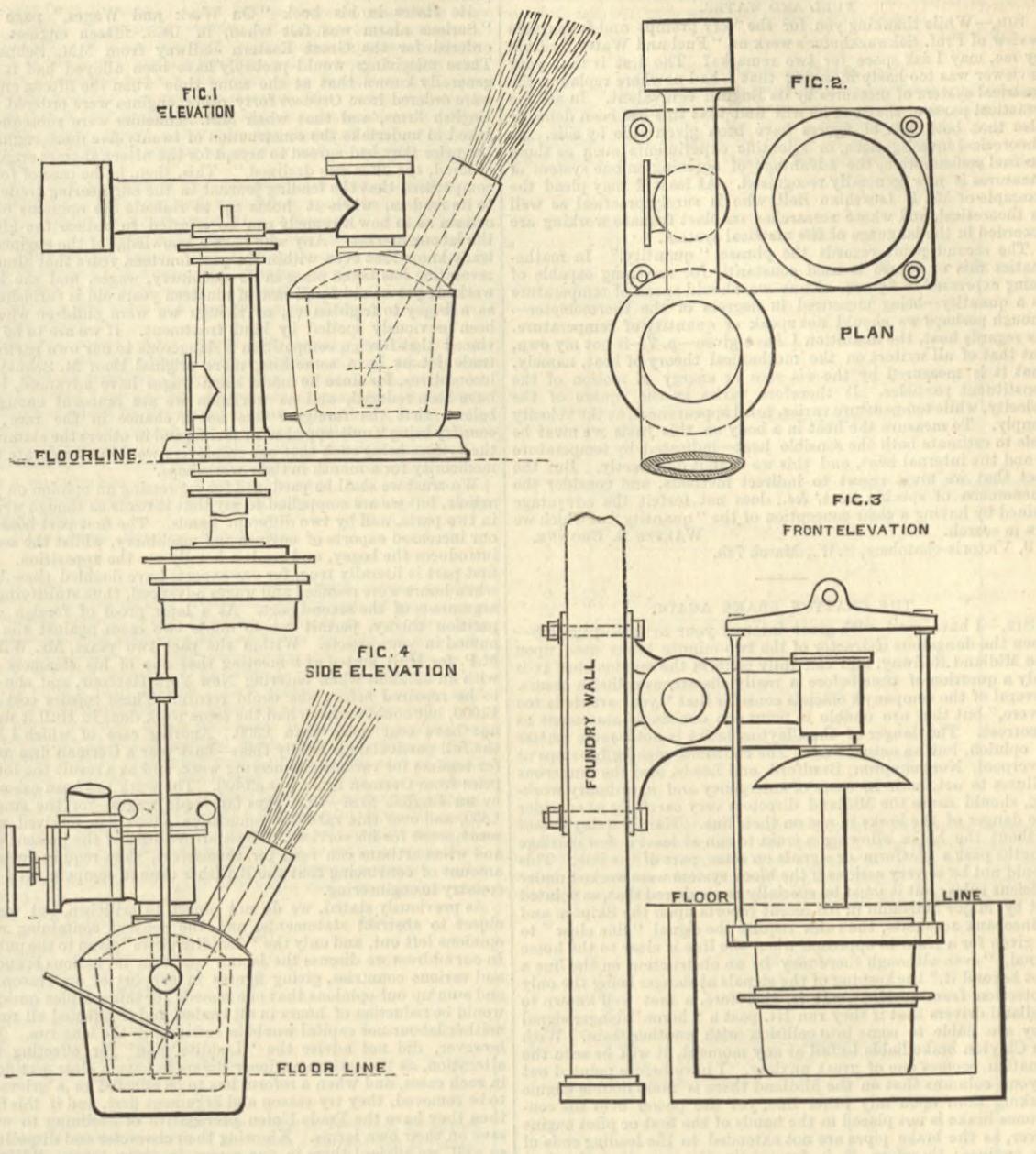


carried by the springs will tend to turn round the point L. As, however, the engine will not turn over, we have a horizontal component of the force denoted by the arrow to deal with, tending to burst the track. If the centre of gravity be brought down to the point H, the moment of the overturning force will be reduced, there will be less difference in the load on the two springs, and there will be a greater force tending to drive the outer rail out of gauge. With the same springs, the high engine will swing more than the low engine, but it will ride more easily, and the elasticity of the springs being brought more fully into play, the road will be spared rough side shocks and jolts, and the axles and wheels will also be less violently tested. On the other hand, as we have already said, the chances that springs will be broken are increased; and the system of springing that will answer with a low engine will not necessarily be the best for a high engine. Thus, for example, balance beams are especially useful in the case of engines of moderate height; but we doubt that any locomotive superintendent would use them with a lofty engine. They would supply too flexible a base for the dead weight, and would permit the engine to roll too much at high speeds. It must not be forgotten that, for the reasons already pointed out in connection with Fig. 3, the load on the inner rail of a curve will be greatly reduced; experiments, indeed, have shown that it may entirely vanish under certain conditions. There is, then, nothing to keep the wheel on the rail but its own weight. The higher the centre of gravity, the more will the load be transferred from the inside to the outside rail. This is, no doubt, useful, because the flange of the leading wheel will be pressed hard against the outer rail when the engine is running at speed round a curve, and the load will prevent it from climbing the rail; but the engine is liable at any moment to have its leading end jerked violently toward the inside of the curve, and if the load on the inside wheel is then small, the engine may leave the rails. There are plenty of instances of this; engines running off the inside rail of a curve, and this is specially likely to happen if the "cant" or superelevation of the outer rail is too great.

Balancing all the various considerations, we see no reason to fear that the use of a 9ft. driving wheel could raise the centre of gravity so much that the engine would be unsafe at any speed up to 80 miles an hour, or even beyond that. Danger would only arise, indeed, on tolerably sharp curves, and these should not be attempted at all at such speeds as we are contemplating. On the other hand, there is no reason to doubt that an engine with 9ft. drivers would run quite steadily at 75 or even 80 miles an hour round curves of good radius, but, as we have said, special care would be required to supply springs of just the proper stiffness. Too many people hold that a spring is a spring, while others look on them as nuisances which interfere much with the design of a locomotive. On proper springing the engine depends for smooth running, and too much care cannot be taken to secure the best results. Nothing but experience, however, can dictate the best practice in this respect.

L.

DAVY'S STEEL-MAKING PLANT.



DAVY'S STEEL-MAKING APPARATUS.

THE accompanying engraving illustrates a steel-making apparatus patented by Mr. Alfred Davy, of Messrs. Davy Brothers, Sheffield. The drawings will explain themselves. The principle involved is that of the Bessemer converter. A ladle full of cast iron being drawn from the cupola, is submitted to the action of a blast of air, by which the metal is Bessemerised and converted into a species of steel. We need hardly say that there is nothing novel in this scheme, which has often been suggested in one form or another, and tried; but no apparatus so complete, or so well calculated to secure the required object, has hitherto been brought before the public; and we understand that Messrs. Davy Brothers are now putting down twenty-four sets of their plant in Sheffield alone.

It may be well to explain that unless due precautions are taken the results obtained will be extremely disappointing. Thus certain classes of pig are quite unsuitable for Bessemerising. Indeed, nothing but hematite should be used when the best results are required. Again, in all cases the blow should be continued until the whole of the carbon has been got rid of, and the proper percentage should be restored by the addition of spiegel. In fact, the whole process must be carried out on the same lines as the Bessemer process. Any attempt to improve cast iron by "blowing" out some of the carbon must end in failure, because in no two cases can the same results be obtained. We have no doubt, however, that in proper hands, and with suitable irons, very excellent castings can be made in this way.

In our engravings Figs. 1 and 2 are an elevation and plan of the apparatus, with a sliding tuyere, pipe, and converter; and Figs. 3 and 4 are front and side elevation of an apparatus with a fixed tuyere, pipe, &c., and foundry ladle, worked by an ordinary foundry crane. Mr. Davy states that this apparatus will enable every ironfounder to produce large or small quantities of steel for castings or other purposes at about the cost of cast iron; and he claims that "the quality is superior to most crucible steel used for castings, and may be guaranteed to contain not more than 35 per cent. carbon, with a tensile strength of 40 tons per square inch and 20 per cent. elongation." The 35 per cent. is obviously a misprint for 0·35 of 1 per cent. It is claimed that steel may be produced by this apparatus of any temper or quality—except perhaps the highest class of tool steel—in large or small ingots, at £4 to £4 5s. per ton—taking pig iron at 60s. per ton and other materials at the prices current to-day. The cost of apparatus for ironfoundries is as follows:—Figs. 1 and 2, for producing 1 ton of steel at a time, or say 100 tons per week, or any lesser quantity, at the user's option, £595, with blowing engine complete; Figs. 3 and 4, for similar quantities, £525, complete. Larger plants cost the same in proportion to output. For steel works, where there are no cupolas, the cost of a cupola only would have to be added to these figures.

ELECTRICAL ENGINEERING.—The final lecture of this series was delivered by Mr. John C. Fell, in the reading-rooms of the Society of Engineers, Westminster-chambers, on Monday evening, March 10th, Mr. Arthur Rigg, president, in the chair. The lecturer concluded this series by an explanation of the nature and action of secondary batteries. He pointed out their most valuable functions for the regulation and storage of the electrical current in any case of electric light installation, the steady supply of a uniform current being thereby insured, and the danger of sudden darkness from the stoppage of the generator thereby obviated. Mr. Fell concluded with an account of some novel results in thermo-electricity.

LETTERS TO THE EDITOR.

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

FUEL AND WATER.

Sir,—While thanking you for the very prompt and favourable review of Prof. Schwackhofer's work on "Fuel and Water," edited by me, may I ask space for two remarks? The first is that your reviewer was too hasty in saying that I had nowhere replaced the metrical system of measures by its English equivalent. In all the practical parts of the book he will find that this has been done, or else that both sets of figures have been given side by side. In theoretical investigations, or scientific experiments such as those on fuel consumption, the advantage of agreeing on one system of measures is now generally recognised. At least I may plead the example of Mr. I. Lowthian Bell, who is surely practical as well as theoretical, and whose researches on blast furnace working are recorded in the language of the metrical system.

The second point regards the phrase "quantity." In mathematics this of course is used constantly for anything capable of being expressed in figures. Thus we should speak of temperature as a quantity—being measured in degrees of the thermometer—though perhaps we should not speak of quantity of temperature. As regards heat, the definition I have given—p. 7—is not my own, but that of all writers on the mechanical theory of heat, namely, that it is measured by the *vis viva* or energy of motion of the constituent particles. It therefore varies as the square of the velocity, while temperature varies, to all appearances, as the velocity simply. To measure the heat in a body on this basis we must be able to estimate both the sensible heat—indicated by temperature—and the internal heat, and this we cannot do directly. But the fact that we must resort to indirect methods, and consider the phenomena of specific heat, &c., does not forfeit the advantage gained by having a clear conception of the "quantity" of which we are in search. Walter R. Browne.

9, Victoria-chambers, S.W., March 7th.

THE CLAYTON BRAKE AGAIN.

Sir,—I have read with great interest your article—page 168—upon the dangerous character of the two-minute brake used upon the Midland Railway, and can fully confirm the opinion that it is only a question of time before a really disastrous collision occurs. Several of the company's officials consider that "your article is too severe," but they are unable to point out one single statement as incorrect. The danger of the Clayton brake is not a mere matter of opinion, but an actual fact. The collisions with buffer-stops at Liverpool, Northampton, Bradford, and Leeds, also the numerous failures to act, both in cases of emergency and in ordinary working, should cause the Midland directors very carefully to consider the danger of the brake in use on their line. Hardly a day passes without the brake allowing a train to run at least a few carriage lengths past a platform or signals on some part of the line. This would not be so very serious if the block system were worked under efficient rules; but it must be specially remembered that, as pointed out by Major Marindin in his recent reports upon the Skipton and Wincobank accidents, the rules require the signal "line clear" to be given for a train to approach when the line is clear to the home signal, "even although there may be an obstruction on the line a foot beyond it," the keeping of the signals at danger being the only protection from accident. It is, therefore, a fact well known to Midland drivers that if they run 1ft. past a "home" danger signal they are liable to come into collision with another train. With the Clayton brake liable to fail at any moment, it will be seen the situation bcomes one of great anxiety. I have before pointed out in your columns that on the Midland there is more double engine working than upon any other line, yet the power over the continuous brake is not placed in the hands of the first or pilot engine driver, as the brake pipes are not extended to the leading ends of the engines; therefore, it is frequently the case that the first driver sees danger but can only whistle to call the second driver's attention to put on the continuous brake. Think of the serious loss of valuable seconds here lost, when a quarter of a second may mean the difference between danger and safety. Very frequently the steam and smoke from the first engine obstruct the second man's view to such an extent that he can see neither road nor signals for minutes together. More than ten years ago I pointed out the advantage of continuing the brake pipes to the leading ends of engines so that the control should be placed where it ought to be, namely, in the hands of the leading driver. The additional cost of a few feet of pipe and a hose coupling would be a mere trifle, yet the company still neglects to supply its engines with the required fittings.

Your readers will remember that about three years ago Messrs. Bramwell and Cowper were employed by the Midland to consider the merits of the Sanders and Clayton brakes. These gentlemen found that the Clayton system leaked off in less than two minutes, but considered "two minutes are sufficient to admit of the application of hand scotches to the wheels." All the vans have since been provided with the necessary scotches for the guard to jump out and apply to wheels when necessary in consequence of the brake leaking off on an incline. This scotch idea was from the first absurd, and the company has now decided to place a valve in each van and stop up the leak hole in the one piston under the van itself. If the handle of the new valve be placed to one side the brake will leak off in two minutes as before, but if placed to the other side the van brake will remain on for a considerable time. This plan will come into general use in a few weeks, but already it has been found that great care will be required in placing the handle in the right position, also delays have taken place in releasing the brake on the vans. Since writing the above another Clayton brake failure has occurred. On the 6th inst. the 9.15 a.m. train from Bradford to Leeds, consisted of a tank engine and fourteen coaches. The brake was in good order when it started, yet when applied as usual to stop at Apperley Bridge the whole train ran its full length past the platform. What would the result have been if an obstruction had—as allowed by rule—been upon the line a foot beyond the home signal? Clement E. Stretton.

Saxe-Coburg-street, Leicester, March 8th.

LABOUR AND MACHINERY.

Sir,—In your issue of the 29th ult. you have favoured our Society with an article on the remarks addressed to our members in the 59th annual report. The object we have in view when sending these annual reports to the press is for the purpose of inviting criticisms on our utterances, and then, whether adverse or friendly, we try to profit from the opinions of those who are outside our ranks. Having this object in view we naturally expect that at times the organs of capitalists will attempt the "pulverising" process, but as we voluntarily offer ourselves to undergo the process we cannot make any complaints; but on the other hand we generally pass through the ordeal without any great amount of suffering. In present instance we should have done so and uttered no complaint as to your article, nor even attempted to reply, had it not been for one paragraph, that if it is not corrected will lead astray many of our members who are readers of your excellent paper. The paragraph reads as follows:—"They—the Steam Engine Makers—have apparently forgotten that engines are still running on the Great Eastern Railway which were built at Creusot in France." We confess that we had almost forgotten the fact, as it is so long ago, and the complaint we have to make is why did you not tell your readers when this occurred? It is nineteen years since M. Schneider supplied the fifteen locomotives named, and if the working engineer is to be convinced of the risk he is likely to run from foreign competition, we think he should have had a case of more recent date than the one in question. The fact, however, that these locomotives were made in France does not, even as an isolated instance, show any proof of foreign competition, for at that time—1865—the locomotives engine builders of this country had so much work on hand that, if we are to take Sir Thomas Brassey as an authority, they did not feel any evil effects even at that period.

He states in his book "On Work and Wages," page 183: "Serious alarm was felt when, in 1865, fifteen engines were ordered for the Great Eastern Railway from MM. Schneider. These misgivings would probably have been allayed had it been generally known that at the same time when the fifteen engines were ordered from Creusot forty other engines were ordered from English firms, and that when MM. Schneider were subsequently asked to undertake the construction of twenty-five more engines at the price they had agreed to accept for the fifteen engines originally ordered, the offer was declined." This, then, is the case of foreign competition that the leading journal in the engineering trade tells to its readers, when it holds up to ridicule the opinions of the artisan as to how a remedy can be effected to reduce the glut in the labour market. Any who have a knowledge of the engineering trade know that even within the past fourteen years that almost a revolution has taken place in its machinery, wages, and the hours worked; yet an old fossil case of nineteen years old is furbished up as a bogey to frighten us, as though we were children who had been previously spoiled by kind treatment. If we are to be convinced that foreign competition is dangerous to our own particular trade, let us have something more original than M. Schneider's locomotives, for since he made them wages have advanced, hours have been reduced, and as workmen we are innocent enough to believe that the foreigner has not a chance in the race, one country being handicapped with tariffs, and in others the stamina of the artisan being such that our employers would not tolerate their mediocrity for a month in their workshops.

We trust we shall be pardoned for expressing an opinion on your article, but we are compelled to say that it reads as though written in two parts, and by two different hands. The first part boasts of our increased exports of engines and machinery, whilst the second introduces the bogey, and reads a homily on the apparition. The first part is literally true, for our exports have doubled since 1871, when hours were reduced and wages advanced, thus stultifying the arguments of the second part. As a later proof of foreign competition theory, permit me to quote two cases against the one named in your article. Within the past two years, Mr. Wilson, M.P. for Hull, stated at a meeting that one of his steamers met with an accident when entering New York Harbour, and she had to be repaired before she could return. These repairs cost him £1000, but could he have had the same work done in Hull it would not have cost more than £300. Another case of which I have the full particulars is briefly this:—Last year a German firm asked for tenders for various engineering work, and as a result the lowest price from German firms was £1400. The work has been executed by an English firm—that pays fair trade wages—for the sum of £850, and over this rate the commission agent has received some recompense for his services. These are realities of the present day, and when artisans can read for themselves, they require quite an amount of convincing that the Britisher cannot compete with any country in engineering.

As previously stated, we do not object to criticism, but we do object to abstract statements, and the context containing mild opinions left out, and only the "Luddite views" given to the public. In our address we discuss the labour question in various branches and various countries, giving figures in support of our reasoning, and sum up our opinions that one remedy for this complex question would be reduction of hours in all trades, and if effected all round neither labour nor capital would be sufferers in the long run. We, however, did not advise the "Luddite plan" for effecting this alteration, as the artisan engineer claims to have a clear certificate in such cases, and when a reform has to be effected or a grievance to be removed, they try reason and argument first, and if this fails then they have the Trade Union prerogative of declining to work save on their own terms. Knowing their character and disposition so well, we advised them in our report in these terms—"We do not advise this course to be taken at once, but let us discuss and argue the question in all its bearings and effects, gain public opinion in its favour, and then"— This advice as given in our report, from which you extract part statements only, shows that we have some system in our madness and avoid revolutionary advice, but suggest reason and argument as the first step to effect what we desire and what, we believe, will benefit both employer and employed.

My letter has already reached such a length that I cannot trespass on your space further by replying to your comments on labour-saving machinery. I must therefore content myself by picturing in my own mind that happy time when inventors will have succeeded in utilising the strength and power of our great tidal rivers that their force may supply the motive power for our mills and workshops, and at the same time supply artificial light as though it were one of nature's gifts. When this happy time arrives skilled artisans may sit on the river banks, and watching the water's flow that is depriving them of work, may think the millennium has arrived, break forth into songs of praise, and conclude with your solemn dirge—"The next generation may be better off. The present generation can starve slowly to death."

As a counter opinion to that expressed at the end of your article in relation to the power of the Steam Engine Makers' Society, permit me to conclude this letter by an extract from a leading journal in one of our principal cities, wherein they quote the paragraphs to which you take much exception: "We give this quotation without any comment to show the view taken as to the solution of the most difficult of industrial problems, by the guiding spirits of one of the best conducted and most powerful of our trade organisations." James Swift.

General Secretary, Steam Engine Makers' Society,
General Office, Market-buildings, Thomas-street, Shudehill,
Manchester, March 8th.

[We publish Mr. Swift's able letter with much pleasure. Truth can only be reached by discussion; let us have both sides by all means. Let us take Mr. Swift's view of the importation of locomotive engines, and see what follows. Locomotives could not be had at the time in England, therefore they were obtained in France. Now the effect of shortening the hours of labour must be to make, let us say locomotives, harder to be got in England than they were before. The result would be not more work for the Steam Engine Makers' Society, already fully employed, but the importation of locomotives from abroad. We shall be glad to hear what Mr. Swift has to say on this subject, and we would, to condense matters, ask him to say definitely at what point a contraction in the length of the working day must stop in order that risk of foreign competition may not be incurred? Secondly, would he permit the number of steam engine makers to be increased if the working day was shortened? and, thirdly, how he would deal with orders to be executed in a given time—for example, twenty locomotives are ordered from a given firm which cannot complete them in the time without running seventy hours a week. Should the firm take the order or refuse it?—Ed. E.]

"THE CREATORS OF THE AGE OF STEEL."

Sir,—My attention has been called to the fact that Mr. Carulla, the general manager of the Landore-Siemens Steel Works, stated at the Royal Institution that "readers of the technical papers may have seen from Mr. Mushet's indignant letters that Mr. Jeans, in 'The Creators of the Age of Steel,' has done him scant justice, as he is far from regarding Mr. Mushet as one of the creators of the age of steel." Such a statement, coming from a gentleman like Mr. Carulla, has led me to re-examine the point, and I find that Mr. Mushet's patent of September 16th, 1856, which was his first patent, was for applying a mixture of "oxide of manganese and such carbonaceous matter as bituminous coal," reduced to "small pieces or powder," to molten iron purified by air in Martien's process. But then I also find that four months previously—on May 31st—Sir Henry Bessemer specified in his patent the use of oxide of manganese in the powdered state; and five months previously—March 15th—Sir Henry specified the use of carbonaceous matter, such as charcoal, anthracite, &c., in his converter for the purpose of improving the iron or steel produced in it. This is the fact that Mr. Mushet carefully omits in all his different explanations, vindications, or self-glorifications; and besides, there is the inexorable fact that all Mr. Mushet's patents up to February, 1859, were taken out for the Martien process, which Mr. Mushet himself now describes as "utterly worthless." In his second patent Mr. Mushet proposed to use carbonaceous matter only, such as coal-dust—no manganese; and in his first two patents of September he mentioned iron only—no steel—as the result of their use. Sir Henry's patents of March and May both mentioned steel. It was not till his third patent—September 22nd—that Mr. Mushet mentioned the use of manganese without coal for producing steel; while Sir Henry had mentioned the use of manganese separately for producing steel in his patent of May 31st.

Is it any wonder that Mr. Mushet's own friends would not pay £50 for his patent? Is it any wonder that a man who represents his patent for improving an "utterly worthless process" as a "discovery even more valuable than that of the Bessemer process," is "indignant" at the primary facts being brought to light? If I were to describe as a creator of the age of steel a man whose "invention" appears to consist in patenting for an "utterly worthless process" the use of the materials that another man had, four months previously, specified the use of in his own invaluable process, I should feel that the evidence of facts and the dictates of truth would alike convict me of a wilful perversion of language.

The man I have done "scant justice" to is Sir Henry Bessemer, for I omitted to give the date of his patent which had specified the use of manganese in the Bessemer converter before Mr. Mushet knew of the existence of the Bessemer process; but I shall take care that in the new edition of "The Creators of the Age of Steel," now in preparation, the exact facts as to his honourable priority will for the future be placed beyond doubt by any sane man.

Brixton, March 10th. W. T. Jeans.

THE FASTEST TRAIN IN GREAT BRITAIN.

Sir,—The Scotch express is a heavy train, and not the fastest on the Great Northern. At present the Manchester special expresses compare fairly with the Dutchman and Zulu. The up trains are allowed 147 minutes from passing Newark to reaching King's Cross, *i.e.*, excluding 5 minutes at Grantham, they run 120 miles in 142 minutes, as against 118½ miles in 143 minutes, the running time from Paddington to Bristol. The Great Western stops twice, and the Great Northern only once. On the other hand, the latter almost invariably does its run under time. The fastest timed Great Northern train now is the 5 p.m. down on Sundays, which accomplishes the distance from Hitchin to Peterborough, 44¼ miles in 50 minutes = 53·1 an hour. The 1.15 down express runs from Grantham to Doncaster, 51 miles, in 58 minutes = 52½ an hour. All these speeds were surpassed by the Leeds expresses in 1880. Four trains a day did the 186¼ miles in 3¾ hours, and in July the dining car train was only allowed 77 minutes from Grantham to Wakefield, 70¼ miles, or 54¾ miles an hour.

May I add that twenty years' constant experience of express travelling has made me entirely incredulous of such speeds as 80 miles an hour in daily practice. On falling gradients a rate of 70 is not unfrequently attained, anything above is exceptional. The great merit of the Dutchman is the steadiness with which it maintains an almost uniform rate of from 58 to 62 miles an hour over a large portion of its journey. G.

March 10th.

Sir,—In an article which appeared in your paper a week ago on this subject, I see that no mention is made of the Cheshire Lines expresses. There are no less than fourteen of these daily, which run from Manchester to Warrington, 16 miles, in 18 minutes, which gives a speed of 53⅓ miles per hour. When allowance is made for time lost in stopping and starting, they will come out even more decisively the fastest trains in Great Britain.

In justice to the Great Northern it is only fair to say that the Scotch express is far from being their fastest train; for instance, the Manchester special expresses run from Grantham to London, 105½ miles, in 2 hours and 4 minutes, while the Scotch express takes 2 hours and 9 minutes to do the same distance. One of the fastest of the Great Northern expresses is that which leaves King's Cross at 1.15 p.m. This train runs to Doncaster, 156 miles, in 3 hours and 13 minutes, and after deducting the time occupied in starting, stopping, and standing, the speed comes out at nearly 54 miles per hour, as against 50 of the Scotch express, and 56 of the Dutchman to Bath.

As regards extreme speeds, I should think that the Great Northern trains, over some portions of their journeys, run at a higher rate than the Great Western, owing to the gradients being steeper, and it is probable that the Midland, Caledonian, and North British railways eclipse them both in this respect.

Blackheath, March 10th. T. W. Bacon.

THE EFFICIENCY OF FANS.

Sir,—I was pleased to observe in your last week's impression that Mr. Capell admitted his misrepresentations. I note also he calls his 3ft. fan a little fan of 18 gauge iron. I beg to say that I have made and sold over 6000 fans, not one of them being made in stouter iron than 18 gauge up to 4ft. in diameter, and I have seen one of my 3ft. fans give 28in. of water pressure. He tells you the fan I put up at Plaistow was of the Lloyd type. I have never made a Lloyd type fan in my life.

He says the power to draw from the tube was surprising to all concerned, but I was not surprised, because I knew the power could be traced to another cause. He gives you the speed in feet per minute with an acknowledged smashed instrument, and that he put the stop on as soon as broken; the instrument was not in the suction two seconds before it smashed. He puts forward another table for a square zinc pipe, knowing at the same time it was round, with lapped joints in 3ft. lengths and soldered from end to end. The speed of the 4ft. fan, he says, was 1460 revolutions per minute; this is also incorrect, as it was only 1044. He should have remained at the trial and learned the data of power taken. I have scores of 4ft. fans at work, and every fan user as well as fan maker will know that he is stating what is incorrect. I should at no time be surprised to see one of Mr. Capell's fans at work, as its operation would not be foreign to me, as I have already replaced his with my old patent fan of 1868 in London. In answer to his comparisons between fans, I am quite aware how he performs the operations he mentions, and I have made fans of certain types for the past sixteen years that would not a little surprise him, were he to see them, much more than he can surprise me, even to outward and inward blades; and after what Mr. Capell has thought fit to say about comparisons of fans, I would now confirm Mr. Hendy's statement of my fan 4ft. discharging 35,000 cubic feet of air at 285 revolutions per minute. Henry Aland.

46, Commercial-road, Lambeth, S.E.,
March 6th.

WORKS IN WOOD.

Sir,—Will you kindly allow me to call the attention of your numerous readers to the Exhibition of Works in Wood, about to be held under the auspices of the Carpenters' Company and the Joiners' Company of the City of London, at the new hall lately erected by the former Company, at the corner of Throgmorton-avenue and London Wall.

It is well known that these two companies had for many years the entire control, and, indeed, monopoly of the two crafts whose name they bear, and it is doubtless owing to this fact that British workmen, and especially Londoners, attained to their rare excellence in those branches of art. The days of restriction and search for bad workmanship are past and gone; but there seems no

reason why the spirit of emulation, so rife in these days, should not be evoked to produce similar results. These two companies have, therfore, determined to invite British workmen generally to compete in the several branches of these crafts, and have offered a number of prizes, details of which can be had by application to the Clerk of the Carpenters' Company. The number of responses received warrants the belief that there will be a good collection of articles of interest, of which a large number will be made for the occasion.

I hope that many more of your readers will still find time to prepare something for the exhibition, and as it is proposed to form a museum of every kind of illustration of both carpentry and joinery, the committee will be much gratified by receiving merely for the purpose of exhibition any models of drawings of existing or ancient works in wood, which would be of interest in showing the kind of work done both in the olden and the modern times.

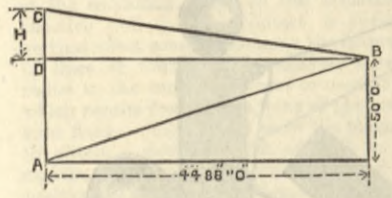
The exhibition will be opened about the middle of May, and will continue open for about three weeks from eleven o'clock in the morning till five o'clock in the evening on four days in the week, and till nine o'clock on Wednesdays and Saturdays.

WILLIAM WILLMER POCOCK,
Master of the Carpenters' Company.

Carpenters' Hall, London Wall, E.C.,
March 10th.

FRICTION OF WATER IN LONG PIPES.

SIR,—I wish to say a few things in answer to your correspondent "C. A. C." (1) Referring to his diagram in your last issue, I may say that the power necessary to discharge 3000 gallons of water per minute through 44,880ft. of 12in. pipe would be nearly the same whether it was forced from A to C to discharge at B, or direct from A to B. Undoubtedly the best course is from A to B. In either case the head necessary to discharge the quantity under these circumstances would, according to Molesworth's Tables—which your correspondent used—be about 1346ft. I find that other tables give a higher head; but disregarding this, and taking 1346 as the true head—as it will answer my present purpose—we have this head of 1346ft. consumed in forcing this quantity through 44,880ft. of 12in. pipe. This is termed "loss of head due to friction," and is altogether irrespective of the height of 50ft. in the diagram. (2) It will thus be seen that the sending of this quantity of water along such a great length of 12in. pipe gives rise to a very large amount of friction. Your correspondent will not be surprised at this when he remembers that the friction of liquids, though very little for low velocities, increases tremendously with increase in velocity. In high speeds the increase being in proportion to the cube of the velocity, so that four times the velocity means 4^3 times the amount of friction. In the case before us, however, it does not amount to quite so much as this. (3) It follows from this that to do the work set before us in this case economically, we must reduce the friction by reducing the velocity. Taking it for granted that the quantity of water and length of pipe are fixed, let us suppose that the 12in. pipes are replaced by 24in. pipes. Now note the result. Taking the same tables as before, we find that to discharge 3000 gallons per minute through 44,880ft. of 24in. pipe a head of about 70ft. is necessary. Add this to the original 50ft., and we have a total of 120ft. head to do the whole amount of work. Hence the power required is that which will raise 3000 gallons per minute to a height of 120ft. Your correspondent will doubtless see the reason of this great decrease in the power required. The velocity is reduced from 10·2ft. per second to about 2·45ft. per second. In other words, we have four times less velocity in the 24in. pipes than in the 12in. pipes; and from what has been said it will be clearly seen that this means a tremendous reduction in the amount of friction.



J. G.

Bradford, March 10th.

BOLTLESS RAIL JOINTS.

SIR,—I was glad to see the letter on "Boltless Rail Joints" in your last week's issue, as I am much interested in the Vignoles permanent way. As the tendency now is to reduce first cost as much as possible, I am of the opinion that the Vignoles way will, under certain circumstances, be more used than it has been. In fact, it is well known that in the last few years several hundred miles of new line have been laid in England with this way. Abroad it is in general use; the Northern and Eastern Railways of France and nearly all the German lines have adopted the Vignoles section. For heavy traffic and express running there certainly is nothing like the bull-headed rail, 80 lb. to 85 lb., laid down by our principal railway companies; but I see no reason why a road of the above heavy description, costing for laying and ballasting some £1900 per mile, should be laid for lines running through thinly populated agricultural districts, whose earnings will only be about £12 to £15 per mile per week, when a Vignoles way laid with rails, say, 70 lb. to the yard, at a cost of about £1100, would be ample. In fact, very heavy traffic can be and is worked by 60-ton engines over way of this description.

It is hardly necessary to enter into the peculiar merits of the various systems, as that has been so often done. I simply advocate the Vignoles way for the purposes and reasons above stated. Its advantages may be summed up as follows:—Small first cost, elasticity of road when laid, and small amount of damage done if a truck accidentally gets off the road. This on a double-headed road means heavy repairs in chairs and often derailment of other trucks. It has this disadvantage, that owing to the lack of weight in the road it is rather apt under heavy traffic to knock out of line, especially on a single track; this makes it rather more difficult to keep in order. It can, however, be maintained with the usual man per mile. On some of the heavily laid lines where there is not much traffic three men are kept to four miles, while on others I have known as many as five men to 2½ miles. You will, however, think that I am wandering from the subject, viz., rail joints, but I only wished to show that although the Vignoles road is not held in much favour in England, yet owing to its small first cost it is being more used, and therefore anything that would tend to improve it should receive consideration. With regard to the Gibbon rail joint I should like to ask the question that directors always ask first, viz., "What will it cost?" Secondly, what advantage—leaving out the question of bolts—has it over the ordinary fish-plate with a sleeper under the joint? There is a great advantage in not requiring bolts, for besides the continual labour in tightening required, the cost of renewals is an item in maintenance amounting as I have found to nearly £1 per mile per annum. The test of the joint, however, will be under main line fast traffic, not in a siding, and I for one should like to see a piece laid down in England.

WM. MARRIOTT.

March 10th.

CLIMBING TRICYCLES.

SIR,—In reply to the various correspondents on this subject, I would say that having no interest in any particular machine I certainly had no intention to offend the National Company or any one else, but solely to contend for right principles in construction. My experience extends over fifteen years, so that I claim some knowledge of cycling and also construction, and I judge a tricycle by the expenditure of power required to drive it; also its speed in proportion to the rate of pedaling. Thus I find nothing in the "National" showing its superiority in any point, but rather the reverse. It is absurd to talk about "enormous friction" and "complication" in the chain system, otherwise why is it that 75 per cent. of the makers of tricycles adopt that mode of transmitting the power from the crank? The fact is there is practically very little friction in properly constructed chains, and certainly no complication. It is also useless to make any comparison with the bicycle, as the laws governing the two machines are widely different. Stability affects one but not the other, viz.: It matters little with the bicycle whether the rider is elevated 20ft. or 5ft., but in the tricycle it is a very material point as to the centre of gravity with a limited wheel gauge. Therefore the object of both chain and stirrup is to lower the centre of gravity and thus obtain greater stability.

I should like to know if the dynamometer was applied to any other tricycle at the show, and with what result, because there is no more weight or friction in the "Monarch" than in the "National;" therefore with the same size wheel or crank the result must be the same? But I do not accept such a test; it should be carried out during the running of the machine over a variable road at a stated speed. I should as soon think of testing a balloon in a coal mine as to test the capabilities of a tricycle up and down stairs.

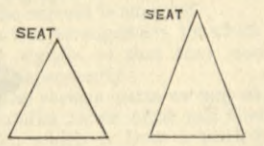
There are many other important details wanting in the "National," such as perfect double driving, size of wheels, free pedals, rate of pedaling, perpendicular position of the rider, &c. &c., but I think I have shown enough to demonstrate that better results are obtained by the use of a chain or a stirrup, because the centre of gravity is lowered and a better position obtained to perform the work required and the safety of the rider increased. For the information of those who wish to know, I may add that I prefer a modification of the "Merlin" system, and shall be glad to have it tested with any direct-acting tricycle either up hill or on a variable road.

H. ALDRIDGE.

40, Oxford-street, Reading, March 10th.

SIR,—Your correspondents in last week's issue appear to overlook two important points. Granting the increase of power in a direct-acting tricycle, when, however, it comes to ascending long steep inclines, with possibly a bad road and an adverse wind, the work of propulsion is enormously increased, sufficiently so to severely tax the powers of an average good rider, even when mounted upon a light bicycle. As a matter of fact, under such conditions, he dismounts and pushes his machine before him.

It is here, therefore, that a well-made tricycle with multiplying gear, which can at will be speeded down, say, from 48in. to 30in. must have a decided superiority over a direct-acting one of equal-sized wheels. Given good roads and a fair wind, the increased weight and friction of gearing become factors of minor importance. The second point overlooked is that a direct-acting tricycle must of necessity have its seat placed at a much less safe height, when the distance between wheels—which is common to both—is considered. The difference in the height of the seat between a geared and a direct-acting machine is roughly about 1ft., and the relative position of the seats will be seen by these two triangles.



The addition of the stirrup arrangement partially meets this drawback; but as a set off, it entails occasional bruises, by the shins coming in contact with the cranks; besides which in the case of a spill it may involve entanglement.

A. L. G.

London, E.C., March 12th.

SIR,—In confirmation of your able article in favour of the direct-action tricycle, as the inventor of the same, I should like to remind your readers that it is by no means unusual for the simplest idea to appear almost last, and as the result of the most complicated experiments.

For fifteen years I have been carefully experimenting with tricycles and bicycles, &c., as the Patent-office can show; my inventions have anticipated and covered a very large field of improvements, but they were chiefly to increase power by adding various kinds of mechanism. Gears of many sorts and various speeds have, however, now been dropped, for by slow degrees I have learned that it is impossible to increase the power, which in the bicycle and tricycle is that of the legs only. The improvements, in my opinion, can only arise in the direction of economy in spending the strength.

Hence I have come to direct action, which has enabled me to publicly exhibit, at the Agricultural Hall, all this week, the following challenge, which ought to answer your correspondent's letter conclusively. The only response, so far, has come from two who have completely failed and two others who have withdrawn after accepting the challenge.

[*Copy of Challenge on Stand No.* 10.]

"Challenge for every other tricycle in the Show."

"As a test, to prove the weakness and loss of power existing in tricycles with chains and cogs, I hereby challenge anyone to ascend these stairs on one of those machines, treading fairly, alternately, as daily performed here on my "Old National Roadster at 4 and 8 o'clock." "H. J. Lawson, Coventry."

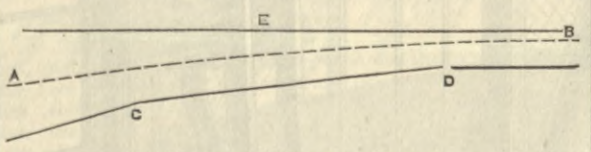
"NOTE.—A tricycle that can be ridden up and down a flight of stairs is far easier than any tricycle yet heard of."

H. J. LAWSON.

National Cycle Works, Coventry,
March 11th.

PROPELLER SHAFTING.

SIR,—The proposal made in your number of the 7th inst., to support the intermediate part of steamship's screw shafting lying between the crank and the stuffing box by means of an independent girder, will, even if it was not practically too expensive and took up too much room to carry out, simply make the bending strain or angle more acute and sudden next both the base plate carrying the crank—practically rigid—at the one end of the shafting, and the same at the propeller end—also practically rigid—instead of being distributed over the whole length. If the curve A B, under the true line E, in an exaggerated form, represents the drooping or flexure that the stern of a steam vessel is subject to, either permanently or as the momentary yielding caused by passing waves, the length of shafting on which the propeller is keyed, and which



may be considered as rigid within the stuffing box, would then throw the whole strain on the shafting at C, where the propeller shaft joins the shafting, turning within the proposed girder; the same thing will happen at the crank end D.

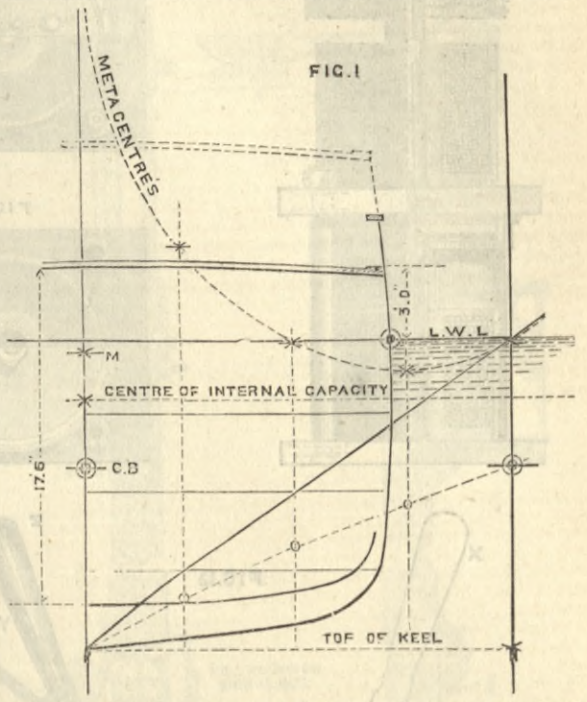
Say the length of shafting that is subject to flexure to be 100ft., and that the stern of the vessel droops or alters ½in. for every passing wave, then at every revolution the end of the propeller shaft is forced out of truth equal to its describing a circle 1in. in diameter. This straining and curving as each wave passes cannot go on for ever, the shaft gets tired of it, opens out and breaks. In your number of 18th February, 1882, I described a coupling for quick disconnection to save steamers from falling into the trough of the sea when disabled, and pointed out that such a coupling with a slight modification is suitable to prevent strains on shafting arising from the lines of a vessel being altered from any cause. Such a coupling placed about the middle of the length of shafting, or preferably nearer the crank, and having within itself in a limited range the properties of a universal joint, would take up and neutralise all passing strains thrown on it either by the weakness of construction of the vessel or the weight of cargo carried, and will save wear and engine power as well.

LOG CHIP.

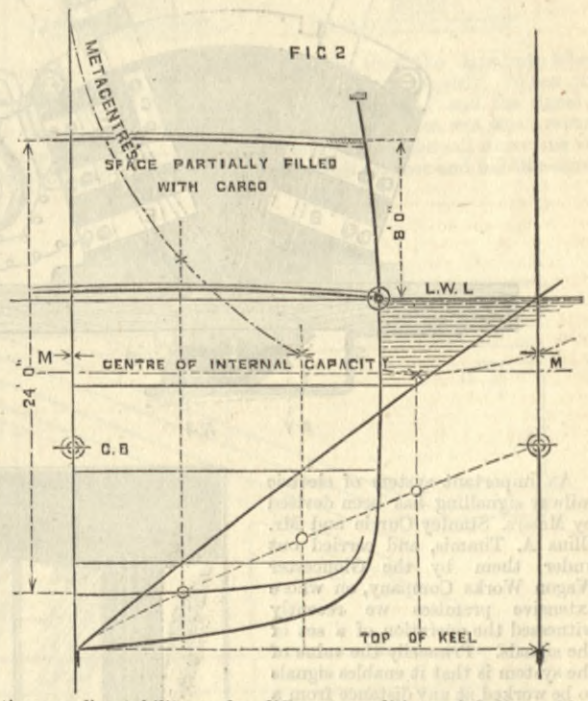
March 8th.

THE MERCHANT SHIPPING ACT.

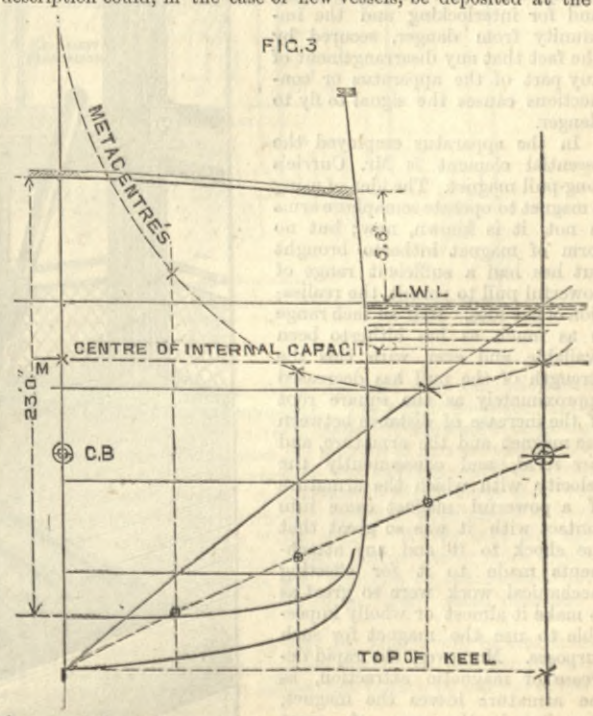
SIR,—The strong opposition raised to the new Merchant Shipping Act seems directed more particularly to the clauses relating to insurance; the question of the vessel's constructive stability or seaworthiness is not commented upon. Is it not possible to have some record of a vessel's stability and condition of lading under



which she sails? Could not underwriters and owners be induced to examine more closely into the question of a vessel's stability and condition of loading at variable draughts of water? By the construction of a metacentric curve, as applicable to all classes of vessels, it would be easy to see and determine the relative value of



the vessel's stability under different conditions of lading. The accompanying figures show a metacentric scale or curve for each increasing and variable draught of water; and by placing the centre of internal capacity, it is possible to see the value of the metacentre under any condition of stowage, and with any variable kind of cargo at different draughts of water. If a scale of this description could, in the case of new vessels, be deposited at the



Board of Trade, it would be possible to examine and see the probable stability any one vessel may have under the condition of her sailing, and also would enable the Board or surveyor to determine the draught to which the vessel should be laden to ensure stability and power to resist overturning when rolling in a sea way.

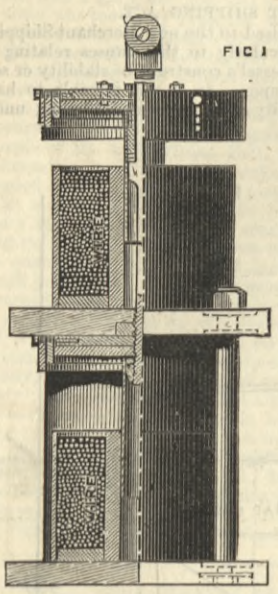
J. ANDREWS, N.A.

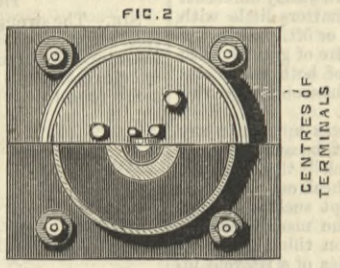
Old Charlton, March 10th.

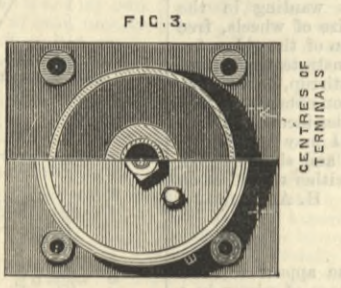
[*For continuation of Letters see page* 210.]

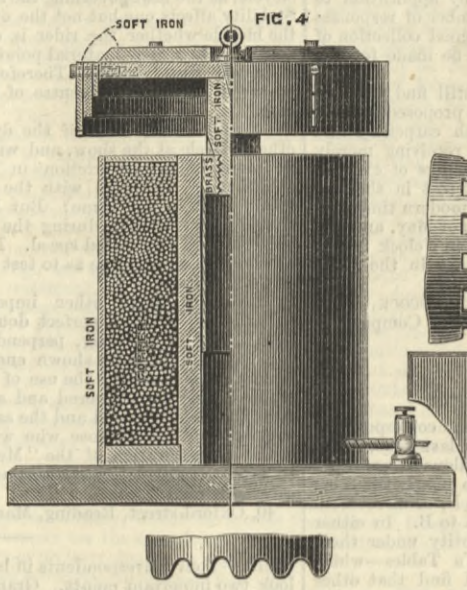
CURRIE AND TIMMIS' ELECTRIC RAILWAY SIGNALS.

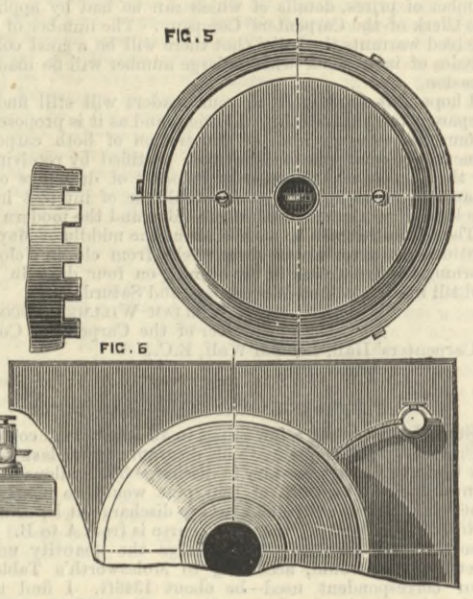
THE GLOUCESTER WAGON WORKS COMPANY, GLOUCESTER, ENGINEERS.

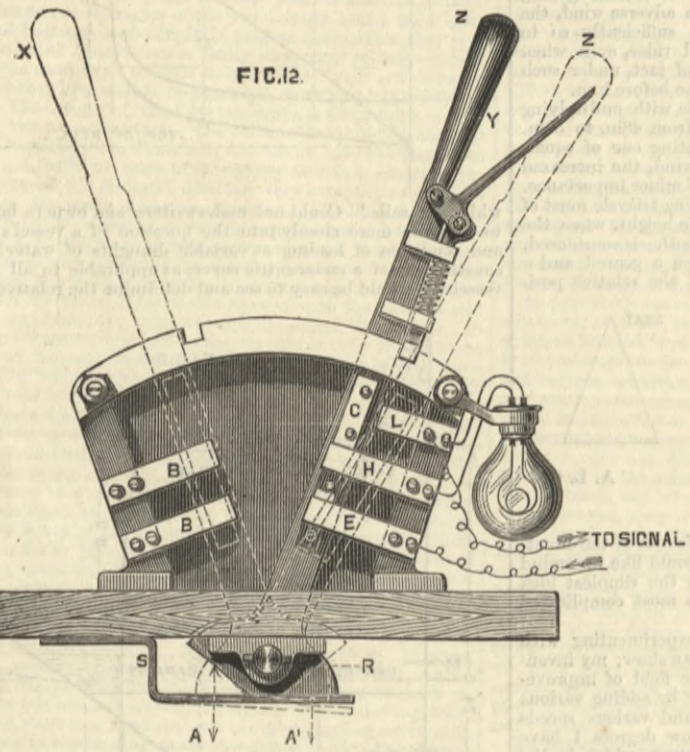


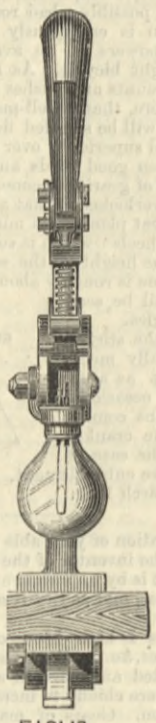


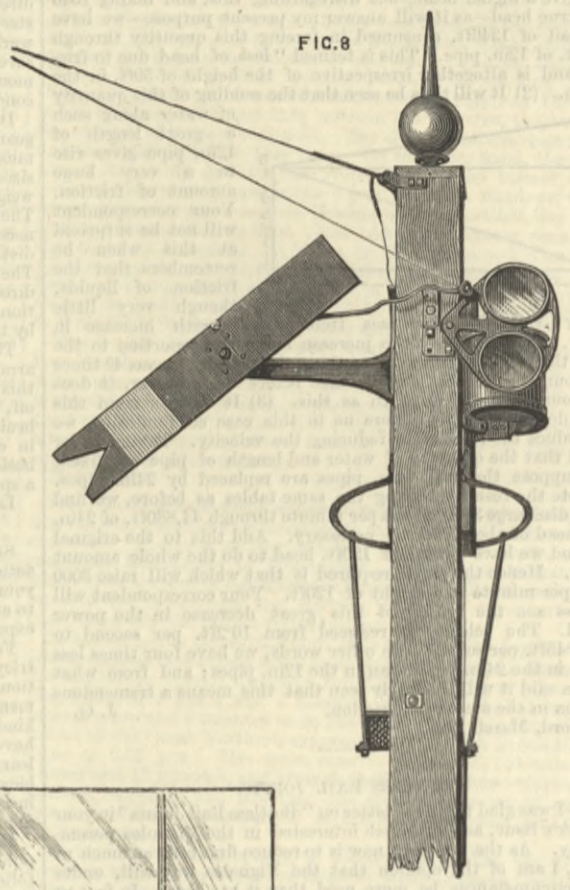












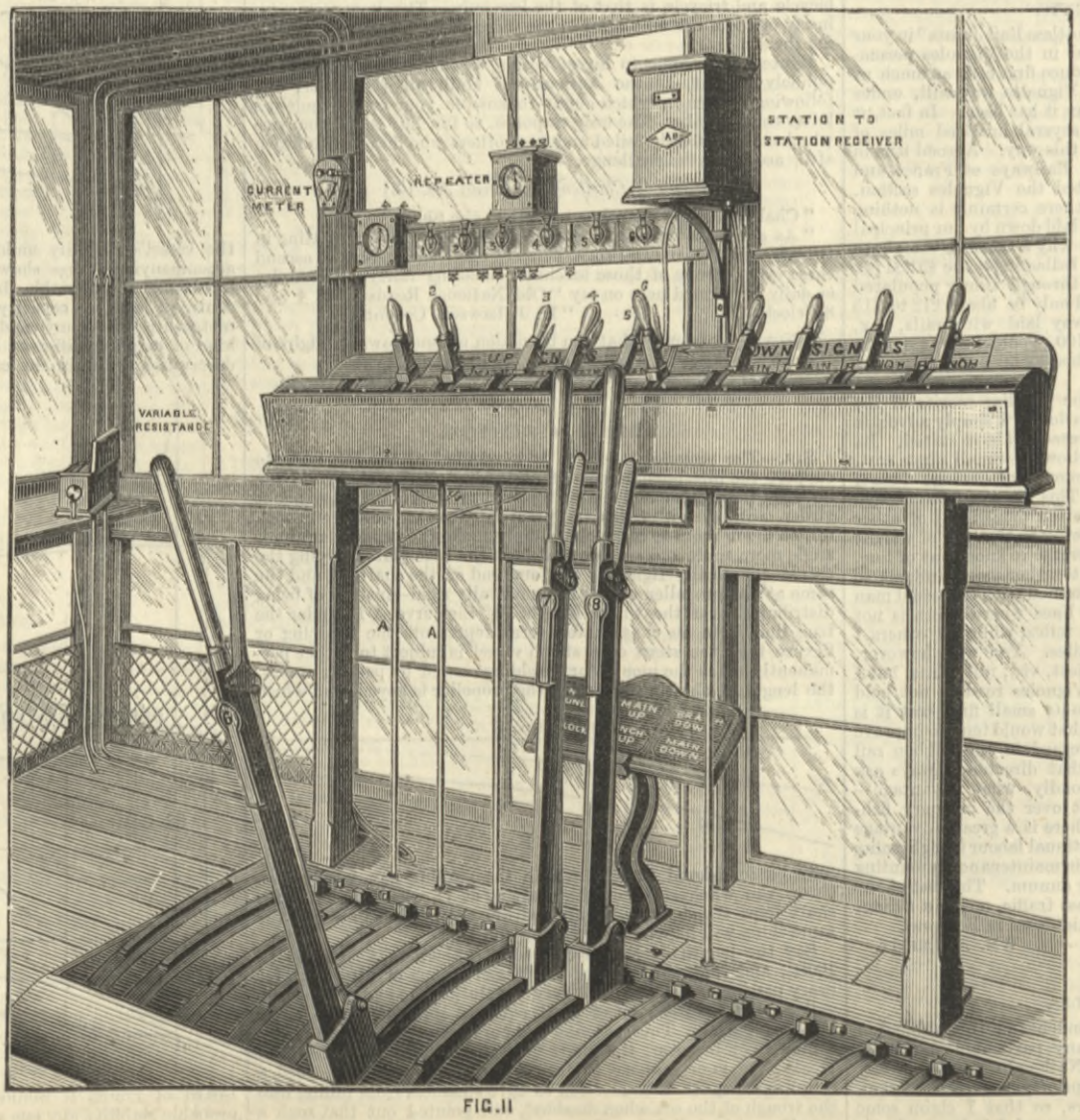


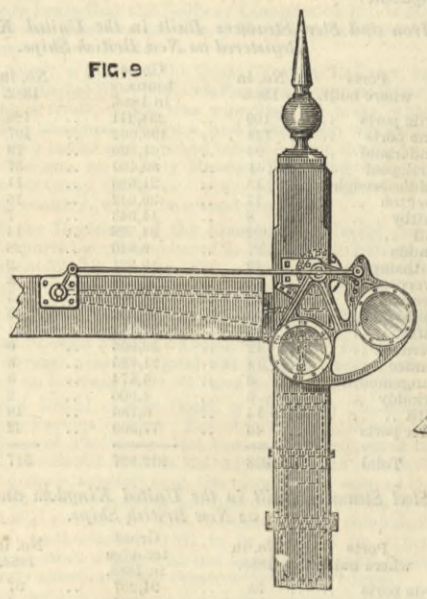
FIG.11

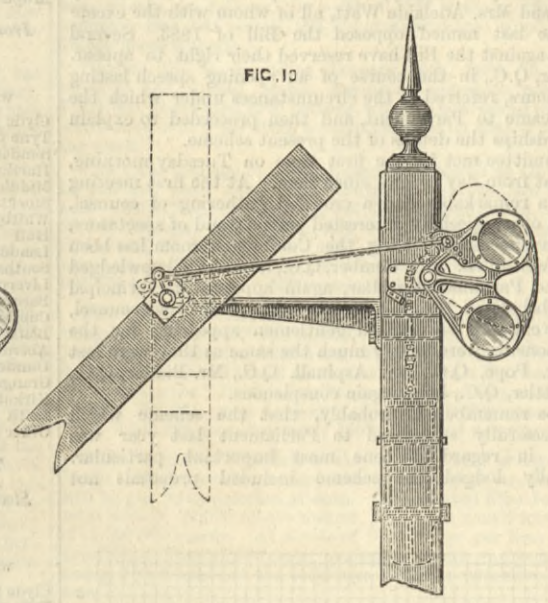
An important system of electric railway signalling has been devised by Messrs. Stanley Currie and Mr. Illius A. Timmis, and carried out under them by the Gloucester Wagon Works Company, on whose extensive premises we recently witnessed the operation of a set of the signals. Primarily the value of the system is that it enables signals to be worked at any distance from a signal-box or station; but several other important collateral advantages are obtained, including great facility of arrangement of large signal plant, simplicity of the working apparatus and the arrangement, and for interlocking and the immunity from danger, secured by the fact that any disarrangement of any part of the apparatus or connections causes the signal to fly to danger.

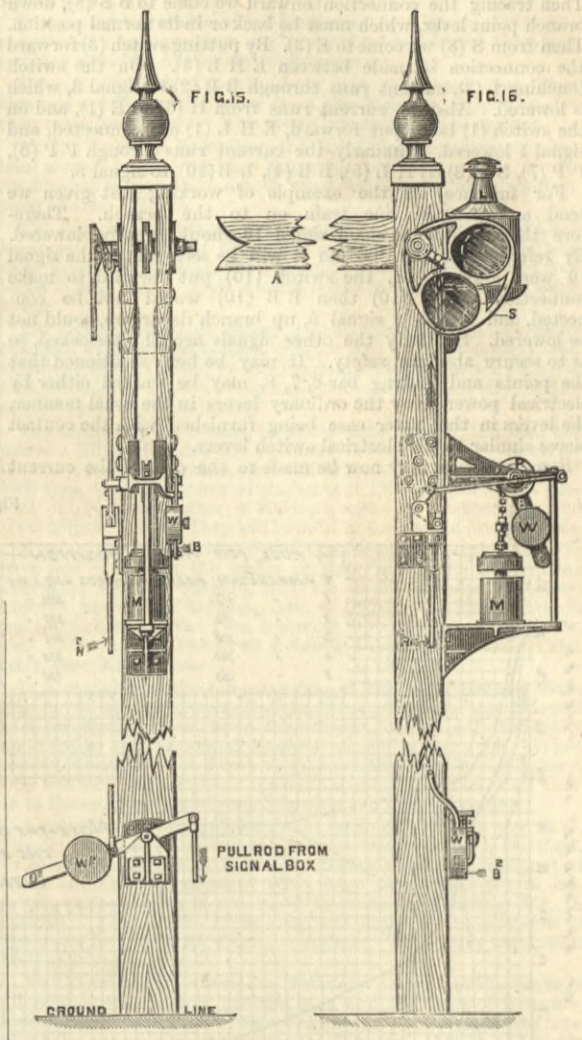
In the apparatus employed the essential element is Mr. Currie's long-pull magnet. The idea of using a magnet to operate semaphore arms is not, it is known, new; but no form of magnet hitherto brought out has had a sufficient range of powerful pull to permit the realisation of the idea. Half an inch range is as much as has hitherto been available, and even with this the strength of the pull has decreased approximately as the square root of the increase of distance between the magnet and the armature, and *vice versâ*, and consequently the velocity with which the armature of a powerful magnet came into contact with it was so great that the shock to it and any attachments made to it for effecting mechanical work were so great as to make it almost or wholly impossible to use the magnet for such purposes. Moreover, the rapid decrease of magnetic attraction, as the armature leaves the magnet, necessitated the use of great electro-motive force, and a powerful electro-magnet, in order to obtain any considerable pull even at half an inch, and this great power is nearly all wasted at the final part of the pull. These disadvantages are, however, obviated in the "Currie long-pull electro-magnets," because the magnetic attraction in them is much more evenly distributed over a long range, and, at the same time, a much stronger initial pull can be obtained at a greater distance than in any other electro-magnet of the same weight and with the same current. It exercises a practical working pull of several inches, and by the use of various sizes and shapes of the movable parts of the armature and magnet, the pull can be graduated according to the requirements of any particular case. It is simple of construction, and the wire helix is thoroughly protected. A very small current is required, and a very small electro-motive force, and consequently there is no danger in handling the wires when the magnet is at work.

This magnet we illustrate in two forms by Figs. 1 to 6. From these it will be seen that the single magnet, Figs. 4, 5, and 6, consists of a central soft iron tube, the lower end of which is attached to a soft iron plate, which at its periphery supports a larger soft iron tube, the annular space between the two being filled with wire of various sizes, generally ·048. A brass plate covers the upper part of the magnet so made. The armature consists of a central core, the lower part of which is covered by a brass tube. At the top of the brass tube the core is made conical for a short distance, and above this it supports a soft iron disc, with a flanged periphery, of the section shown at Fig. 4. The outer part of this flange is adjustable as to the amount by which it projects downwards from the disc, and it is, moreover, in some cases made with a serrated or waveformed edge, as shown near Figs. 4 and 6, the object and the result of this being that the pull by the magnet is not suddenly increased as the disc nears the magnet head. It will be seen that the magnet and the short core act as a solenoid, until the core has entered a considerable distance into the tube. This gives the first part of the pull; and as the strength of the pull on the core is decreasing, owing

CURRIE AND TIMMIS' ELECTRIC RAILWAY SIGNALS.





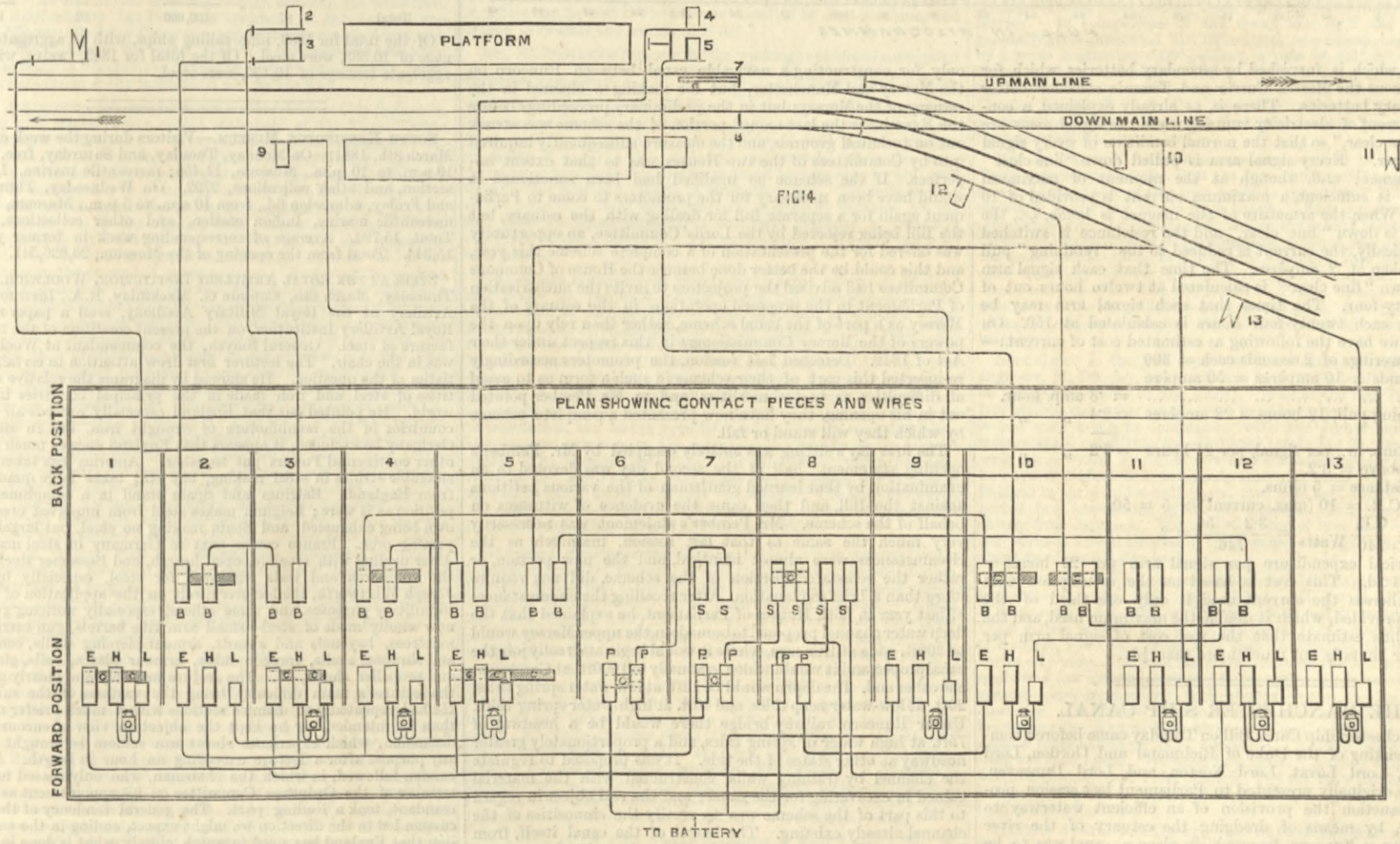


to the core having reached the position of greatest solenoid effect, the disc head itself is nearing the magnet head, and the pull on it consequently increasing. Hence the approximately equal pull through a considerable range. The sudden contact by a violently strong pull, which is common to ordinary magnets when the armature reaches the magnet, is avoided by the form of the disc periphery. Owing to the use of the encircling flange to the armature, a good deal of the effective pull just at contact is prevented by the loss of vertical effect consequent upon the diversion of the attraction or of lines of force—or of ampèrian currents—into a direction radial to the magnetic centre or normal to its cylindric surface, which results from the capping of the magnet pole by the armature flange. Figs. 1 to 3 show the magnet as arranged in pairs, to obtain a double length of pull, as required, for working signals, when the semaphore is required to stand at the three positions of line clear, caution, and danger. When the armature of the upper of the pair of magnets has reached its lowest point, the armature of the lower magnet has reached a position in which it has just begun to act, the spindle connecting the two being free to slide within the core of the upper armature. This is sufficiently obvious from the engraving to make further explanation unnecessary. The curves given at Fig. 7 show the variation of the pull of the magnet as the armature descends. This is reproduced from a diagram, and gives the pull in inches and kilogrammes. A good deal more might be said respecting this magnet, and its many possible applications; but whole of this arrangement is so simple as to require no further explanation. Figs. 9 and 10 show the application of the modified form of the magnet, made, as already stated, with a view to holding the semaphore in either of the three positions, "line clear" |, "caution" \, and "danger" —. This has been arranged with special reference to the requirements so often pointed out by Colonel Yolland, Major Marindin, and other officers of the Railway Department of the Board of Trade.

At Fig. 11 is a sketch of the arrangement of the signals and switches and point levers in the signal box in the Gloucester Wagon Company's Works. Three point levers of the usual kind are shown, and ten signal levers by the new system, with the accompanying electrical instruments. In order to describe the arrangement of the wires, contacts, and commutators employed in this signal-box, with the various connections, we must refer to the details shown at Fig. 12 and 13, and the diagram plan Fig. 14, which shows the coupling up of levers, resistances, and secondary batteries by which the current is supplied.

At Figs. 15 and 16 we show the arrangement by which the system is applied to existing signals, so that they may be worked by old or new system independently.

In describing the action of the various parts we may at first refer to the signal levers or handles as we must call them, as they are so small. In Fig. 11, which is from a photograph taken from within the signal-box at Gloucester, the switch levers, numbered 1 to 6, are coupled up, the remaining four were not only act as resistances, but they show the signalman when the current is passing and all is working properly. When the armature of the magnet is pulled "home" and the signal is "free"—*i.e.*, "line clear"—a contact switches on a small return resistance wire—between the magnet and the rail conveying the return current—which works a small magnet and tell-tale signal



the electro-magnetic phase of the matter will occur to most electricians, while engineers will be satisfied to let these gentlemen amuse themselves with the physical side, so long as they know that they are provided with the practical fact that such a magnet is now obtainable. We may therefore pass on to its application.

In our engraving, Figs. 8, 9, 10, will be seen the magnet as applied to a signal, with the semaphore balanced at mid-length, as on the Great Northern Railway. From these it will be seen that a box containing the magnet is at the side of the post opposite to that carrying the arm and spectacle. The spectacle forms the balance weight, or rather weight by which the semaphore is held at "danger," when the electric circuit is broken and the magnet not acting; the rod between spectacle and semaphore is jointed to spectacle, so that when the spectacle is down, showing danger, its pivot or spindle, and the rod joint upon it, are in line with the rod, and consequently the semaphore is locked in that position against any forces other than the pull of the magnet upon its quadrant at the other end of the spectacle plate. The not. Levers 1, 2, and 6 are forward, and the corresponding lamps are incandescent. In Figs. 12 and 13 these small switch levers are shown to a larger scale, and the Swan lamps used as resistances are shown attached near the lever instead of in the position shown in Fig. 11. From these engravings it will be seen that when the lever Y is in the position Z the contact piece C is not touching L, so that the current now going to the signal magnet must pass through the lamp into L. Only a very small current is thus passing, this being the position of the lever when the armature is upon the magnet. When the lever is in the position X, see Figs. 12 and 13, the semaphore stands at danger. When the lever is pulled over to the position Z^1, the contact piece C being in contact with L, the full current passes to the signal magnet. This is required to start the magnet and pull the semaphore down. This is done momentarily and the lever will not remain in this position unless purposely held, because the spring S pressing against the quadrant R causes the lever to take the position Z. The quadrant and spring also come into play when the handle is pushed beyond X. The Swan lamps or "repeater" in the signal-box, and thus tells the signalman the position of the semaphore. The small resistance wire which takes up the return current, instead of allowing it to go directly through the rail, reduces the amount of current passing through the magnet from 5 ampères to ·125 ampères, and thus economises the electric current. A reference to Fig. 7 shows that ·125 ampères is more than sufficient under all possibilities to keep the signal arm down—*i.e.*, "line clear." Where only one signal is worked, a single switch is used; where two or more signals are worked from the same box, multiple or commutator switches are used, making it impossible to "free" more than the ight signals at one time.

We may now refer to Fig. 14, and it will be seen from this that all the signals and points which are not actually required to be in operation are locked, and cannot be worked at the same time as any others.

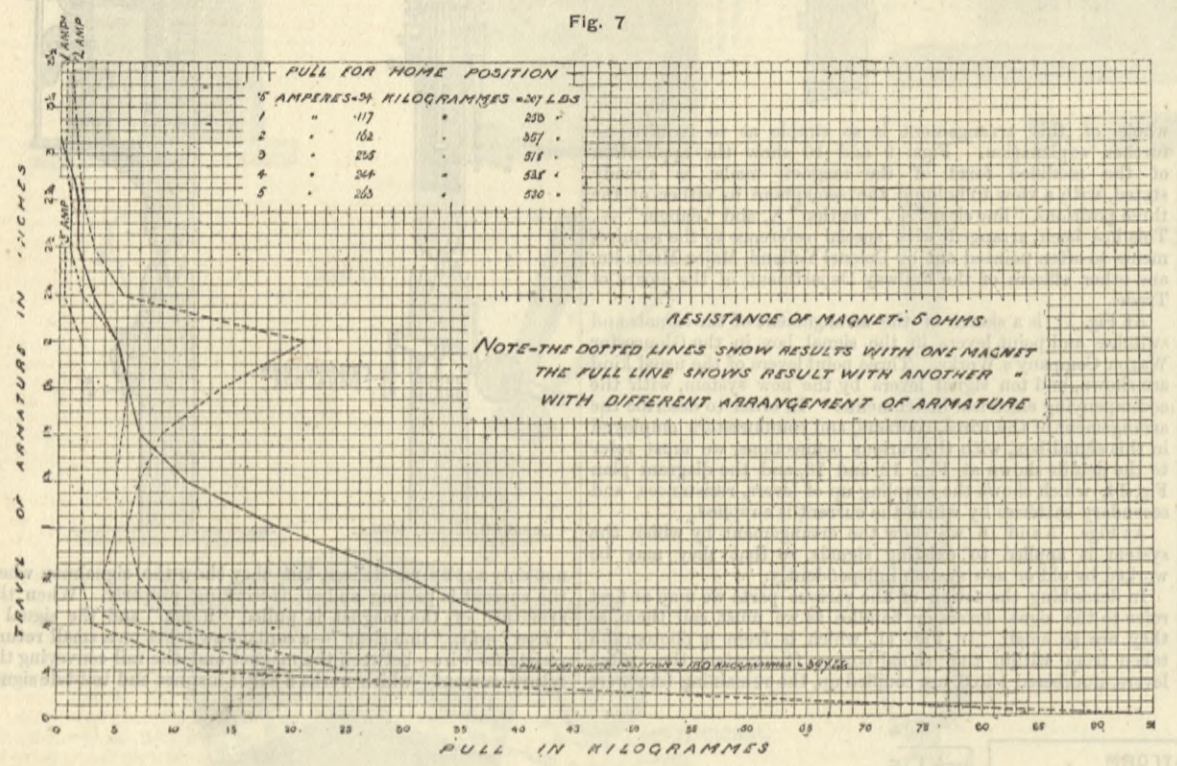
As an example of the method of working, let it be supposed that an up main line train is required to be sent on to the branch. It will be necessary to work the points 7, Fig. 14, the locking

bar 6, the signals 1, 3, and 5. The normal position of points being as shown on drawing, it is necessary to pull the locking bar and point lever forward, making connection between P P (6), and P P (7). The points are then set right for the branch line. Then tracing the connection onward we come to S S (8), down branch point lever, which must be back or in its normal position. Then from S (8) we come to E (3). By putting switch (3) forward the connection is made between E H L (3). On the switch touching L (3), current runs through B B (2) to signal 3, which is lowered. Also the current runs from H (3) to E (1), and on the switch (1) being put forward, E H L (1) are connected, and signal 1 lowered. Similarly the current runs through P P (6), P P (7), S S (8), E H L (5), B B (4), B B (10), to signal 5.

For instance, in the example of working just given we send an up main line train on to the branch. Therefore the down home main signal 10 should not be lowered. By reference to the diagram it will be seen that if the signal 10 were lowered, *i.e.*, the switch (10) put forward to make connection E H L (10) then B B (10) would not be connected, and therefore signal 5, up branch departure, could not be lowered. Similarly the other signals are all interlocked, so as to secure absolute safety. It may be here mentioned that the points and locking bar 6, 7, 8, may be worked either by electrical power or by the ordinary levers in the usual manner, the levers in the latter case being furnished with the contact pieces similar to the electrical switch levers.

Some reference may now be made to the cost of the current

Fig. 7



employed, which is furnished by secondary batteries, which for several reasons the Messrs. Currie and Timmis consider better than primary batteries. There is, as already explained, a continuous current of electricity running while the signal arms are down, "line clear," so that the normal condition of every signal is at "danger." Every signal arm is pulled down "line clear" by its magnet; and, though at the moment of maximum 5 ampères is sufficient, a maximum current is provided of 10 ampères. When the armature of the magnet is home, *i.e.*, the signal arm is down "line clear," and the resistance is switched in automatically, the current is reduced to the "retaining" pull which is taken at ·2 ampères. The time that each signal arm may be down "line clear" is calculated at twelve hours out of each twenty-four. The times that each signal arm may be lowered in each twenty-four hours is calculated at 150. On these data we have the following as estimated cost of current:—

150 lowerings of 2 seconds each = 300 seconds × 10 ampères = 50 ampère min. ... ... = ·8 amp. hour.
Retaining pull, 12 hours × ·2 ampères = 2·4 " "
Amp. hr., per signal, per 24 hours = 3·2 " "
C. as above = 3·2.
R. resistance = 5 ohms.
E. = C.R. = 10 (max. current) × 5 = 50.

$$\text{H.P.} = \frac{\text{C.E.}}{746}\ \text{Watts} = \frac{3{\cdot}2 \times 50}{746} = {\cdot}2.$$

This electrical expenditure per signal arm per 24 hours = ·2 H.P. = 1·2d. This cost is based on the assumption that E. = 50, whereas the current used is only one-third of the maximum provided, which is double the maximum used, and the inventors thus estimate that the real cost of signal arm per twenty-four hours is not much more than ¼d.

THE MANCHESTER SHIP CANAL.

The Manchester Ship Canal Bill on Tuesday came before a committee, consisting of the Duke of Richmond and Gordon, Lord Barrington, Lord Lovat, Lord Norton, and Lord Dunraven. The Bill, as originally presented to Parliament last session, proposed to sanction the provision of an efficient waterway to Manchester, by means of dredging the estuary of the river Mersey as far as Runcorn, from which place a canal was to be constructed to Manchester. The Examiner found, however, that inasmuch as the promoters had failed to deposit plans and sections of the estuary low water channel works, they had failed to comply with the requirements of the Standing Orders; and this decision was so far sustained by the Standing Orders Committees of Lords and Commons, that they only allowed the Bill to proceed on condition that all powers relating to this portion of the scheme should be struck out of the Bill. As amended, therefore, the project went before a Select Committee of the House of Commons, and after a more or less patient hearing, extending over a period of more than six weeks, the Bill received the sanction of the Lower House. In due course it reached the committee stage of the House of Lords, and after another searching inquiry, was rejected. The promoters, not disheartened, thereupon set to work to remedy the defects in their Bill, and the scheme now submitted to Parliament is the result of their labours. The principal opposition to the scheme is necessarily almost identical with last year, and we accordingly find as the eight petitioners appearing against the Bill the Corporations of Liverpool and Birkenhead, Sir Humphrey de Trafford, the Mersey Dock and Harbour Board, the Mersey and Irwell Navigation Commissioners, the London and North-Western Railway Company, the Shropshire Union Railway Company, and Mrs. Adelaide Watt, all of whom with the exception of the last named opposed the Bill of 1883. Several petitioners against the Bill have reserved their right to appear. Mr. Pember, Q.C., in the course of an opening speech lasting over four hours, referred to the circumstances under which the promoters came to Parliament, and then proceeded to explain to their lordships the details of the present scheme.

The Committee met for the first time on Tuesday morning, and have sat from day to day since then. At the first meeting there was a remarkable and a crowded gathering of counsel, agents, and other specially interested persons, and of spectators, and on each successive sitting the Committee room has been more than well filled. Mr. Pember, Q.C., now the acknowledged leader of the Parliamentary Bar, again appeared as principal counsel on behalf of the Bill, supported by four other counsel, and the twenty or so learned gentlemen appearing for the various opponents were pretty much the same as they were last session, Mr. Pope, Q.C., Mr. Aspinall, Q.C., Mr. Bidder, Q.C., and Mr. Littler, Q.C., being again conspicuous.

It will be remembered, probably, that the scheme which was unsuccessfully submitted to Parliament last year was incomplete in regard to one most important particular. As originally lodged the scheme included proposals not only for constructing a navigable canal between Runcorn on the Mersey and Manchester, but for making a channel in the estuary of the Mersey; but in the preliminary proceedings before the Examiners the last-named portion of the scheme was struck out on technical grounds, and the measure subsequently inquired into by Committees of the two Houses was to that extent imperfect. If the scheme so modified had been sanctioned it would have been necessary for the promoters to come to Parliament again for a separate Bill for dealing with the estuary, but the Bill being rejected by the Lords' Committee, an opportunity was offered for the presentation of a complete scheme this year, and this could be the better done because the House of Commons Committee had advised the projectors to invite the authorisation of Parliament to the proposed operations in the estuary of the Mersey as a part of the canal scheme, rather than rely upon the powers of the Mersey Commissioners in this respect under their Act of 1842. Defeated last session, the promoters accordingly re-inserted this part of their scheme in such a form as to avoid all difficulties as to technicalities, and as Mr. Pember pointed out in his opening, they have now presented a complete scheme by which they will stand or fall.

The first day's sitting was entirely occupied by Mr. Pember's opening statement; half of the second day was devoted to an examination by that learned gentleman of the various petitions against the Bill, and then came the evidence of witnesses on behalf of the scheme. Mr. Pember's statement was necessarily very much the same as that last session, inasmuch as the circumstances were almost identical, and the new portion, or rather the reinstated portion of the scheme, did not require more than a brief explanation. After recalling the circumstances of last year in both Houses of Parliament, he explained that the deep water channel proposed to be made in the upper Mersey would be 300ft. wide at Runcorn, where it would begin and really join the canal proper, and it would widen gradually to 1000ft. at Garston at the other end. The depth would be 12ft. at low-water spring tides, 20ft. at low-water neap tides, and 40ft. at high-water spring tides. Under Runcorn railway bridge there would be a headway of 75ft. at high water of spring tides, and a proportionately greater headway at other states of the tide. It was proposed to regulate the channel by training walls, constructed with the material gained in excavating for the canal; and the real object in regard to this part of the scheme was to rectify the sinuosities of the channel already existing. The length of the canal itself, from Runcorn to Manchester, would be 21½ miles, with four sets of locks. The total fall from Manchester to the river would be only 50ft., or about 2½ft. to the mile; the minimum width at the bottom would be 120ft., but at each end the bottom width would be much greater, so that two large vessels would be able to pass each other, and still leave a roomy highway. Mr. Pember pointed out that the width would be greater than that of the Suez Canal or the Amsterdam Canal; and for the rest of his speech enlarged upon the immense advantages which the construction of this canal would confer, not only on the commercial interests of Lancashire, but on the trade of the United Kingdom. The inquiry is likely to last over many days.

Sir W. Siemens.—A perfect likeness of the late Sir W. Siemens has been published by the Universal Printing Company, High Holborn. It is an admirably executed steel engraving rather larger than the cabinet size, and the likeness is more real, or conveys more perfectly the character of the face of the man, than any photograph.

SHIPBUILDING IN 1883.

The following figures, showing the enormous increase in the tonnage of shipping built last year, are from the *Nautical Magazine*:—

Iron and Steel Steamers Built in the United Kingdom and Registered as New British Ships.

Ports where built.	No. in 1883.	Gross tonnage in 1883.	No. in 1882.	Gross tonnage in 1882.
Clyde ports	160	234,211	128	202,054
Tyne ports	128	198,662	107	169,036
Sunderland	94	161,306	79	138,730
Hartlepool	41	69,430	37	65,373
Middlesbrough	15	21,826	11	17,710
Stockton	17	36,042	18	33,006
Whitby	8	14,043	7	11,268
Hull	22	24,528	14	22,006
London	21	6,840	28	8,592
Southampton	10	19,321	2	2,515
Liverpool	8	8,684	8	15,666
Barrow	12	18,837	13	34,300
Cumberland ports	5	5,452	3	3,124
Belfast	18	27,111	11	20,325
Aberdeen	12	10,993	6	7,298
Dundee	18	21,925	8	12,303
Grangemouth	6	4,574	3	1,592
Kirkaldy	3	4,906	2	5,268
Leith	14	6,786	10	13,694
Other ports	46	17,360	22	5,867
Total	658	912,837	517	789,727

Steel Steamers Built in the United Kingdom and Registered as New British Ships.

Ports where built.	No. in 1883.	Gross tonnage in 1883.	No. in 1882.	Gross tonnage in 1882.
Clyde ports	55	94,257	37	74,923
Tyne ports	2	835	2	255
Sunderland	2	3,179	—	—
Hull	2	3,573	2	3,408
London	14	3,386	8	2,514
Southampton	—	—	1	340
Liverpool	1	2,993	1	894
Barrow	3	7,838	3	12,116
Cumberland ports	1	1,512	—	—
Belfast	5	16,083	3	9,863
Dundee	8	12,137	1	4,043
Grangemouth	2	2,236	2	1,172
Kirkaldy	3	4,906	1	1,863
Leith	1	1,304	1	1,640
Other ports	4	2,380	2	358
Total	103	156,619	64	115,389

Iron and Steel Sailing Ships Built in the United Kingdom and Registered as New British Ships.

Ports where built.	No. in 1883.	Gross tonnage in 1883.	No. in 1882.	Gross tonnage in 1882.
Clyde ports	49	64,045	49	650,154
Tyne ports	—	—	1	251
Sunderland	3	4,653	5	7,436
Stockton	2	3,479	1	1,712
London	1	91	5	877
Southampton	8	14,874	4	8,001
Liverpool	11	19,433	11	21,345
Barrow	1	2,129	—	—
Cumberland ports	4	7,439	5	7,370
Belfast	3	7,723	4	7,289
Aberdeen	—	—	2	2,705
Dundee	3	3,021	3	3,226
Leith	2	3,765	1	1,032
Other ports	1	8	—	—
Total	87	130,660	91	126,393

Of the total for 1883, nine sailing ships, with an aggregate tonnage of 10,583, were steel. Of the total for 1882, twelve, with an aggregate tonnage of 10,156, were steel.

South Kensington Museum.—Visitors during the week ending March 8th, 1884:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 11,456; mercantile marine, Indian section, and other collections, 2792. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 5 p.m., Museum, 1421; mercantile marine, Indian section, and other collections, 125. Total, 15,794. Average of corresponding week in former years, 15,343. Total from the opening of the Museum, 20,826,541.

Steel at the Royal Artillery Institution, Woolwich.—On Thursday, March 6th, Captain G. Mackinlay, R.A., Instructor in Artillery at the Royal Military Academy, read a paper at the Royal Artillery Institution, on the present condition of the manufacture of steel. General Smyth, the commandant at Woolwich, was in the chair. The lecturer first drew attention to certain statistics of the question. He showed by diagrams the relative quantities of steel and iron made in the principal countries in the world. He pointed out that England especially exceeds all other countries in the manufacture of wrought iron, but in steel, if Germany be excluded, it appears that England does as much as all other continental Powers put together. America has taken considerable strides in steel making, but still takes large quantities from England. Belgium and Spain stand in a complimentary position as it were; Belgium makes steel from imported ores, her own being exhausted, and Spain making no steel, but largely exporting ores. France comes next to Germany in steel making. After dealing with crucible, open hearth, and Bessemer steel, and the standards and tests employed for steel, especially by Sir Joseph Whitworth, the lecturer dwelt on the application of these to military purposes, and some others, especially noticing guns—now wholly made of steel—small arm rifle barrels, gun carriages, axletrees, bayonets and swords, armour-piercing shells, common and shrapnel shells, torpedo tubes, armour plates, rails, girders, and propeller shafts, &c. The lecture was ably and clearly given, the lecturer's main difficulty being the vastness of the subject. He had repeatedly to dismiss sections with a much briefer notice than he intended, as he kept the object in view of encouraging discussion, which experience shows can seldom be brought on to any purpose after a lecture exceeding an hour in length. A discussion followed, in which the chairman, who only ceased to be a member of the Ordnance Committee on his appointment as commandant, took a leading part. The general tendency of the discussion led in the direction we might expect, ending in the conclusion that England has need to watch closely what is done in steel on the Continent, especially in the matter of projectiles and armour. It was noticed that an American Commission has reported that in war material, steel on the Continent is ahead of steel in England. Some sense of relief was evident at learning that the splendid Whitworth projectile exhibited, which had been through 18in. of iron, did not represent a supply of similar shells to a foreign Power. The following specimens were lent to the lecturer on the occasion:—From the Gun Factories, Laboratory, and Carriage Department, test pieces, gun hoop, torpedo tube, shrapnel shell, and axletree; from Enfield, barrels and bayonets; from Sir J. Whitworth's, the 9in. shell noticed above, and a series of test specimens; from Hadfield's, specimens of steel bricks, &c., contorted without fracture; from Gilchrist, phosphorus pig and steel articles made on his process; from Middlesbrough, steel rails; Scotland Steel Company, steel plates and bars for shipbuilding; Cammell's armour, Landore mild steel twisted in knots; Atlas Company (Brown's) photograph of armour manufacture; South Kensington Museum, diagrams of processes of manufacture and broken steel roll from mint; Delmard lent projectiles made from steel tubes with heads drawn in, and shells stamped from discs of steel.

RAILWAY MATTERS.

THE Whitechapel Extension of the East London Railway has been opened for public traffic.

THE *Daily News* hears that the Railway Commission Bill is now drafted, and that it is possible that it may be introduced into the House of Commons before Easter.

JACOB KOBYLANSKI, a fitter on the Great Western Railway, has been accidentally killed at St. Clear's station in a remarkable way. He was repairing a truck, which was supported on jacks, which gave way, or rather launched the truck, and Kobylanski was struck on the shoulder by a buffer and crushed into the bank, death being instantaneous. He was an elderly Russian Pole, and had been employed by the company thirty-two years at Carmarthen, since his exile from his country, where he owned property.

THE report of the Registrar of the London Coal Market states that the total imports by rail and canal in February amounted to 547,720 tons, against 524,438 tons in 1882. The tonnage carried by the various companies were:—London and North-Western, 126,300; Great Northern, 80,929; Great Western, 86,799; Midland, 180,648; Great Eastern, 65,094; South-Western, 5314; South-Eastern, 1950; and Grand Junction Canal, 685 tons. In the two months of the current year the total was 1,118,258 tons, against 1,083,302 tons, or an increase of 34,956 tons in the present year.

THE report just issued of the Board of Trade on the South-Eastern Railway—Various Powers—Bill observes that, in spite of the adverse decision of Parliament last session on the subject of the Channel Tunnel, the South-Eastern Railway have again brought in a Bill authorising the construction of the tunnel. As soon as this Bill is put down for second reading the Board of Trade will oppose the project, and will recommend that the time for the compulsory purchase of lands authorised in 1881 to be acquired for experimental borings and other works shall not be extended until Parliament has definitely sanctioned the construction of the tunnel.

THE number of railway carriages now being provided with improved means of lighting is larger than generally thought. The Pintsch's Patent Lighting Company has fitted on the Midland Railway 11 carriages and has 84 in hand; for the Great Western they have fitted 30 carriages; for the South-Eastern 154 are fitted; for the Metropolitan, 257 fitted and 60 in hand; for the District, 296 fitted and 54 in hand; for the London and South-Western, 292 fitted and 61 in hand; for the Great Eastern, 560 fitted and 32 in hand; for the Caledonian, 102 fitted and 40 in hand; for the Glasgow and South-Western, 100 fitted and 100 n hand; for the North British, 2 fitted and 24 in hand; making a total of 1804 carriages fitted and 456 in hand. But of course a total of 2260 is small compared with the total number in use. It is, however, indicative of the spread of a much-needed improvement.

AMONG the further indications to hand—writes our Birmingham correspondent — of the necessity for the South Staffordshire Freighters' Protection Association may be cited instances of anomalies to which attention has just been drawn by Mr. Thomas Barker, of the Chillington Iron Company, Limited, Wolverhampton. Complaining of the matter to the local newspapers, Mr. Barker points out how custom of the Liverpool and London galvanising houses for black sheets is being transferred from South Staffordshire to South Wales. From South Staffordshire to London—120 miles—the freightage rate is 15s. per ton; and to Liverpool—90 miles— 10s. a ton. But from South Wales, although the distance is greater, the rates are much lower. To London—160 miles—the rate is 12s. 6d. a ton; and to Liverpool—150 miles—it is 10s. These figures may well seem to be proof that the railway boards are developing the industries of every country and district—Germany, Belgium, or South Wales—whilst, with their iron hand, they are holding South Staffordshire back from its legitimate markets. As Mr. Barker correctly enough remarks, the trade from South Staffordshire has been the backbone of the London and North-Western Railway Company, supplying its shareholders with magnificent dividends for years past; but the traffic returns show that the trade is being driven out of the district, and possibly, when the carriers discover the mistake, it will be too late.

MR. J. FOGERTY, the *concessionnaire* of the Vienna City Railroads, writing with reference to a recent statement of the *Times* Vienna correspondent, observes:—"When the concession was applied for in the yeas 1882, the railway committee of the corporation suggested that a portion of the proposed system on the Franz Josef Quay should be constructed as a 'double railway' with four lines of rails, on account of the great traffic to be expected on that section, connecting several of the existing main lines of the country with the proposed Central Station near the Bourse, and this suggestion was adopted by the Government, although objected to by the promoters on the ground of extra expense. Now that the working plans of this section of the railway, with four lines of rail, along the bank of the Danube Canal have been approved by the authorities, and the official order to commence the works is about to be issued, the Vienna Corporation suddenly reconsidered the question, and withdrew their previous suggestion by asking that only two lines of rails, as originally proposed by me, shall be constructed. The decision rests with the Government, who merely receive the opinions or suggestions of the municipal authorities, and, as communicated recently to me, it is 'that for the present two lines will suffice if so laid that the additional width of structure for a double railway with four lines of rails can be added at a future date when requisite for the traffic,' which, is certainly expected, will require the extra accommodation at this point at no distant date. Had the Vienna Corporation decided at an early date to agree to the inevitable, or understood as clearly as the railway officials of the Government did from the outset that no 'underground' or 'tunnel' system of railway was practicable in Vienna, the works of the proposed elevated railway would in all probability be now in active progress. As it is, from want of knowledge, or from the obstinacy peculiar to corporations, they have merely hindered for a period of two years the execution of a great public work of admitted necessity."

A GOOD deal of difference of opinion is being expressed upon the merits of the proposed Parks Underground Railway, which seems to be promoted under very influential support. A great deal is made by the promoters of the necessity for cheap communication between the outskirts and centre of London for working men, and the *Saturday Review* waxes eloquent on the discovery that the Parks Railway Company does not really wish to construct the railway for philanthropic purposes any more than other companies have done. The impression seems to be gaining ground that the proposed railway will in some way injure the parks, and that the route to be taken and the sites for the termini are not such as will best meet the requirements of the class whose needs are supposed to be most considered. The *Times* points out that it is a manifest defect in the proposed line that it will have no junction with the District Railway, and Mr. St. G. Mivart, writing to the same journal, adds that it has the further defect of not carrying the mass of the people where they want to go. "They do not want to go from Paddington to Albert-gate, but to Charing-cross, as is shown by the crowded state of the omnibuses which descend the Edgware-road to the latter place. Neither is either Praed-street or Edgware-road the best northern starting point. Several western lines converge there, but others come in at the next station—Baker-street. Obviously, then, public convenience would be best served by a line direct from Baker-street to Charing-cross, with a junction at either end. Such a line, I am told, might be constructed at no excessive cost, descending Northumberland-street and tunnelling under Cavendish-square, with an Oxford-circus station in Argyll-street. Thence it might pass under small streets to Golden-square, Windmill-street, and Oxenden-street, and so reach its southern junction. Thus the public would be most efficiently served without risk to the parks, which, as becoming more and more the centre of London, will become more and more difficult to preserve, even with the greatest care."

NOTES AND MEMORANDA.

OF the 1,329,604 tons of new shipping constructed in 1883, 1,116,555 tons were built to Lloyds' survey in steel, iron, and wood respectively, as follows, viz.:—Steel, 109 vessels, 166,428 gross tonnage; iron, 644 vessels, 933,774 gross tonnage; wood, 95 vessels, 16,353 gross tonnage.

DURING the week ending January 26th, 1884, in thirty-one cities of the United States, having an aggregate population of 7,301,300, there died 2946 persons, which is equivalent to an annual death rate of 21·0 per 1000, a slight increase on that of the preceding week.

THE gross tonnage of new shipping constructed to Lloyds' survey in iron and steel respectively, during each of the last four years, was—1880: Iron, 362 vessels, 447,389 tonnage; steel, 26 vessels, 36,943 tonnage. 1881: Iron, 461 vessels, 659,153 tonnage; steel, 37 vessels, 71,533 tonnage. 1882: Iron, 529 vessels, 785,592 tonnage; steel, 73 vessels, 127,927 tonnage. 1883: Iron, 644 vessels, 933,774 tonnage; steel, 109 vessels, 166,428 tonnage.

THE total gross tonnage of new shipping launched in the United Kingdom during 1883 was 1,329,604 tons, against 1,240,824 tons in 1882, the increase for 1883 being thus 88,780 tons. The aggregate tonnage launched in each of the last four years has been given by Mr. Jeans in the "British Iron Trade Association Report" as follows:—1880, 796,221 gross tonnage; 1881, 1,013,208 gross tonnage; 1882, 1,240,824 gross tonnage; 1883, 1,329,604 gross tonnage.

THE extensive filtration works of the Tegel water supply at Berlin, which were begun less than two years ago, are finished, and will be put into operation at once. Ten covered filter-beds, with a total area of 22,000 square metres, have been constructed at a cost of 1,900,000 marks. At a rate of 0·12 metre per hour, it will be possible to filter 45,000 cubic metres of water every twenty-four hours, 70 per cent. of the total area being in operation at any one time.

FOR the week ending February 16th, 1884, in thirty-one cities of the United States, having an aggregate population of 7,325,800, there died 2923 persons, which is equivalent to an annual death-rate of 20·7 per 1000, a slight increase over that of the preceding week. For the North Atlantic cities the rate was 18·9; for the Eastern cities, 23·1; for the Lake cities, 14·6; for the River cities, 18·2; and in the Southern cities—for the whites, 19·2; and for the coloured, 39·0 per 1000. Of all the deaths 37 per cent. were under five years of age, the proportion of this class in the Lake cities being 43·3 per cent., and rising to 50 per cent. in Detroit.

THE Director of Public Gardens in Jamaica reports the existence in St. Helena of large quantities of black oxide of manganese, or pyrosulite, samples of which have been analysed by Professor Roscoe, with the result that one sample of St. Helena manganese, soft, found in clay beds, yielded 35·41 per cent. of manganese di-oxide; while a second sample, hard, found in clinker, yielded as much as 63·19 per cent. of manganese di-oxide. This recalls the fact that large quantities of this material exist in Jamaica, samples of which, analysed by Dr. Lewis Hoffmann for the Geological Survey of Jamaica, show 88·89, or practically 90 per cent. of manganese di-oxide.

AN interesting experiment with the phonograph is to be made by Dr. Zintgraff, who, in company with Dr. Chavanne, is about to visit the Congo and the interior of Africa. "He takes with him," says the *Daily News*, "a phonograph wherein to fix the speech and melodies of hitherto unknown tribes, which, thus received by the instrument, will be forwarded to scientific men in Germany. The apparatus—which will be used for such a purpose for the first time—has been made by Mr. Fuhrmann, of Berlin, and exactly corresponds with one he has in that city, so that the plates used in Africa can be sent to Berlin to be unrolled by that machine, and caused to re-emit the sounds received."

MR. W. PARKER'S formula for the working pressure of corrugated furnaces, 1½in. deep, is $p = \frac{1000 \times (T - 2)}{D}$ where T is the thickness of the plate in sixteenths of an inch, and D the greatest diameter of the furnace in inches. If this rule is adopted, new furnaces of $\frac{5}{16}$, $\frac{6}{16}$, $\frac{7}{16}$, and $\frac{8}{16}$in. in thickness will possess margins of safety of 5, 5·17, 5·45, and 5·62 respectively, while the same furnaces, when their thickness is reduced by corrosion by $\frac{1}{16}$in., will in each case possess a margin of strength of 3·9. The introduction of the term (T — 2) in the numerator practically provides for the fact that an equal amount of corrosion weakens a structure composed of thick plates to a less extent than it does one made of thin plates.

THE deaths registered in twenty-eight great towns of England and Wales for the week ending March 8th corresponded to an annual rate of 22·5 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 Birkenhead, Derby, Brighton, Bristol, Wolverhampton, and Cardiff. In London 2754 births and 1639 deaths were registered. London was during that week growing at the rate of 16·4 births per hour, and decreasing by 9·73 deaths; but immigration is also increasing the growth. Allowing for increase of population, the births were 100 and the deaths were 180 below the average numbers in the corresponding weeks of the last ten years. The annual death-rate from all causes, which had been equal to 20·2 and 19·3 per 1000 in the two preceding weeks, rose to 21·3 last week. During the first ten weeks of the current quarter the death-rate averaged only 20·2 per 1000, against 26·3 and 21·0 in the corresponding periods of 1882 and 1883.

AT a recent meeting of the Chemical Society a note was read on the behaviour (1) of the nitrogen of coal during destructive distillation, and (2) a comparison of the amounts of nitrogen left in cokes of various origin, by Watson Smith. Prof. Foster in a recent paper—"Chem. Soc. Jour. Trans.," 1883, 110—states: "I have not made any experiments on the amount of nitrogen in tar, nor am I in possession of any information on the subject. I have assumed that the quantity is relatively small." The author of the present paper has investigated the subject, having observed in 1868 that ammonia was frequently formed during the distillation of coal tar. He has obtained the following numbers:—Nitrogen in the tar, 1·667 per cent.; in crude benzene from the tar, 2·327; in "light oil," 2·186; in creosote oil, 2·005; in "red oil," 2·194; in the pitch, 1·595. The author has also estimated the amounts of nitrogen in three cokes—(*a*) ordinary gas coke, (*b*) beehive metallurgical coke, (*c*) a hard compact metallurgical coke from Simon Carve's oven. (*a*) contained 1·75 per cent., (*b*) 0·511, ("*c*") 0·384 per cent.

IN a book on the high Alps and glaciers of New Zealand, Mr. W. Spotswood Green gives some interesting information. The latitude of Mount Cook corresponds with that of Florence in the northern hemisphere, but the mean annual temperature of the southern island is 10 deg. lower than that of corresponding latitudes in Western Europe. There is, however, much less difference between the extremes. For instance, the mean summer temperature of Dunedin—lat. 45 deg. 50 min.—is 57·2 deg.; the mean winter, 50·7 deg. Fah. The rainfall on the eastern coast is much the same as on the English lowlands, being 33in. at Dunedin and 25in. at Christchurch; but on the western coast, at Hokitaka, it is 118in. Thus the snowfall on the mountains is heavy, and the line of permanent snow is full 3000ft. lower than on the Alps. Hence the glaciers descend far below the level of those in Switzerland, coming down on the western side at one place to within 670ft. of the sea-level, while on the eastern they terminate at about 2000ft.; on this side, however, the limit of perpetual snow is about 750ft. lower than on the western. On the whole the area covered permanently by ice and snow in the Southern Alps is about 160 square miles, or twenty more than that in the Bernese Oberland. The Great Tasman Glacier is eighteen miles long, thus exceeding the Great Aletsch by three miles; further it is two miles wide at the end, while the other does not exceed a mile in any part.

MISCELLANEA.

PROFESSOR F. ELGAR read a paper before the Royal Society yesterday, upon "The Variation of Stability with Draught of Water in Ships."

IT is thought probable the Government of Victoria will repea the offer of a high premium for a combined reaper and thrashing machine suited to Australian requirements.

MESSRS. GERARD AND CO. have just announced that they obtained a diploma of honour from the Fisheries Exhibition for their installation there. This seems late enough to be curious.

AT the Calcutta Exhibition the Bell-Coleman refrigerator has been awarded a gold medal. Numerous trials were made of the machine, as refrigerators are of great importance from a sanitary point of view in India.

THE discussion which has been occupying the Institution of Civil Engineers on hydraulic propulsion confirms the conclusions long since arrived at by some, that to pump a lot of water aboard and throw it astern at a high velocity is a very wasteful way of using power.

THE Giffard-Northcott patent cold-air machine and ice-making chamber, made by the General Engine and Boiler Company, and exhibited by the Giffard Patent Freezing Company at the Calcutta Exhibition, have received the highest award, viz., 1st class certificate of merit and gold medal.

THE United States Senate, by thirty-eight votes to thirteen, has passed a Bill authorising the building of seven new steel vessels for the navy, one of 4500 tons, one of 3000 tons, one despatch vessel of 1500 tons, two heavily armed gunboats of 1500 tons, one light gunboat of 750 tons, another of 900 tons, and also one steel ram and three torpedo boats. They will be built by contract in private yards.

MESSRS. C. C. DUNKERLEY AND COMPANY, of Manchester, who have just completed the girder contract for the Olive Spinning Company, Limited, Oldham, and the Duke Spinning Company, Limited, Shaw, near Oldham, have, we learn, secured the contracts for the girders for the Fern Spinning Company, Limited, Shaw, near Oldham, and Patricroft Spinning Company, Limited, Patricroft, near Manchester.

IT is stated that the sub-committee of the Departmental Commission to whom the subject of harbours of refuge was referred have practically agreed upon their report, and it will be finally approved by the sub-committee about the end of this week. When revised it will be handed over to the Committee on Convict Labour, who will add to the experts' reports a statement of their own view as to the employment of such labour in the selected project.

A WELL has been completed to the depth of 300ft. for the E. C. Powder Company, Limited, at their new works at Bean, Dartford, by Messrs. C. Isler and Co., of Southwark-street, the first part of which is sunk to the depth of 208ft. from the surface 6ft. in diameter, the remainder is continued by means of a boring 10in. in diameter. The cause of sinking that depth is the existence of the water level at 209ft. from the surface. The supply obtained is 2500 gallons per hour.

THE ironmasters' returns for February show that the make of Cleveland pig iron was 149,886 tons, and the make of hematite, spiegel, and basic iron, 71,376 tons, making a total of 221,262 tons, or 8362 tons less than the output for January. At the end of the month there were 71 furnaces making Cleveland iron, and 33 other kinds of iron. The quantity of iron in stocks and stores amounted to 296,940 tons, being an increase of 10,623 tons since the end of January. The stocks have increased in all about 76,000 tons during the last three months.

MR. BENJAMIN SYKES, the manager of Messrs. Charles Cammell and Co.'s file department, popularly known as the "Father of the Cyclops Works," has retired from his work after forty-six years' service. In recognition of the event the staff and workmen generally have presented Mr. Sykes with an address, accompanied by a purse containing fifty guineas, a pair of gold-rimmed spectacles, with a handsome edition of Shakespeare's works. Mr. Sykes was widely known, even outside the circle of Messrs. Charles Cammell and Co., and this pleasant proof of his appreciation by his colleagues in that great concern has given gratification to all who know him.

THE Ironmasters' Association has just applied to the Board of Trade expressing the wish that the Department will be disposed to accede to the desire of the iron trade to recognise "B.G." as the standard gauge for sheets and hoops. This application is in accordance with the decision reached at the recent meeting of the sheet and hoop makers in Birmingham, when it was decided that the trade should adopt as the future standard that gauge issued some time ago by the Ironmasters' Association, and a copy of which was deposited with the Board of Trade. Many of the ironmasters of North Staffordshire, Lancashire, and Scotland are acting in unison with the South Staffordshire makers in this matter.

ACCORDING to the last report of the Panama Company's chief engineer, M. Dingler, the works are now being pushed on actively on fourteen sections of the Canal. Within the last few months four million cubic metres of earth have been removed. That total is not very much in comparison with the eighty million cubic metres which constitute the estimated total; but M. Dingler hopes with the powerful machines now at work, and the ease with which he says labourers are procured, that the canal will be entirely finished in three and a-half years, that is to say, a little before the period first announced by M. de Lesseps. The labourers come chiefly from Jamaica. The total number of men now engaged on the works is fifteen thousand; their wages' average being, it is said, about five francs a day each.

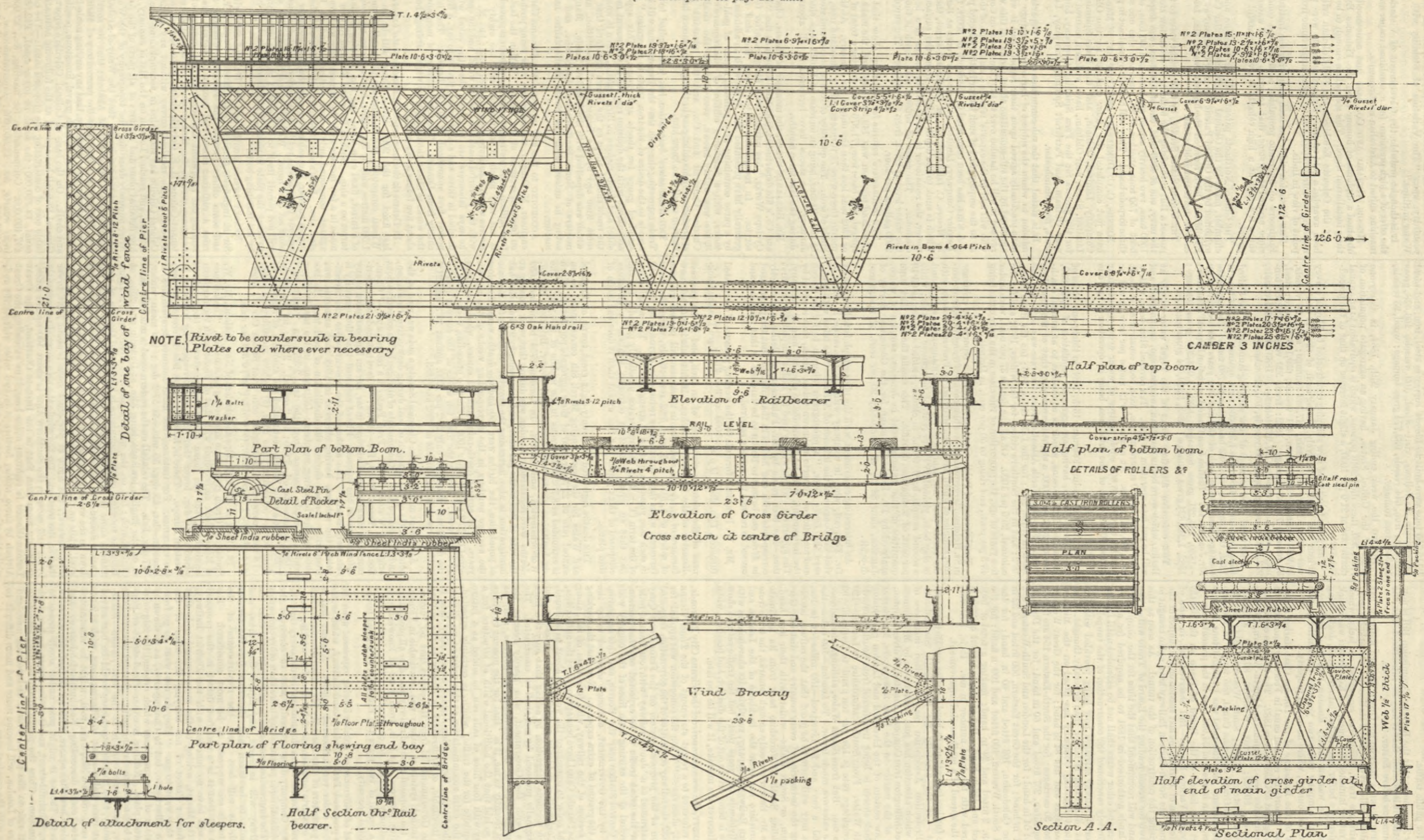
IN Denmark the long-expected armour-plate experiments are at last fixed for the 20th inst. There will be an Ellis and a Wilson compound, and a Creusot plate, all 2 metres long by 1·500 metres wide by 9in. thick, bent so as to represent a segment of a turret, fixed on a wood and iron backing similar to that of a turret on a ship. Both in Italy and England further trials will be made in a few months with the largest guns we have—in England against compound only—both systems—and in Italy against steel also. Italy's new 100-ton breech-loader, with the new German brown powder, is capable of giving the heaviest blow to which any armour plate has as yet been subjected. Armour has thus got its work set once more. We have now arrived at this stage, that it will not permit itself to be pierced; but the blow can be sufficient to break the plate in pieces, which have to be kept in their place by the fastening bolts.

NEARLY twelve months ago the Duke of Sutherland, Admiral Sir E. Inglefield, Admiral Lord Clarence Paget, Mr. Mackinnon, and some others formed the Palestine Channel Syndicate to raise a sufficient amount of money to defray the expenses of sending out competent engineers for the purpose of making the necessary surveys for that project. It was arranged that Lieutenant-Colonel H. E. Colville should go to Akabah, and complete, if possible, the required survey without any official assistance. Colonel Colville has succeeded in accomplishing the object of his mission, and reached London on the 31st of January, bringing with him detailed plans and sections of all parts of the Arabah Valley. After minutely describing the topography of the Wady-el-Arabah he arrives at the conclusion that the Wady-el-Arabah was once a continuation of the Gulf of Akabah; that its southern end has been filled up by *debris;* that the promontory of Rishi is underlaid by sandstone; and, therefore, that any cutting made from sea level to sea level would be through gravel, limestone, possibly sandstone, and chalk. On the basis of Colonel Colville's report, Lieutenant-General Rundall has arrived at the following estimate of the probable cost of constructing the proposed canal:—The north or upper canal, £4,880,000; the south or lower canal, £42,580,000; total, £47,460,000. Compensation for flooding, &c., £2,000,000; buildings, wharfs, &c., £1,000,000; superintendence, direction, &c., £2,000,000; contingencies, £3,000,000; total, £55,460,000.

SALTERHEBBLE VIADUCT, HULL AND BARNSLEY RAILWAY, HUDDERSFIELD AND HALIFAX EXTENSION.

MR. W. SHELFORD, M.I.C.E. ENGINEER-IN-CHIEF

(*For description see page 189 ante.*



FOREIGN AGENTS FOR THE SALE OF THE ENGINEER.

PARIS.—Madame BOYVEAU, *Rue de la Banque.*
BERLIN.—ASHER and Co., 5, *Unter den Linden.*
VIENNA.—MESSRS. GEROLD and Co., *Booksellers.*
LEIPSIC.—A. TWIETMEYER, *Bookseller.*
NEW YORK.—THE WILLMER and ROGERS NEWS COMPANY, 31, *Beekman-street.*

TO CORRESPONDENTS.

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

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

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

M. G.—*You will not infringe A. S.'s patent.*

W. S.—*Send your sketch, and you shall have our opinion.*

M. H. G. W.—(1) *Probably Messrs. Selig, Sonnenthal, and Co., Queen Victoria-street.* (2) *There is no American journal of the kind. The* Scientific American, *published by Munn and Co., New York, may answer your purpose.*

LOCO.—*The indicator diagram taken from the high-pressure cylinder is to be dealt with on its own merits, just as though it was taken from a single-cylinder engine. The low-pressure diagram is to be dealt with on the same principle. You need not concern yourself about the intermediate pressure; the indicator will take care that you are not credited with too much.*

G. V. O.—*We have driven a 4 ton helve with gearing. On the helve shaft was keyed a wheel* 12ft. *in diameter,* 6in. *wide on the face, and* 3½in. *pitch, geared with wood. On the crank shaft of a small horizontal engine was keyed a cast iron wheel* 2ft. *in diameter, which geared with the large spur. This gave no trouble. We have no experience of driving helves with both wheels of iron. The engine had a light fly-wheel. The large spur took up all the shock. Rope driving gear is much used in Wales for driving helves.*

SUBSCRIPTIONS.

THE ENGINEER *can be had, by order, from any newsagent in town or country at the various railway stations; or it can, if preferred, be supplied direct from the office on the following terms (paid in advance):—*

Half-yearly (including double numbers) .. .. .. £0 14s. 6d.
Yearly (including two double numbers) .. .. .. £1 9s. 0d.

If credit occur, an extra charge of two shillings and sixpence per annum will be made. THE ENGINEER *is registered for transmission abroad.*

Cloth cases for binding THE ENGINEER *Volume, price* 2s. 6d. *each.*

A complete set of THE ENGINEER *can be had on application.*

Foreign Subscriptions for Thin Paper Copies will, until further notice, be received at the rates given below:—Foreign Subscribers paying in advance at the published rates will receive THE ENGINEER *weekly and post-free. Subscriptions sent by Post-office order must be accompanied by letter of advice to the Publisher. Thick Paper Copies may be had, if preferred, at increased rates.*

Remittance by Post-office order. — Australia, Belgium, Brazil, British Columbia, British Guiana, Canada, Cape of Good Hope, Denmark, Egypt, France, Germany, Gibraltar, Italy, Malta, Natal, Netherlands, New Brunswick, Newfoundland, New South Wales, New Zealand, Portugal, Roumania, Switzerland, Tasmania, Turkey, United States, West Coast of Africa, West Indies, Cyprus, £1 16s. China, Japan, India, £2 0s. 6d.

Remittance by Bill in London. — Austria, Buenos Ayres and Algeria, Greece, Ionian Islands, Norway, Panama, Peru, Russia, Spain, Sweden, Chili, £1 16s. Borneo, Ceylon, Java, and Singapore, £2 0s. 6d. Manilla, Mauritius, Sandwich Isles, £2 5s.

ADVERTISEMENTS.

*** *The charge for Advertisements of four lines and under is three shillings; for every two lines afterwards one shilling and sixpence; odd lines are charged one shilling. The line averages seven words. When an advertisement measures an inch or more the charge is ten shillings per inch. All single advertisements from the country must be accompanied by a Post-office order in payment. Alternate advertisements will be inserted with all practical regularity, but regularity cannot be guaranteed in any such case. All except weekly advertisements are taken subject to this condition.*

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

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

MEETINGS NEXT WEEK.

CHEMICAL SOCIETY.—Thursday, March 20th, at 8 p.m.: Ballot for the election of Fellows. Papers to be read: "Note on the Preparation of Marsh Gas," by Dr. Gladstone, F.R.S., and Mr. Tribe. "On the Action of Dibrom-α-Napthol upon Amines," by Mr. R. Meldola.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, March 18th, at 8 p.m.: Ordinary meeting. Paper to be read with a view to discussion, "Wire-gun Construction," by Mr. Jas. A. Longridge, M. Inst. C.E. Thursday, March 20th, at 8 p.m.: Special meeting. Fifth lecture "On Heat in its Mechanical Applications"—"Compressed Air and other Refrigerating Machinery," by Mr. A. C. Kirk, M. Inst. C.E.

ROYAL METEOROLOGICAL SOCIETY.—Wednesday, March 19th, at 7 p.m.: Paper to be read, "Brief Notes on the History of Thermometers," by Mr. Robert H. Scott, M.A., F.R.S., President. After the reading of this paper the meeting will be adjourned in order to afford the Fellows and their friends an opportunity of inspecting the exhibition of thermometers, and of such new instruments as have been invented and first constructed since the last exhibition.

SOCIETY OF ARTS.—Monday, March 17th, at 8 p.m.: Cantor Lectures, "The Alloys Used for Coinage," by Professor W. Chandler Roberts. F.R.S., Chemist to the Royal Mint. Lecture I. Gradual development of the processes of coining. The compositions and "standards of fineness" of the alloys used for coinage in ancient and modern times. Tuesday, March 18th, at 8 p.m.: Foreign and Colonial Section. "Borneo," by Mr. B. Francis Cobb, Vice-President of the Society. Admiral A. P. Ryder will preside. Wednesday, March 19th, at 8 p.m.: Fifteenth ordinary meeting. "The Elephant in Freedom and Captivity," by Mr. G. P. Sanderson, Superintendent of Government Elephant-catching Operations in Bengal. Sir Joseph Fayrer, K.C.S.I., M.D., F.R.S., will preside.

THE ENGINEER.

MARCH 14, 1884.

THE SEWERAGE OF THE LOWER THAMES VALLEY.

WHILE the discharge of sewage into the Thames below London is the subject of a costly inquiry under the powers of a Royal Commission, the Local Government Board have been called upon to investigate a scheme for rescuing the Thames from pollution above London. This up-river inquiry comprehends a district extending from Mortlake to Hampton, but omitting Brentford and Teddington. Kingston, Richmond, Kew, Barnes, Mortlake, Esher, Heston, Isleworth, West Molesey, Hampton, and New Malden, are all concerned in the matter, being represented on the Lower Thames Valley Main Sewerage Board, by which body the scheme has been promulgated. The urgency of the question appears when we consider that a suburban territory with a population of at least 120,000 persons is prohibited from discharging sewage into the Thames, and at present has no other outlet available. Of necessity sewage is entering the river daily from some of the localities, but tremendous penalties have been threatened, and the fines prescribed by law would suffice to confiscate all the property in the several parishes. The Thames Conservators put the law in motion, but there has been an arrest of these punitive proceedings, and time has been allowed for the execution of works which shall dispose of the sewage without polluting the river. Next Michaelmas the days of grace expire, and the most that can be hoped for in the meantime is that some plan will be finally approved, such as shall reconcile the requirements of the law with respect to the river, and likewise furnish the inhabitants with proper means of drainage. The story is an old one, the drainage of these parishes having been the subject of schemes and contests for the last ten years. An expenditure of £30,000 has simply brought the matter to where it now stands, not a single house being drained in consequence, nor a single outlet provided. Sewage irrigation has been scouted as a nuisance, and plans for carrying off the drainage to a point of discharge below London have proved abortive. At one time there seemed to be a fair prospect that the Joint Board would succeed in getting the sewage admitted into the West Kent system, and this was a plan which found favour with the Local Government Board. But difficulties arose and the project broke down. So it has happened from first to last, that whether separate localities tried to help themselves, or whether—as in the later period—there was a combination of all under a Joint Board, every effort ended in an extra rate to pay for the cost of a Government inquiry without any practical good being accomplished. Eminent engineering talent has been called in, and elaborate plans have been prepared, without carrying the subject a single step towards a settlement.

One more inquiry has now taken place, and although it has been of a costly and extensive character, it is very doubtful whether it will at once put an end to the deadlock which has so long prevailed. Mr. J. Thornhill Harrison has been the inspector before whom the proceedings have taken place. His report, and the decision of the Local Government Board thereon, are now anxiously awaited. The basis of the inquiry is an application made by the Joint Sewerage Board for an extension of time in which to carry out the requisite works, and for a Provisional Order giving power to acquire compulsorily certain land at Mortlake on which to erect sewage works in accordance with a plan adopted by the Board. This plan has been devised by Messrs. Mansergh and Melliss, and provides for bringing all the sewage of the district to a spot on the banks of the Thames in the parish of Mortlake, having an area of fifty acres, and there treating it by a chemical process. The effluent will pass off into the Thames, and the deposit or "sludge" will either be sold as manure after being dried by pressing, or it will be carried off in barges down the river to Rainham, in Essex, where it will be laid upon the land, a space of twenty acres being proposed for that purpose. The present sewage of the population is estimated at 5,261,850 gallons per day, and from thirteen to twenty tanks are to be erected at the Mortlake works in order to effect the precipitation of the solids. One of the opposing counsel at the inquiry suggested that if the plan were put into operation, Mortlake should henceforth be called "Tankerville." The estimated cost of the entire scheme, including the sewers, is £276,647. The annual charge to the Joint Board is reckoned at £25,534, requiring a rate of 8d. in the pound. The estimate provides for paying off the principal in thirty years. Against this scheme has been arrayed a formidable opposition, consisting of the Duke of Devonshire and two other landowners in the vicinity, together with various parties interested in some way or other in the question. Notably the Thames Rowing Clubs, to the number of forty-nine, comprehending more than 6000 members, objected to the project, as calculated to impair the quality of the stream where they practice.

The absolute necessity of providing some method for the relief of the district concerned is now so clearly recognised that if the present scheme cannot be accepted as it stands, there seems a prospect that it will lead to some modification of its outline that will provide for a final settlement. The concentration of so large a volume of sewage in one place is one of the leading objections, and it also appears that the towns will be put to a further expense to provide for the disposal of surface water. These are matters which suggest the probability of a change in the elements of the scheme, though the project may yet serve as a very useful point of departure. The plan is itself somewhat elastic, or at least the original report had that characteristic. In the proposals laid before the Joint Board by Messrs. Mansergh and Melliss, two other sites were specified as alternatives to the one at Mortlake. In fact there were three different plans—one concentrating the sewage at Mortlake, another at Barnes, and the third at Ham Fields. But in each case the final treatment of the sewage was the same. Taking the sewage to Barnes, the estimate was £323,814, and the rate nearly 9d. in the pound. For taking the sewage to works at Ham Fields the estimate was £237,634, and the rate a little under 7½d. in the pound. In the course of the inquiry much stress was laid on the suitability of the Ham Fields site. It seems rather remarkable that this spot was not selected in preference to either of the others. It was the cheapest, both in capital outlay and annual cost. Messrs. Mansergh and Melliss, in their report, said with regard to Ham Fields: "No one can deny that this place is in every way admirably adapted for the establishment of sewage works for chemical treatment." The situation is almost in the centre of the population whose sewage is to be provided for; and although not actually in the district of the Joint Board, yet power to purchase the land would not be difficult of attainment, supposing the scheme to be approved. But the Joint Board professed to be afraid of the opposition that would have to be encountered in that quarter, though it is not readily to be conceived that this would amount to anything more than that which has arisen over the Mortlake scheme. The Ham Fields outlet being near to Teddington Lock, might suggest a fear that the sewage effluent would possibly reach the intakes of the Water Companies during extraordinary high tides. Mr. Baldwin Latham, who gave evidence in favour of the Mortlake plan, said it was now known that the tidal wave did sometimes pass over the lock. Boats at Kingston had been known to swing round from the effect of this wave; and as the channel was likely to be deepened below Teddington, he thought it was likely that, at every spring tide, this wave would surmount the lock. It does not appear that the members of the Joint Board had this consideration before them when debating the report. But they had another matter on their minds, and it was this—that an attempt had been made to obtain the Ham Fields site on a former occasion, with absolute failure. So also a site at Barnes had been sought in vain. Mortlake was a new idea; but it has scarcely justified the preference.

One objection to Mortlake is its proximity to London. If an outfall at Ham Fields would be near the intakes of the Thames Water Companies, an outfall at Mortlake would be within six miles of Hyde Park Corner. To create such an establishment on the western border of London naturally excites apprehension. If, as some people believe, sewage can come up to Westminster from Barking and Crossness, what may be expected with reference to sewage coming down from Mortlake! But the up-river sewage is to be purified. Will it indeed be pure? Opinions differ. Leyton is cited as an example of success in the chemical treatment of sewage. But the Leyton works are young, and the establishment has the air of a "show-place;" besides which the population is only about one-fourth that which has to be dealt with above London. Coventry was mentioned as a place where the Rivers Purification Company had effectually dealt with the sewage. The town clerk acknowledged that there had been complaints lately, and the Warwick Town Council had threatened legal proceedings under the Rivers Pollution Act; but the Coventry town clerk considered the alleged pollution of the river by the works of his borough "a complete delusion on the part of Warwick." The effect of the Hertford works on the river Lea also came under review. Even the sewage works at Chiswick, erected with the concurrence of the Duke of Devonshire, were the subject of complaint from some parties. Thus it appears that the effluent may prove troublesome, if not immediately at least subsequently; and if the effluent be correct, there may be a difficulty with the sludge. If chemical precipitation were accompanied by filtration through land on the irrigation principle, there would be a fair chance for a good effluent. But this is not proposed in the Thames Valley scheme. If the sewage were wholly diverted and carried away past the southern outskirts of London to some spot far down the river, the ratepayers would have a tremendous bill to pay, and perhaps even then the Joint Board would have to fight a hard battle. No doubt sewage can be purified so as to go into the Thames without risk of harm providing it is clear of the intakes. But, after all, there is the sludge to be dealt with, and this may be troublesome at times. Moreover, where the volume of sewage is very large the difficulties multiply. Apparently we must reconcile ourselves to the idea that sewage is inevitably a troublesome and disagreeable thing. All we can do is to choose that plan which is best, though it may fall far short of perfection. One witness, who came from Kew, gave a very honest opinion when he said that, according to his view of the matter, the proposed plan was a great improvement on the cesspools which at present existed, and which were a great detriment to property.

It will be highly interesting to mark the result of the inquiry which has just been held. The Local Government Board must be anxious to terminate a state of things which has grown into a great public scandal, and which is now attracting more attention than heretofore. If the scheme is endorsed as it stands, it is believed that there will be further opposition offered when the Provisional Order comes before Parliament. On the other hand, there is a disposition on the part of those who oppose the scheme, including the Duke of Devonshire, to be content if each locality had to bear the burden of its own sewage only. This policy, if adopted, would, of course, split up the district and put an end to the Lower Thames Valley Main Sewerage Board. But probably the Board would be glad enough to go, if only the long struggle could be brought to an end and the townships rescued from their unhappy dilemma.

TRAMWAYS IN IRELAND.

GOVERNMENT offer to lend the people of Ireland £2,000,000 for the purpose of constructing tramways or light railways at 4 per cent., 2 per cent. to be guaranteed by the inhabitants in each barony, to be paid out of the taxes if it were not earned by the tramways. In other words, they offer to guarantee 4 per cent. on all sums expended in making tramways, up to £2,000,000. If the promoters cannot otherwise raise the money on this security, the Government will advance it. As many schemes might be brought forward as was thought proper, but they must all be submitted to the Grand Juries meeting during the present month. These juries in some respects resemble in their functions so many select committees, and they will not impose rates unless there is sufficient reason shown. A good many of the tramway proposals have been brought before them already, and they have been rejected. The farmers have opposed the whole scheme tooth and nail; they have absolutely refused to guarantee the payment of 2 per cent., and it may be taken for granted that little more will be heard about tramways in Ireland. The Irish peasant is extremely shrewd. If £2,000,000 of English money was to be spent in Ireland, so much the better. He would try to get as much of it as he could, and laugh at the folly of those who anticipated a return for their money; but these conditions were not those under which tramways were to be made. He did not want the tramways, and their presence would entail a heavy annual cost. So he has used his power of veto, and the tramways will not be made in agricultural districts. A few will, no doubt, be completed in the immediate neighbourhood of cities like Cork or Belfast; but the rural lines which were to do so much will have no existence. No doubt this will be a heavy blow to the doc-

trinaires who saw in facilities for transport a chance for the regeneration of Ireland. The sensible, practical man, on the spot, does not value such lines as being worth 2 per cent. per annum of their cost; and he is, no doubt, perfectly right. No wilder scheme has ever been discussed seriously by a modern British Parliament. Why it was discussed at all we need not stop to explain.

We pointed out in our impression for Sept. 7th, 1883, that to lay tramways to be worked by steam power on the highways would be for the most part impracticable; and an examination of the proposals brought before the Grand Juries proves that our forecast was accurate. We read of bridges to be built, valleys to be filled up, embankments to be made, and very little about the laying of tram rails on high roads. The idea that a horse-worked tramway would pay was quite absurd; and even the most dense and prejudiced advocate of the undertaking as a whole came to see that it meant light railways or nothing. Then came the question, Were such railways wanted? The people of Ireland say they are not, and we presume that nobody knows better than they do. The theory that light railways would do Ireland a great deal of good is based on an entirely erroneous analogy. It is argued that railways in the colonies have made these colonies; that without them they could not become productive or even civilised. The development of America along the track of railways is pointed out as an apt and striking illustration of the power of the iron horse; and we are told that if this is possible in Canada, in the United States, in India, and in Australia, it must also be possible in Ireland. Those who argue thus totally forget that there is an enormous difference between Ireland—an old country—and new regions. Where railways have done most for the colonies or America there are no roads worth the name. There it is the railway or nothing. A settler who is more than a very few miles from a railway can find no sale for his crops. There is no road by which they can be taken to market. In Ireland, on the contrary, we have a system of roads probably unrivalled for excellence. They are broad, fairly level, and well kept. The narrow, rutty, ill-kept English parish road has practically no existence in Ireland; and not only are the roads good, they are abundant to superfluity. Under such conditions, the traffic on a light railway must be extremely small. Minerals there are practically none to transport, because Ireland has none. Ages ago the surface of the sister isle was carried away, and the lower strata, which contain neither coal nor iron, were exposed. The small quantity of anthracite still remaining may be regarded as the last vestiges left untouched of the coal measures which the country once possessed. There is a little good iron ore found in the north. Such things in no way affect a general scheme for tramways. As to sending grain to market, it would be cheaper to cart it direct to the railway station than to first cart it to the tramway, and then cart it from the tramway to the railway or the brewer. Cattle are self-sufficing, they are peripatetic; so are sheep. Once pigs are got into a cart they are best kept there; they do not take kindly to many transfers. They are firm and noisy, and have their own way. Time is of no value whatever in Ireland; and a peasant would willingly walk five miles rather than pay 2½d. for being carried. The roads present no difficulties; nay, they are so plentiful that a choice may usually be made, and the monotony of an excursion to a neighbouring town may be avoided by going by one road and coming home by another. All these things are against the tramways, and their advocates will find that common-sense still exists in the world, and that even Irish peasants can understand that nonsense is now and then talked in Parliament. To give £2,000,000 to Ireland is one thing, but to spend it on making tramways would be sinful waste. That is what is said in Ireland, and no doubt with truth.

Yet it is possible after all that the £2,000,000 may be spent on tramways or light railways in process of time. The money will not go far. Assuming that the new lines cost complete £5000 a mile, it would make just 400 miles. This would do very little toward developing the resources of the country; but a good many miles will, as we have said, probably be laid near large towns or cities. Not 400 miles in all; but neither will such lines be made for £5000 a mile. Before, however, it is too late we would venture to suggest that the tramway scheme be quietly suffered to die a natural death, and that the money be expended in a totally different way, namely, on improving the arterial drainage of the country. A difficulty which will crop up as soon as any attempt is made to reduce this scheme to practice will be found to be identical with one well known in this country. The value of the land saved from floods is not worth the sum which must be expended in saving it, and those who live on high land unaffected by floods refuse to pay for the relief of their lowland neighbours. When we read more or less harrowing accounts in the pages of the daily press concerning the results of disastrous floods, we are apt to say that it is a shame that something is not done to prevent such occurrences. We forget that in point of fact it would not pay to prevent the floods. An expenditure of a million might be necessary to keep 1000 acres of land clear of water; but no one supposes that agricultural holdings are worth £1000 an acre. An outlay of £5 an acre is probably the utmost that on the whole could pay. At this rate £2,000,000 would have to rescue not less than 400,000 acres from inundation. We do not say that this could not be done. We do say that we doubt that it can be done in Ireland. Whether it can or not, it is quite certain that £5 an acre will not be spent by those more immediately benefitted. There is only one way in which arterial drainage can be carried out. Let the grant be increased to £5,000,000 and let the island as a whole guarantee 2 per cent. on the outlay, those actually directly benefitted to pay besides an annual sum, which would suffice to clear off the whole in fifty years. In this way something useful might be effected, and the outlay, if properly managed, would prove to a certain extent remunerative. We do not suppose, however, that the suggestion will be adopted in any shape or form. To mention it would be enough to evoke a storm of indignation from those who live far above rivers. This is the reason why no steps are taken in this country to carry out arterial drainage. It will not pay if the whole cost is thrown upon those whose land is drained, and those whose land is not drained will urge with much force that it is no affair of theirs. It would seem hard that a man living in Harrow or on Hampstead Heath should have to contribute money for straightening the course of the Trent; but that is what the inhabitants of Harrow and Hampstead would have to do if the rate were distributed over the taxpayers of England. We do not say that such a thing should not be done, but it will not be done until we have an autocratic Government—at least not in England. It may be done in Ireland, but then Ireland is like no other place in her Majesty's dominions.

We have wandered away from the more immediate subject of this article "Tramways in Ireland." So far as can be seen, the Grand Juries are doing their duty, and Ireland will not have many new tramways. The whole transaction from beginning to end is extremely instructive. It suggests among other things an old nursery story about the top brick of a chimney.

BRIGHTON BEACH.

The old saying that "Time brings about its revenges' is being aptly illustrated by the course of events at Brighton—as apart from Hove—with regard to the foreshore at that place. We have before drawn attention to the fact that our predictions as regards the ultimate course which would be forced upon the authorities of the adjacent parish of Hove have been fully verified, and now we have, with regret, but with no surprise, to state that what we named as almost certain to follow as the result of proceedings at Brighton has been justified by recent occurrences. We repeatedly drew attention to the most suicidal policy adopted by the Corporation of the latter town with regard to the sale of beach near the Toll-house at its western extremity. This was the spot, we felt certain, at which the ill-effects of the works proceeding at the neighbouring beach of Hove would become manifest; and although a few members of the Town Council of Brighton echoed our repeated warnings, they were without effect, and day by day the valuable shingle was removed for building purposes and the height of the protecting beach lessened to a degree which was manifestly fraught with danger. Well, the end has come, and from all appearances there is now practically no beach left to speak of between the West Pier and the Toll-house above referred to, the late severe gales having removed almost the whole of the small amount of shingle which the needs of the Corporation had left untouched. We hear that during the recent stormy weather the sea made a clean sweep right up to the ornamental gardens now in course of construction below the wall of the esplanade; and being at length thus rudely aroused to the sense of danger, the engineer to the Municipality has brought before the Council a plan for temporarily meeting it. It is somewhat amusing to those who have carefully watched and noted the proceedings upon which we have commented for several years past to observe the pretension upon which this proposal is put forward, and we should say that intelligent ratepayers of Brighton would scarcely be deceived by it. Not a word do we read in the report of the Council's discussion of the matter on February 21st respecting the real cause of the difficulty, or of its being already apparent. Far from that, we read that "by the folly of the Shoreham Harbour people in setting up a groyne which they had no right to, Brighton was robbed of a large quantity of beach:" and, again, "their neighbours—Hove—were taking care of themselves, and they were suffering from it." All reference to the fact that the town had been robbing itself for years past, in spite of urgent warnings, was carefully avoided.

In fact, we cannot but realise to ourselves that there is a great want of candid dealing in this matter, to which the ratepayers will do well to look. What is the proposition now brought forward to meet the immediate urgency of the case and furnish prospective protection? Nothing more nor less than to construct a huge and unsightly timber groyne, rising 37ft. high above low-water mark, at one of the most attractive parts of the town, immediately facing the Bedford Hotel! and we understand Mr. Lockwood, the engineer to the Corporation, to state that it will only be required to serve a temporary purpose, and that when it has accumulated sufficient shingle to replace that given over to the speculative builders of the town it may be removed. With the fullest respect for the opinion of Mr. Lockwood, on this question we decidedly join issue with him. If the groynes erected close by at Hove have for years past failed to secure the required supply of beach, how can it be expected that one placed still further to the eastward will do so? We have pointed out before that at Hastings it has taken years for the travelling shingle to pass a groyne erected to the westward of the town; and all our past experience condemns the hope that Brighton will be more fortunate. At the base of the sea-wall which is now to be constructed at Hove will be run out short groynes, for the purpose of retaining a protecting berm of shingle. Until that is supplied Brighton may wait her needs in vain; and meanwhile what will become of the new ornamental gardens on which the town is now expending so large a sum?

Further, we observe that a statement was made in the Council that, on Mr. Lockwood's dictum, the groyne now proposed by him would not be necessary "when the East-street groyne was lengthened and did its work." But it is manifest therefrom that the East-street groyne has not done its work, and that measures are to be taken to give it some chance of success. It is easy to foresee that some day or other, if this sort of patchwork is allowed to continue, Mr. Lockwood, or his successor, will come to the Council with further propositions, and will state that these only involve "temporary" measures until the Bedford Hotel groyne "has been lengthened and has done its work." And so on and so on *ad infinitum*, until thousands of pounds have been wasted for want of what is really common honesty of conviction and intent. There is not a man in the Council who must not know that a course of deliberate robbing of the beach has been going on unchecked for years; and its members, if they exercise the deductive common sense we must suppose them to possess, must be aware, from the experience gained at Hove, that erect as many groynes as they will, the shingle will not be forthcoming to be retained by these for years to come. Among the intelligent residents of Brighton who do not participate in the official honours of its Town Council are many who regard with great distrust both the late and present proceedings of that body, and who foresee with ourselves that the day will not be far off when, after having spoilt their sea front by unsightly high groynes, they will have forced upon them the course to which the Hove Commissioners are now compelled—the erection of a sea wall.

What a commentary does the present position of affairs offer on the text upon which we originally started our remarks on the subject of the "Brighton Beach," viz., the want of combined action between the two conjoint towns of Brighton and Hove in the first place; and secondly, the practical proof that want has afforded of the necessity of imperial control in such matters. On this point we observe a statement to have been made by a member of the Council, "that a gentleman wrote very truly in the *Times* the other day that the Hove Commissioners and the Council (Brighton) should join together and compel the Shoreham Harbour Trustees to cease intercepting the beach as they did at present." But we fail to see why with equal justice the inhabitants of Rottingdean further to the eastward may not apply to Parliament for an injunction to stay the very works which the Brighton Council now contemplates. Who is to be the judge as to the requirements of Shoreham if those of Brighton are to be exempt from official control? It really is, it appears to us, until Government does its duty in the matter, a case of every man for himself.

We may fitly close this article with some allusion to the results of the late storms at what we cannot but call the abandoned works at Hove. We understand that the very serious encroachment of the sea we reported in our latest article on this subject has been surpassed within the last few weeks; and that not only has the lower walk of the esplanade been in places entirely destroyed, as we then wrote, but that the green itself has now suffered considerably. The rapidity with which the sea has advanced its inroads, in spite of the temporary expedients used to check it, demonstrates in the fullest degree possible how desirable it is that no start should be allowed to such inroads. That the Hove Commissioners did their best, with their then limited experience, to stay such a start by groyning, we cannot but concede, though we pointed out at the first that it probably would be found to be a mistaken and uneconomical course; but that, with this experience before their eyes, the Town Council of Brighton should be following in the same futile course, is, to say the least, astonishing.

However, we suspect the reason is not far to seek. The sale of the shingle, which has so denuded the beach as to bring about the present danger, is the real though carefully concealed cause of the demand upon the purse of the ratepayers of Brighton now made. For that sale, and therefore for that demand, the Town Council is reponsible to its electors, and we can well understand its members prefer to face the latter with a threatened estimate of £1250 for a groyne rather than with one for £12,500 for a sea-wall; and it is "pretty," as Pepys observed, to see how convinced a considerable number of the governing body are that £400 is quite sufficient to meet all absolute requirements. We only trust that the townspeople will not be misled by amateur engineers in the Council, and have the dust of deception thrown in their eyes. A heavy responsibility has been incurred, against which these columns spoke early in warning, and it is too late to endeavour to cloak it by bringing forward such expedients as the Town Councillors of Brighton are only too willing to cling to.

ARMOUR EXPERIMENTS.

As we have pointed out on different occasions, all nations are in want of a definite system on which to calculate results of firing against the harder classes of armour, that is those which cannot be perforated but yield by fracture. We are glad to learn that some experiments are shortly to be carried out, we believe by the Admiralty, with a view to determine, if possible, some law of resistance; and 12in., 14in., 16in., and 18in. steel-faced plates are being supplied for this purpose from Messrs. Cammell and Brown's works. On the present system these plates would be expected to be a match for shot capable of perforating about 14in., 16¾in., 19¼in., 21½in. of wrought iron respectively. We cannot say the line of investigation to be followed in these trials, or whether the results will be treated as confidential. The need of them, however, is most unquestionable, and we hope that they may lead to good results. The subject is interesting, and we are tempted to indicate the direction we should be inclined to take ourselves, but we must guard our readers from supposing that we can guess in the least what will actually be done. Believing that the work of fracture on any given plate is proportional to the total energy of the blow, and does not depend on the calibre of the gun, we should endeavour to test this by employing guns of widely different calibre. The larger shot of course would have much more weight and less velocity than the smaller one. It might be that velocity tells more than weight, and that the smaller gun therefore produces most effect, or *vice versâ*. We should check this by having shot of widely different weight for the same gun. By this means we might arrive at how each element told. The great matter, we believe, throughout is to have regular series of trials, taking care in each one to have all elements constant except the actual elements at the moment under investigation. Believing, however, as we do, that a great number of experiments are necessary, we should be inclined to make preliminary experiments on a small scale where little expense would be involved. The action of fracture by cracking is regarded by some as outside the region of mathematical calculation; but we cannot admit that this need be the case. The direction of a crack in a plate may be very uncertain, the position of a bolt or many incidental circumstances may determine it; but after all it is not the question of direction that we care to know so much as the bare fact of the minimum resistance that can be depended on. We can easily imagine that many trials will have to be made; but we believe that something

might be arrived at which would be of great practical value, not only in future calculations of results to be obtained against hard armour, but also in other mechanical questions the data obtained as to laws of cracking and fracture might be valuable. As to experiments on a small scale, we know that Sir Joseph Whitworth has frequently experimented with rifle bullets to test questions for ordnance, and we understand that he has found that the laws governing the experiments are much the same on the greater and smaller scales. This, at all events, might be watched and ascertained by making special trials on smaller scales for comparison with known experiments on a large one. For example, we have recently given the results of a trial of Grüson's. We might find out whether the energy per ton of metal in that had produced a similar result to one we might obtain on a small scale with chilled iron. At all events we shall say that any data that may be allowed to be obtained will be most welcome. We recently heard a complaint made by a foreign officer of high position, who was an adviser to his Government on questions of this kind, that so few experiments were published in England that English material was placed at a disadvantage, and its advocates abroad had an uphill battle to fight. This a question of national interest, and we trust it may be borne in mind by our authorities in weighing the arguments for and against the publication of each experiment.

THE QUALITY OF SCOTCH PIG IRON.

THE committee appointed by the Scotch ironmasters to investigate the allegations "that large quantities of pig iron, in the manufacture of which a considerable proportion of cinder has been used, have recently and are still being sent into Connal's stores as a substitute for Scotch g.m.b.," presented their report to a meeting of ironmasters held in Glasgow on Friday afternoon. The committee stated that Messrs. Connal and Co. refused to render them any assistance, upon which they asked for information from the ironmasters. Returns were obtained from the latter, but not from the whole of the firms; so that the committee's information was not so complete as could be desired. They proceed to say:—"Their investigations, however, leave no doubt on the mind of your committee that in certain of the furnaces in Scotland, representing about one-sixth of the whole production, a large proportion of cinder, varying from 25 to 45 per cent. of the furnace charge, was used during 1883 in the manufacture of pig iron classed as g.m.b., and that a considerable quantity of the iron so manufactured has been sent into Connal's store. Your committee have reason to believe that the use of cinder in such large quantities extends further back than last year, but to what extent iron so made forms the present stock in Connal's store your committee have not been able definitely to ascertain, as the parties who alone could assist them in obtaining this information decline to do so. Under these circumstances, it appears to your committee that the question remitted to them can only be authoritatively decided by an action at law." At their meeting on Friday the ironmasters approved of the above report, discharged the committee, being "unanimously of opinion that iron, in the manufacture of which the quantities of cinder referred to in the report had been used, ought not to be classed as g.m.b., and that a fresh classification of the brands of Scottish iron appeared to be necessary. Until this can be effected," add the masters, "investors in warrants have the remedy in their own hands by specifying the particular brands they desire to purchase." With reference to this matter, Mr. J. Mann Thomson, chairman of William Dixon, Limited, Glasgow, writes as follows:—"As one of the largest makers of pig iron in Scotland, and one whose iron has been stored during 1883, I think the time has come to express my opinion on the question of quality which has been raised by a section of the ironmasters of this country. I think a great deal that has been discussed and written on the subject has really little to do with what is wanted, which is, that the public should have confidence that the iron put into store is good and genuine g.m.b., and will be accepted as such by the consumers and exporters of this country. Whether the pig iron has been made with a certain proportion of cinder, or whether it has been made with a class of ironstone which contains a large proportion of phosphorus and silicon is, I think, beside the question; what is wanted is that the result should be good g.m.b. In making hematite pig iron, in which I have a large experience, there is a fixed limit of phosphorus and silicon which the iron contracted for is not allowed to pass; if it contains more it is rejected. Why not apply this test to the iron to be stored in Messrs. Connal's, and let them have the power of inspecting the fracture as at present, but give them also the power of rejection if the iron is below the standard of analysis? I have no objection that the standard should be fixed by the self-elected committee of the Scottish ironmasters." Here the dispute for the present rests. It is evident that a good deal can be said on both sides of the question.

SAFETY LAMPS AND COLLIERY EXPLOSIONS.

FOR some time past a Committee chosen by the Midland Institute of Mining Engineers have been making important experiments with safety lamps, with a view of determining which is the best and safest lamp now in use when placed in an inflammable current of explosive air and gas. The last series of experiments prior to drawing up a report was made on Monday last at the Aldwarke Main Colliery, near Rotherham, belonging to Sir John Brown and Co. The company had provided ample machinery and appliances for carrying out the tests, including the erection of two small gas-holders, with pipes and machinery for regulating and testing the speed of the current. The Committee had caused lamps of all kinds to be collected, and as this was the last meeting for testing the lamps prior to reporting on the experiments, a good deal of interest was attached to the proceedings. In the course of the experiments a French lamp, which has been largely introduced into collieries in an adjoining county, was tested. This was said to be impregnable, but, like the others, it exploded when subjected to a severe trial. The results of the experiments will be made known in a report which will shortly be laid before the members of the Institute. The question is important, inasmuch as at a recent inquest an opinion was expressed by one of the leading district mining engineers that there is at the present time no such thing as an absolute safety lamp in use.

THE LOAD LINE COMMITTEE.

THE meetings of the Load Line Committee at Newcastle and Sunderland cannot be said to have added much to the knowledge that the public has acquired through the reports of the progress of the inquiry. At Newcastle the Load Line Committee were very coolly received, the dignitaries of the town being absent, and the evidence was far from representative of the views of the shipowners and builders of that town. It is said that this was due to the feeling against the Shipping Bill, and was stimulated by the omission of a Tyne representative from the Committee. At Sunderland the evidence was much more complete; but at both places it conflicted. Some shipowners preferred well-deck ships, others flush deck, and the reasons were given for the preference; but in nearly every case there was a decided objection expressed to the load line that the Board of Trade approved. It would have been interesting, as the Tyne has been one of the rivers where steamers have been very frequently detained, if the local officers of the Board of Trade had, there or at other ports, been put forward so that the fluctuating load lines that they have been endeavouring to enforce could have been shown and their reasons given. As it is, the statement is now made that the primary object of the Committee's visit is one of inspection rather than to take evidence at the outports. So far, at Hull and on the Tyne, the visits have been far from being successful, and the hopes of those who believed the Committee would settle much have not yet been justified.

LITERATURE.

Personal Reminiscences of General Skobeleff. By V. J. NEMIROVITCH-DANTCHENKO. Translated from the Russian by E. A. BRAYLEY HODGETTS. London: W. H. Allen and Co. 1884. 346 pp.

SKOBELEFF played so important a part in the late Russo-Turkish war, and was a man of such remarkable bravery and energy, that reminiscences of his life will be perused with interest by many of our readers other than those of the military profession. Skobeleff's character was many-sided, and as much of the life of a military man is, fortunately for all, spent out of the battle field, this book, so ably translated by Mr. Hodgetts, records a great deal that is indicative more of general character than of military prowess. The author was a very intimate friend of Skobeleff, and some of his pages are written with that unqualified praise which is likely to mark a book written very soon after the death of a much respected friend. Skobeleff was, without doubt, a very remarkable man. He was born in 1845, and though always an erratic and, we might say, wayward and somewhat impetuous genius, scorning the usual favour and patronage road to promotion, he had won his general's epaulettes in his thirtieth year. As a young man he was, at the same time, very fond of study, a voracious reader, and unusually extravagant, even for a Russian. This was the chief cause of his entering the army, as his father could or would no longer pay his enormous debts. He joined a cavalry regiment at Warsaw, and was engaged in repressing the Polish rebellion; but his debts did not grow much less, and he had to quit Warsaw and join the Turkistan army. In 1868 he commanded a sotnia of Cossacks, and in 1871 was on the staff of the Grand Duke Michael. He joined the Khiva expedition and distinguished himself under Kaufmann. Afterwards he went to Spain during the long range fighting of the Carlists, and subsequently joined the Khokand expedition and became general. In 1877 the war with Turkey broke out, and in spite of great opposition of envious favourites, he rose to his high position through the daring and ability which he then showed, the records of which are to a great extent within the memory of all who followed the events of that war. His great abilities as a general showed themselves most at Plevna, some of the events of which, and the passage of the Balkans and the battle of Shipka, are graphically described in this book. In view of the recent phase of the Merv question his exploits at Geok Teppé and his near approach to Merv are of much interest. We must, however, refer the reader to the book itself as one of very great interest.

The Electric Light in our Homes. By ROBERT HAMMOND. London: Frederick Warne and Co. 1884. 205 pp.

THE title of this book almost indicates its purpose, namely, to describe the advantages of the electric light for domestic purposes; and to do this in popular language, so that the many who do not know anything of electricity, and who do not want to become electricians, may nevertheless gain an intelligent idea of what is really the nature of the electric lamps now so commonly used, and how it is that electricity is used in causing them to give the light they do. The book is the substance of some popular lectures delivered by the author in different places; and though it is not claimed for it that it is in any way a scientific treatise, it will help much more to convey to the intelligent general reader a knowledge of the new light than most of the books which are of a more exact and technical character. Electricians refuse to see the value of books of this kind, but that which helps to popularise knowledge of a thing which must become popular in its applications, must be doing good, just as the populariser of any branch of science does good by exciting a wider interest in, and, therefore paving the way to a more general demand for more complete teaching. Those who are thoroughly masters of a scientific subject find considerable difficulty in writing popularly upon it, and popular books are, therefore, seldom written by them; but this is no reason why such books should not be written, provided they do not teach what has afterwards to be unlearned. Omission in them is unavoidable, but to convey false notions is inexcusable. The weakest part of this book is that which describes the production of electric currents, although other points might with advantage be more fully elucidated. The incandescent lamp in many pretty applications is well illustrated, and rooms fitted up with various forms of lamp-holders, as used in hall, dining and drawing-rooms, and study, are illustrated by photographs of those in the author's house; but they do not give at all an adequate idea of the pleasing character of this mode of illumination as there carried out. This private installation is worked by a gas engine, which is started by the gardener, and the engine is then left; and when the light is no longer wanted a switch in one room turns a current into the coil of an electro-magnet, which releases a catch holding the lever of the gas cock by which the engine is supplied, and thus the engine is stopped.

BOOKS RECEIVED.

Electricity in Theory and Practice, or Elements of Electrical Engineering. By Lieut. Bradley A. Fiske, U.S.N. New York: D. van Nostrand. London: E. and F. N. Spon. 1883.

The Gas Engineers' Text Book and Directory of Gas Companies of Great Britain and Ireland, Continental, Colonial, and Foreign Gas Companies. By A. H. Thompson, editor of *The Gas Engineer*, Birmingham. Published at the office of *The Gas Engineer*, 71, Broad-street.

PRIVATE BILLS IN PARLIAMENT.

In the House of Lords on Tuesday, the Select Committee on Standing Orders met to consider the Examiner's report of non-compliance with the Standing Orders in the case of six Bills. The petition of the Belfast and Northern Counties Railway Company for an additional provision to their Bill, the Newport (Monmouthshire) Hydraulic Power Company's Bill, the London Southern Tramways (Extension) Bill, and the London Tramways Bill were allowed to proceed without any question arising for the special consideration of the Committee; but on the Croydon, Norwood, Dulwich, and London Railway Bill a discussion arose on the opposition of the Croydon Direct Railway Company, the promoters of a rival scheme. The various points raised in the petition were dwelt upon at length by Mr. Rees and Mr. Hoskins, the agents for the opponents and promoters respectively; but eventually the Committee held that the Bill might proceed. The same course was taken with regard to the London Eastern Tramways Bill, opposed by the West Ham Local Board.

In the House of Commons the Court of Referees sat on Monday, under the presidency of Mr. Pemberton. The first case which came before them was the Denbighshire and Shropshire Junction Railway Bill, the promoters of which objected to the *locus standi* of the Great Western Railway Company to be heard before Committee against the scheme. The allegation set up in the petition of the Great Western Railway Company was that competition would be established by the new scheme, and on this ground it was submitted that they were entitled to be heard. At the conclusion of the arguments the Court expressed the opinion that the alleged competition was only problematical, and accordingly they declined to sustain the contention of the petitioners. In the next case the Manchester, Sheffield, and Lincolnshire Railway Company objected to the *locus standi* of the River Dee Committee against their Bill for an extension from Chester to Connah's Quay. The Bill also gives to the Sheffield Company running powers over the Connah's Quay line. The standpoint of the promoters was that the Commissioners were not the proper persons to represent the interest on behalf of which they opposed this Bill; and the Court viewing the matter in the same light, the *locus* was disallowed. The Great Western Railway Company—against whose petition objection was also lodged—opposed the Bill on two grounds, viz., on account of the competition which would be established by the introduction of so powerful a company as the M. S. and L. Railway into a district hitherto occupied by the Great Western and the Connah's Quay Company alone; and, in the second place, it was alleged by the petitioners that the bridge to be constructed across the lower Dee would prejudice the port of Saltney, situate higher up the river, the port being Great Western property. The promoters objected to the *locus* on the ground that the alleged competition would not be of such a serious nature as would justify the Court in admitting the Great Western to oppose the Bill. The Court held that the Great Western had a *locus standi* on the question of competition, which, of course, is a general right to oppose the Bill. The promoters conceded the *locus* of the Credit Company, and of those "merchants, shipowners, and others" trading above bridge on the river Dee. On Tuesday the Court allowed the *locus standi* of four petitioners—the Bristol Port Railway and Pier Company, the Great Western Railway Company, and Charles Waring and others, against the Avonmouth and South Wales Junction Railway Bill. The *locus* of Messrs. Lake and Co. and others against the Millford Docks Bill was disallowed.

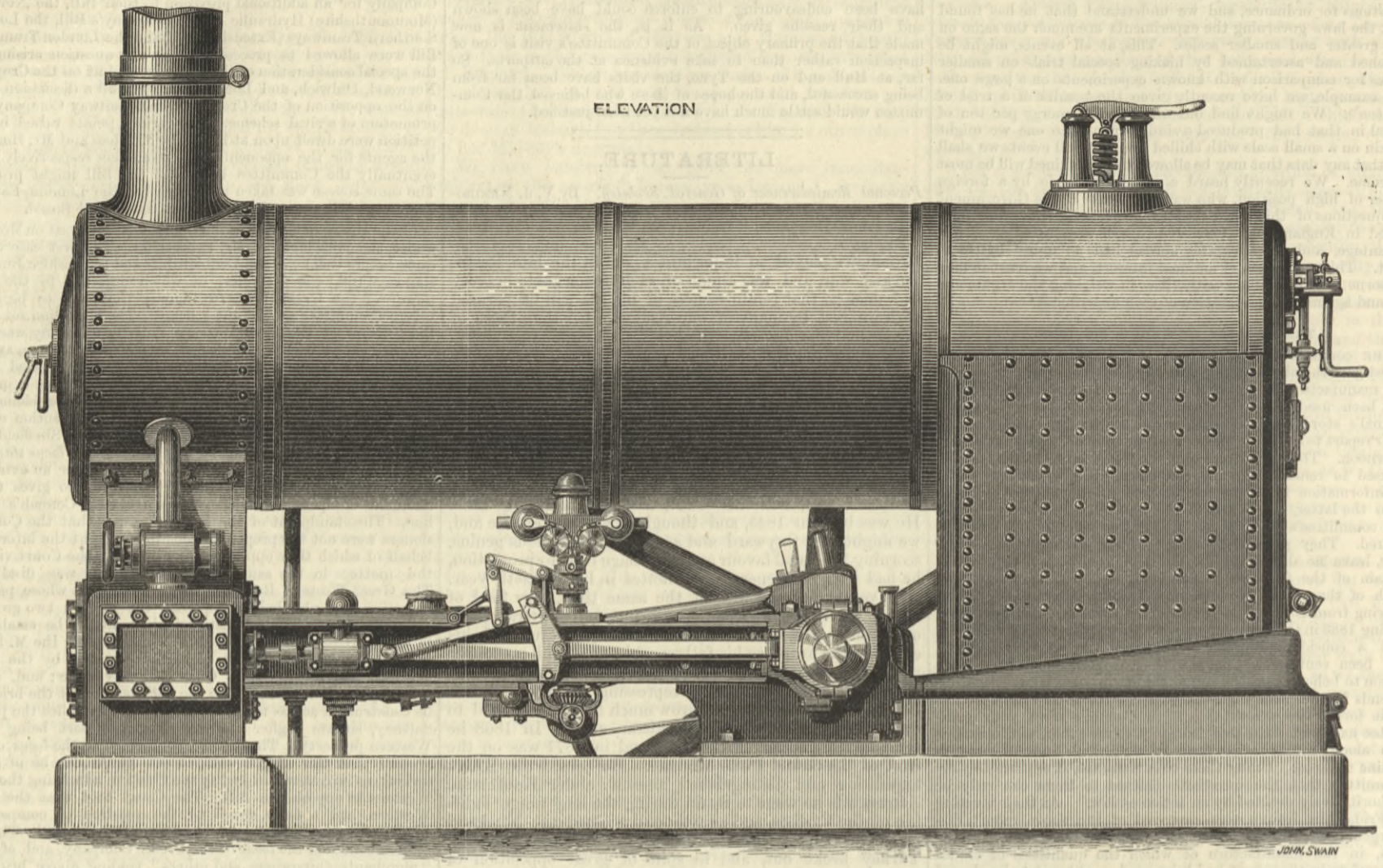
Group 9.—On Tuesday a Select Committee met to consider this group of six west county Bills. The first matter which came before the Committee was the Bishop's Castle Extension to Montgomery Railway Bill, of which the object is "to incorporate a company for constructing a railway from the Montgomery station of the Cambrian Railway to the Lydham Heath station of the Bishop's Castle Railway; and to authorise them to use those two stations, and to pay interest upon calls out of capital. The share capital of the new company is to be £150,000, and power is taken to borrow £50,000. The Cambrian Company opposed the scheme, submitting that the project was unnecessary. The Committee passed the preamble of the Bill.

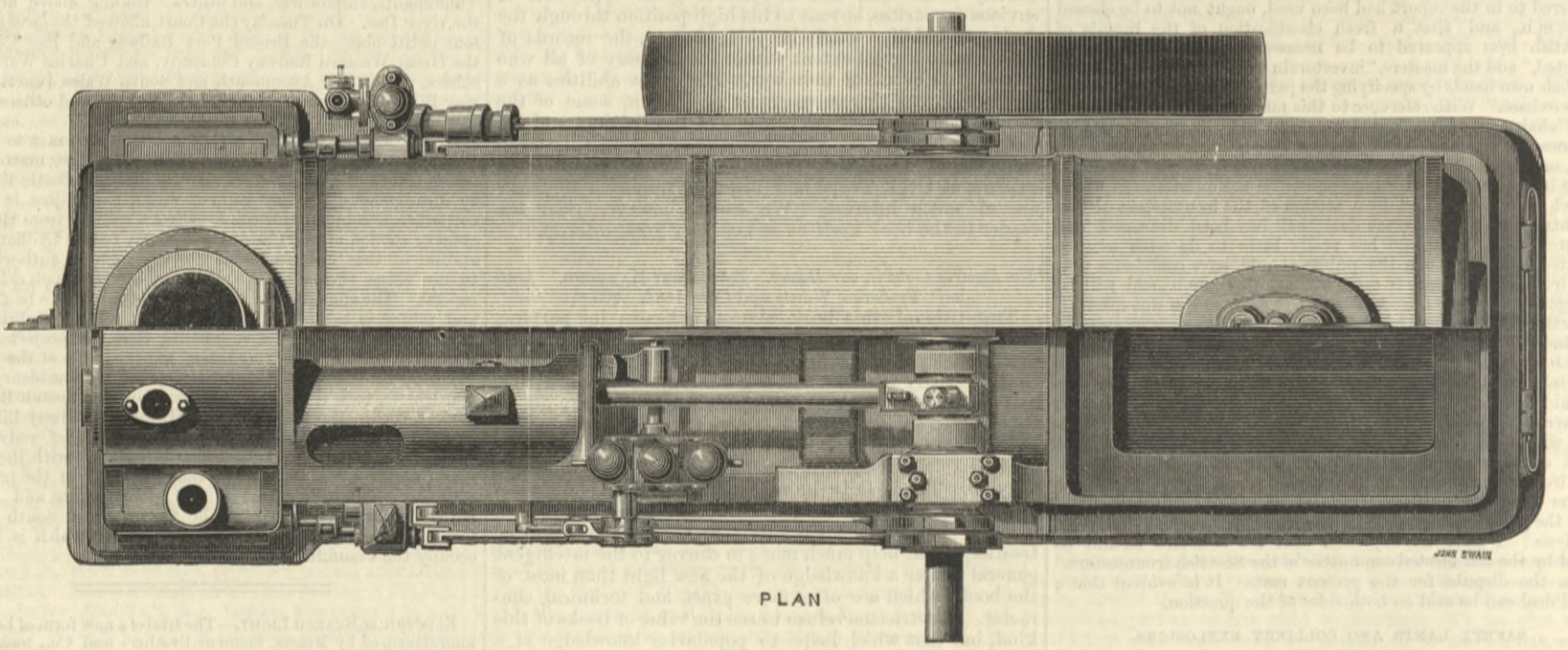
Group 13.—A Select Committee, under the presidency of Mr. Hardcastle, took this group, consisting of four Scotch Bills. The first of these—the Barrmill and Kilwinning Railway Bill—sanctions the construction of various short lines of railway, and enables the company to enter into agreements with the Caledonian Company. It is proposed that the name of the promoting company shall be changed to the "Lanarkshire and Ayrshire Direct Railway Company." The Glasgow and South-Western Company opposed the Bill, the hearing of which is likely to occupy the Committee for some days.

ELECTRICAL SEARCH LIGHT.—The trial of a new form of holophote, manufactured by Messrs. Siemens Brothers and Co., took place at the works of Mr. P. Brotherhood, Belvedere-road, Lambeth, on the evening of Friday last, and was witnessed by a number of experts representing the British Admiralty, foreign Governments, shipping companies, &c., as well as by several members of the Press. The holophote itself, which is to be placed on board Mr. Gordon Bennett's steam yacht Namouna, embodies several novelties which add greatly to its efficiency, as compared with existing apparatus of the same character. The departure from former designs, which constitutes the special feature of the new holophote, are briefly enumerated below:—As in earlier designs by the same makers, the light is concentrated into a beam of parallel rays by means of a Fresnel lens; but in the new holophote a lens of increased focal length is used, so as to admit of it being placed sufficiently far from the arc to avoid any excessive heating of the lens itself; and there was on Friday night's trial ample evidence that the object aimed at was achieved, as the lens, after three hours' run, was not sufficiently heated to prove inconveniently hot to the back of the hand. A plain glass screen in front of the lens, as well as a cylindrical hood, protects it from possible splashings of sea water. Considerable range of motion is given in horizontal and vertical planes, and divided circles are provided to enable any determined inclination to be recorded and reformed if necessary. The conductors in the holophote itself are carried up the trunnion arms, and are readily accessible by the removal of certain cover plates which are secured by screws, continuity at the joints being obtained by metallic slides. The usual coloured glass observing windows are provided, and a focus observer giving an image of the carbon points. There is also an apparatus for transmitting signals by the Morse code, which has the advantage of allowing signals to be sent with the whole beam of light, either concentrated or dispersed by means of an additional lens, a result which has not been hitherto obtained. There is ample ventilation of the lantern. The lamp is regulated by hand, and can be inclined at an angle, or be fixed vertically—when used with alternating currents—or be traversed to and from the lens to adjust its position at the focus. The carbons can be moved and adjusted independently or both together by one hand screw only. The results obtained were considered to be very satisfactory. A dense beam of light of great steadiness was produced with a minimum of dispersion. The current was 100 ampères, derived from a Siemens' self-regulating dynamo (S D_0) driven direct by a Brotherhood engine.

SEMI-PORTABLE COMPOUND ENGINE.

MESSRS. C. BURRELL AND SONS, THETFORD, ENGINEERS.





We illustrate above a fine compound engine which we have already noticed as exhibited at the last Smithfield Club Show. The arrangement shows the makers' new patent automatic expansion gear, in which the chief feature is bringing the die over the rocking centre of the link, thus allowing the valve to remain stationary when the governors are down, and greatly reducing the travel and wear and tear. Another feature is the forming of a parallel motion in the levers connecting the expansion valve rod to the governors, thus reducing all slip and tendency to hunting in the governors. Instead of the steel bands Messrs. Burrell are using Bessemer steel chains to connect the governor balls to the sleeve, and they find them much stronger and more durable. The balls are made with a recessed hole which works up to a shoulder, so that even if the chains were removed they could not fly off. The cylinders are 7in. and 12½in. diameter with 14in. stroke. The crank shaft, of forged steel, has counterbalances and unusually wide bearings. The crossheads are of steel, with steel adjustable shoes. The low-pressure cylinder is fitted with a double ported slide valve of the marine type in connection with a variable expansion excentric, to enable the cut-off to be proportioned to the duty given out by the engine. Starting gear is arranged at both ends in case of accident; the working pressure is 140 lb. per square inch; revolutions per minute, 155. The arrangement of the guides and framing is worthy of particular attention. This is an exceedingly well-designed and well-made engine, which will fully maintain the reputation for solidity of construction enjoyed by the firm. The engine is heavy, but the weight is just in the right place, and wear and tear and the chance of a breakdown are all reduced to a minimum.

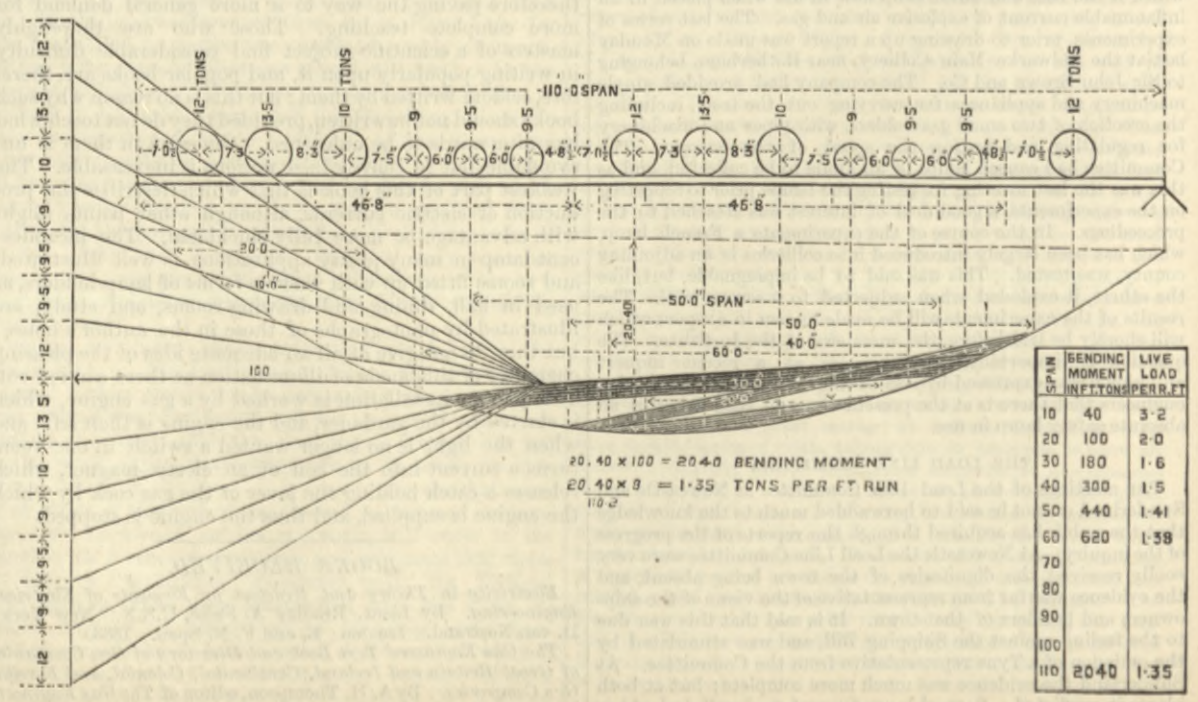
LETTERS TO THE EDITOR.

[*Continued from page* 201.]

GRAPHICS.

Sir,—I quite agree with Mr. Trew as to the advantages of graphic method, which saves a great deal of time and trouble. By this anyone can ascertain in a short time which is the most economical structure by drawing a few skeleton and strain diagrams and comparing their results, while other means fail to give the same result in the same length of time. It is a great blessing to those who have not a mathematical head. I take great interest in it, nd have applied it in designing bridges and roofs.

You will perceive from the following diagram—adopted by me in ascertaining the effects of live load, shearing forces and bending moments on a girder—that they can be ascertained by ruling some



SPAN	BENDING MOMENT IN FT. TONS	LIVE LOAD PER R. FT.
10	40	3·2
20	100	2·0
30	180	1·6
40	300	1·5
50	440	1·41
60	620	1·38
70		
80		
90		
100		
110	2040	1·35

number of lines as given by Mr. Trew. There is nothing new i it; but to show that the number of lines can be reduced, I have compounded the figures which are usually drawn separately. P and

Q, the reactions of supports and span, being given, let us find the position of weight R. Draw horizontal line A B representing the span, at A and B draw lines P and Q. Along the line P lay off by convenient scale A E = P, and from E, E D = Q; from E draw a line E F perpendicular to A D, on the line E F take any point C; join A C and C D. From the point B draw a line B G parallel to C D, then through G draw line R parallel to P and Q. R shows the position of weight on girder. The bending moment can be found by multiplying the length of line E C by H G measured with their respective scales. By reversing the above process we can easily find the reaction at supports.

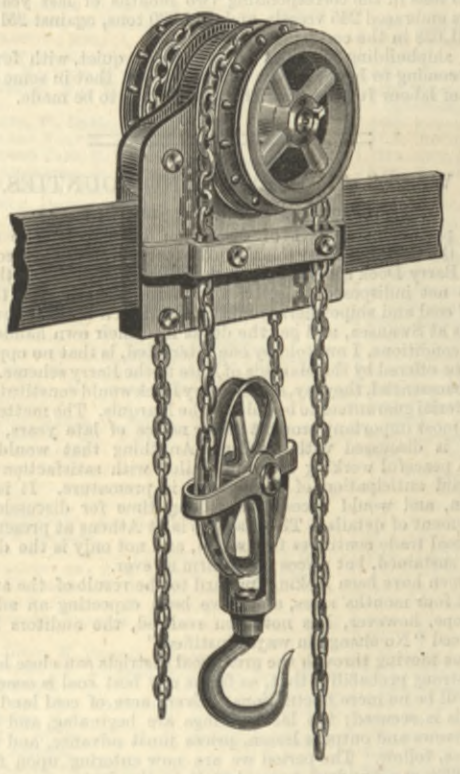
I enclose herein an interesting diagram which was prepared by me for reducing the concentrated loads into uniformly distributed load for bridge purposes. You will perceive what amount of time and trouble it has saved. This is not the only beauty of this diagram; but if it is once drawn for the heaviest load that could be brought on bridge for a span of some magnitude, we can easily find the distributed load for intermediate spans by marking the span under the heavier load that would come on it, and then transferring it to the funicular polygon, as shown in the diagram for 10ft. to 60ft. spans. Finding the bending moment first as mentioned above, for a simple case, we can find the distributed load by multiplying the bending moment by 8 and dividing it by the square of the span as per example given below. To find the bending moment for 110ft. span I have multiplied the ordinate of the funicular polygon 20·40 by 100, the constant horizontal thrust—thus $20{\cdot}40 \times 100 = 2040$ foot-tons the bending moment $\frac{2040 \times 8}{110^2} =$ 1·35 tons per foot run.

DORABJEE B. RABADINA.

Bombay, February 21st.

CHAIN CARRIAGE BLOCKS.

SIR,—During the years 1872, 1873, and 1874, I fitted out my workshop with several light cranes for blacksmiths' and turners' use, of the class which has a horizontal flat bar placed on edge for the weight bearing carriage to roll on, and supported at outer end by a diagonal back stay or stays down from the main post. At first I intended to so construct the carriages that Weston's block could be hooked in under them to constitute the lifting gear; but in the case of two of them which had to pass round under the truss rods of the roof tie beams, in order to lift machinery in and out of lathes, I saw that there was to be a want of height to lift circular work of only 4ft. diameter up to the centres. At this juncture it occurred to me that 10in. or 12in. in height could be gained by combining the top Weston block and carriage in one, and have only the lower block and hook under the crane bar. This combination turned out to be quite practicable, and has made one of the kindliest working lifts that could well be desired. It is shown complete in the accompanying drawing. With your permission I will give a description of the different parts of this combined block and carriage, as such may be of interest and service to some readers of THE ENGINEER. It will be observed that two separate chain wheels had to be used and placed on opposite sides of the carriage, with the largest wheel of the one and the smallest of the other next the side plates.



The chain works on the two inner wheels; the outer ones are of no immediate use, and remain good when those at work are worn out. These two double wheels are keyed fast on a short steel shaft, with length left between them for the weight-bearing roller and the thickness of the two side plates. This shaft is made somewhat larger in the middle, and is filleted down into the bosses of the wheels, and hardened in oil. The weight-bearing roller, which is nearly as large as the smallest chain wheel, is made of hard cast iron, and bushed with a hardened steel ferrule. Two small rollers are put between the side plates at the upper corners of frame, to keep it from tilting, but they take none of the weight off the centre roller; only one of them appears in the drawing. The sheave of the lower block is rounded out, as if made for a rope, and of a diameter to take the width of the loop of the chain as it hangs down from opposite sides of the carriage. Perhaps the most important parts of this combined Weston block and carriage are the chain guides, which necessarily lead the chain unmistakeably fairly on the wheels on both sides of the carriage, whether they are being drawn up or down. Each guide consists of two pieces, an outer and inner half; this last is rivetted to the side plates of the carriage, and the outer halves are fixed to them near the ends, with two set screws, as shown in photo. Two holes are cut centrally out of each half of the guides, and made in the form of a cross, in order to fit the links as they follow each other through them, and just large enough to allow the chain to pass freely. They are always ready for work, as no twisting of the chain ever takes place, and both chain and wheels last very much longer.

WM. ROBERTSON.

Dublin, February 27th.

THE BANGOR AND BETHESDA CONTRACT ACCIDENT.

SIR,—We shall be much obliged by your kindly reporting in a conspicuous part of your paper a correct account of the accident that occurred on the above new railway we are now constructing for the London and North-Western Railway Company. As the report that appeared in your last issue was greatly exaggerated and inaccurate, it has caused great annoyance to the engineers and ourselves. The following is a correct account of the accident:—"On Wednesday last, March 5th, an accident occurred on the above contract now in course of construction for the London and North-Western Railway Company. While four navvies were excavating the rock at the south face of the tunnel so as to allow of the arching being turned, a portion amounting to four cube yards fell upon the stage on which they were working and knocked part of it down, taking with it two of the men. One was killed by falling upon the rails, a distance of 10ft.; the other two were not hurt, and no damage was done to the tunnel. The rock that fell was required to be taken to allow of the tunnel being finished. The cause of the rock slipping was a fault in the formation, and could not have been foreseen." By inserting the above you will greatly oblige.

T. NELSON AND CO., Contractors.

Tregarth, near Bangor, March 12th.

CLOSE FIRE RANGES OR KITCHENERS.

SIR,—In reply to the inquiry of Mr. G. E. Child respecting the name of the inventor of the above, we beg to say a close fire range was patented, and range manufactured, by George Bodley, of Old Quay Foundry, Exeter, about the year 1797, and these were the first cooking ranges made to carry the heat around the oven. They are now manufactured in many counties and still called "Bodley's."

BODLEY BROTHERS AND CO.

Old Quay Foundry and Engine Works,
Exeter, March 12th.

CLOTHING STEAM PIPES.

SIR,—Referring to the letter of Messrs. Reid, Macfarlane, and Co., which appears in THE ENGINEER of last week, and is intended apparently to suggest a doubt about the composition tested being the genuine article, I beg leave to say that it was obtained through Messrs. Morton and Co., Liverpool, who received it direct from Messrs. Reid, Macfarlane, and Co.'s works. The shipping note and invoice issued by Messrs. Reid, Macfarlane, and Co., are in my possession, and they bear the marks corresponding with the casks received here containing the composition which was tested. Under these circumstances there is no doubt that the composition tested was a fair sample of the article Messrs. Reid, Macfarlane, and Co. supply to the public, and its value as compared with the composition of other manufacturers was fairly reported in THE ENGINEER of 25th January last.

WM. R. E. COLES, Hon. Sec.

National Smoke Abatement Exhibition,
44, Berners-street, Oxford-street, W., March 12th.

STEAM HAMMERS.

SIR,—Referring to the letter in THE ENGINEER of February 29th, the information upon which your paragraph was based was not intended to have any personal reference, and, as you are no doubt aware, hammers of this type, without slides, have been made for a generation by engineers at home and abroad. But even the hammers your correspondents refer to confirm the correctness of the statement as to construction. The openings cast in the framing below the cylinders, instead of being machined to the sizes and section of the piston rods, are about ⅛in. larger on all sides, so that there is no guide for the piston rods at the extreme bottom of the central parts of the framing.

B. AND S. MASSEY.

Steam Hammer Works, Openshaw,
Manchester, March 8th.

ELECTRIC LIGHTING FOR MILLS.

SIR,—In your "Miscellanea" for March 7th we notice that you state, in referring to a recent installation erected by the New British Iron Company, that you believe they are the first South Staffordshire ironmasters to adopt the electric light. Will you allow us to state that we have had the Gülcher system of electric lighting in a number of our mills for over twelve months? We are therefore ahead of the New British Iron Company in this respect.

MOREWOOD AND CO.

Woodford Ironworks, Soho,
Birmingham, March 10th.

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

(*From our own Correspondent.*)

THE proposal to reduce the output of ordinary merchant and galvanising sheets is being freely discussed this week. The action of the committee which has been appointed "to consider the best means to be adopted to secure the unanimous co-operation of the trade" will be watched with much interest. This—Thursday—afternoon in Birmingham they held their first meeting, but its direct result was not allowed to transpire upon 'Change. As I have before intimated, there are a great many difficulties in the way, and it is too early yet to pronounce whether they will be overcome.

Meanwhile a few of the makers are voluntarily curtailing the output at their individual works, and the tendency of prices to slightly more strength was more observable to-day than a week ago. In some quarters quotations were 2s. 6d. up upon the week. Singles were quoted £7 12s. 6d. and on; doubles, £8 2s. 6d.; and lattens, £9 2s. 6d. These advanced prices were not, however, generally secured.

The galvanised corrugated sheet makers did not report the receipt during the week of many additional orders of value. The quietude of the Australian market is a matter of much moment to these firms just now. Prices in this branch vary considerably, notwithstanding the existence of a trade association. The local representatives of the Birkenhead Galvanising Company quoted to-day—Thursday—£12 5s. to £12 7s. 6d. for 24 w.g. bundled, delivered Liverpool.

The Wolverhampton Galvanised Corrugated Iron Company, which is one of the largest concerns in the district, has purchased the site of the old Shrubbery Ironworks in Wolverhampton, for many years owned by the celebrated firm of G. B. Thorneycroft and Co. It is understood that the Corrugated Company intends to remove its present works to the new locality. The object aimed at is the securing of canal and railway siding facilities which the present works do not possess.

The demand for thin sheets continues excellent on export and home account, and makers are busy. The report that steel firms are just now pressing them very much for orders for ingots, blooms, and billets, in consequence of the limited amount of work in hand at the rail mills—an amount which promises to decrease rather than increase in the face of the new combination. Thin sheets were quoted by Messrs. E. P. and W. Baldwin to merchants at:—"Severn" singles, £11; Baldwin Wilden B, £12; ditto ditto B. B., £13; ditto ditto B. B. B., £14; ditto ditto charcoal, £16 10s.; ditto ditto Bt. charcoal, £19 10s.; ditto ditto E. Bt. charcoal, £21 10s.

The manufacture of steel in this district is extending. The New British Iron Company is now putting down a steel plant at its celebrated Corngreaves Ironworks, near Birmingham. The open hearth process has been adopted, and concerning the final magnitude of the plant I have it upon the authority of the company that this will be regulated entirely by the requirements of business, as it may by-and-bye develope itself. The company must necessarily, in engaging upon this new manufacture, be guided much by circumstances. At the present stage of the undertaking it does not deem it desirable to make known any more definite particulars. When the plant more nearly approaches completion I shall doubtless be in a position to enter into detail. The New British Iron Company, it will be remembered, is the firm which, as last week stated, has recently adopted the electric light at its works. These evidences of progress on the part of one of the chief "list" iron houses of South Saffordshire are altogether satisfactory.

The bar and hoop trade is in an irregular condition. The amount of business doing at the various works fluctuates considerably. Some mills are not making more than half time. Much activity is, however, noticeable this week at the works of Messrs. Noah Hingley and Sons. This firm, amongst others, is in receipt of good orders from New Zealand, the South and other parts of Australia, and other export markets; for heir excellent quality of bars. For some descriptions of iron on home account also they are experiencing a very fair demand. Upon chain and cable iron for their own use and for sale, the mills are running steadily. The firm quote their present list as here:—Netherton Crown bars, £7 10s.; horseshoe iron, £7 10s.; best rivet iron, £8; Netherton Crown plating bars, £8 10s.; double best ditto, £9; and treble best, £9 10s.

Angle iron up to 8 united inches is quoted £8, and T iron of the same dimensions £8 10s.

The bars of Messrs. Bagnall and Sons, Limited, up to 6in. flat and 3in. round and square, are quoted £7 10s.; 9in. flat and 4in. round and square, £8; 4¼in., £8 10s.; 4½in., £9; 4⅝in., £9 10s.; 5in., £10; 5¼in. rounds, £10 10s.; 5½in. rounds, £11; 5⅝in., £11 10s.; 6in., £12; 6½in., £13; 7in., £14; and 7½in., £15. The firm's turning and plating horseshoe bars are £7 10s. to £8; their angle iron, £8; and rivet iron, £9 to £10.

Wm. Millington and Co.'s ordinary bars are quoted £7 10s.; small rounds and squares, £8; $\frac{5}{16}$in., £8 10s.; ⅜in., £9; No. 5, £9 10s.; $\frac{7}{16}$in., £10; No. 7, £11; No. 8, £12; No. 9, £13 10s.; No. 10, £15 10s.; and No. 11, £17 10s. Cable iron is £8; chain iron, £9 to £10; tang iron, £9 10s., according to quality; rivet iron, £8 15s. to £10 5s.; and angle iron, £8 10s. to £10.

Pigs are here and there moving off in somewhat larger parcels this week, but there is still not much activity in the trade. Such native firms as Messrs. Alfred Hickman and Son report that their current output of part-mine and cinder pigs is going away steadily. All-mine pigs are quoted at 62s. 6d. to 60s. for hot blast sorts, and cinder pigs are 40s. easy. Foreign sorts are unchanged in price on the basis of 45s. for Derbyshires.

The lowness of current prices for scrap iron is shown by the following incident:—Recently a request for tenders to buy 30 or 40 tons of wrought scrap iron was made. The highest offer received was 35s. per ton. This was in South Staffordshire, and covered delivery at works; yet last week a local trader booked in London, as a speculation, 20 tons of wrought scrap at 12s. 6d. per ton. This purchase will be sold again in this district.

Touching the maintenance of the Mill and Forge Wages Board, the masters' secretary has sent round to all the works notices declaring that whether the operatives refuse to subscribe or not, the employers will continue to pay their share. The notices are accompanied with a request that in accordance with a recommendation adopted at a recent meeting of the Board, the notices be posted up in the several works.

The work now being sent away from the constructive engineering yards includes a contract at the Crescent Works, Willenhall, of Mr. Jesse Tildesley, for a roof for a large public building in this country. It is in three portions, one of which is the dome. Steel is not entering in any important degree into any of the structure. The weight of iron to be consumed is 150 tons. The dome is being erected 60ft. from the ground and is itself 40ft. high, whilst the diameter of the largest inside circular measurement is 70ft. The dome consists of strong cellular wrought iron lower curb, with twenty-four rivetted wrought iron jointed, curved, and tapered main ribs. At the top these are held in position by a large wrought iron top curb or ring, and at intervals down their length are secured by rivetted curvilinear purlins. The inside of the base of the dome is a true circle, but the outside is an octagon, of which the peripheric measurement is 240ft. When complete the dome will have inserted between each rib slips of polished marble. The measurements of the whole of the ironwork employed have been most precise, being correct to the eighth of an inch. Of the three portions into which the roof is divided, one had already left the works before the dome was begun. In the course of a few days the dome will be out of hand, when there will only remain that portion of the roof which is intended to cover the transepts of the building.

A contract for between 200 and 300 tons of cast iron socket pipes, 7in., 6in., 4in., and 3in. sizes, is upon the market from the Kenilworth Waterworks Company, and should fall to some founder in this district. Local engineers note also that the ironwork needed for the sewage purification works at Wolverton, Bucks, is now being inquired for. The work includes water-wheel, gearing, mixers, carriers, valves, pipes, and the like.

Export orders for hardwares continue below the average, but an improvement is expected. In some of the heavy trades of the district foreign orders are increasing, and hardwares should by all precedents follow suit. The overstocked condition of the colonial market keeps the demand and prices from that source very satisfactory. Only little good to this district is expected to result from the proposed tariff changes in the United States, even if they should become law. But in the event of the Morrison Bill getting through the House of Representatives, the protectionists will find a great stronghold in the Senate and the President.

Birmingham manufacturers continue to receive intimations from Calcutta of their success at the Exhibition in the matter of awards. The evidence which these awards give of the continued excellence of the manufactures in this great centre is very satisfactory.

The strike in the Shropshire wire-drawing trade continues. Messrs. Nettlefold's wire-drawing works in Birmingham are not affected by the dispute, since the men there are employed under a special arrangement, and the works, therefore, keep in as steady employ as hitherto.

Manufacturers are watching with interest the progress of the King's Norton Gas—Purchase—Bill, before a Committee of the House of Lords. According to Mr. G. Stephenson, engineer, of Westminster, about £80,000 will have to be raised, of which £70,000 will be expended in the erection of works. The revenue would be £9900, and the profit £4767. The interest and sinking fund would represent £3600, and there will therefore be a net profit of £1167 on the year's working. The district consumed over 80,000,000ft. of gas in 1882, and it is asserted that the profit to be attained from the works will largely reduce the rate. The opposers of the Bill affirm that the Birmingham Corporation can supply gas at far cheaper rates.

Among the sanitary engineering operations in prospect hereabouts is the carrying out, by the public authorities of Wednesbury, of a sewerage scheme of considerable proportions. The difficulties in the way of carrying long sewers over ground honeycombed with mines compel the abandonment of what would otherwise be an economical combination of the authorities of Wednesbury, Darlaston, and Tipton in the matter, and throws upon these districts the onus of separate provision. Wednesbury, for its part, finds it necessary to expend some £35,000. Mr. E. Pritchard, C.E., has drawn up for the town a scheme in which the principle is that of precipitation supplemented by filtration. It is for 25,000 persons, sewage only being taken. There would be a straining tank, where the sewage would be mixed with sulphate of alumina, and the effluent would be discharged into the Tame. With the present population of the district there would be 8½ tons of sludge per day to be disinfected. All the mixing and other operations would be carried on underground, and nothing would be left exposed except the clear water in the tanks.

The South Staffordshire railway separates the line where the works would be situated from the nearest houses and property, and the railway is on an embankment to a point above where the tanks would be placed. The owners of this property, however, object to the project, and on Tuesday urged their objections before the inspector, Mr. J. T. Harrison, sent down by the Local Government Board upon the application for powers to borrow the £35,000 required. The decision of the inspector is postponed.

Darlaston proposes to spend on a similar object some £22,500; the principle adopted in this case being a system of filtration by beds, and the sewering of the town by pipes varying from 3in. to 7in. in diameter. The sewage is intended to be discharged into an outfall at James Bridge, and thence would be raised on to land adjoining by pumping engines. During an official inquiry, resulting from an application for powers to borrow, the Local Government Board inspector on Wednesday expressed himself favourable to the scheme.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The condition of business throughout every branch of the iron trade in this district continues very unsatisfactory, and all through there is one general complaint of depression. The weight of new orders coming into the hands of pig iron makers is extremely small, and the position of finished iron makers is even worse, as not only is there so very little business giving out in manufactured iron that some of the local forge proprietors are beginning to feel seriously the scarcity of orders, but they are having to face an exceedingly keen competition on the part of the Cleveland makers, who are offering at prices which local makers could not attempt to accept. Nominally, Lancashire makers of both pig and finished iron are holding on to late rates, and, so far as the pig iron makers are concerned, they have still tolerably large deliveries to make against old contracts; but there is such an absence of any weight of work in prospect that it is more a question of whether present prices can be maintained than of any possibility of an advance, and the whole tendency of the market is in the favour of buyers, who naturally show a disposition to hold back from giving out any orders at present beyond what is necessary for absolute requirements.

There was again a very dull market at Manchester on Tuesday, and although the firmer tone reported from Glasgow and Middlesbrough had to some extent a steadying influence as regards prices, which could not be said to be any lower quotably than last week, the weight of actual business doing was not appreciably affected. Both local and district makers of pig iron report that they are booking extremely few new orders; for delivery equal to Manchester they still quote, however, 44s. 6d. for Lancashire, and 44s. 4d. to 44s. 10d. for Lincolnshire forge and foundry less 2½, but the actual business doing at these figures is so small that they are little more than nominal quotations. During the week an advance of 6d. to 1s. per ton upon late rates has been asked for Middlesbrough iron, and one or two sales of good brands have been made at about 45s. 4d. net cash, delivered equal to Manchester, but the rise in Scotch warrants is altogether disregarded in this market, as it is looked upon simply as the result of purchases that are being made by nervous "bear" speculators.

Occasional fairly large sales of hematites are reported at low figures, but generally business is quiet, and 56s. to 56s. 6d., less 2½ per cent., remains about the average price for good foundry brands delivered into this district.

In the finished iron trade, rather more business is reported in sheets, chiefly for shipment, and for the better class brands makers are holding for £8 per ton, but there are inferior qualities to be bought for delivery into this district at 5s. to 10s. per ton under the above figure. In other descriptions of finished iron there is no improvement whatever; Lancashire makers, in most cases, still quote £6 for bars delivered into the Manchester district, although in a few cases 2s. 6d. less might be taken for good specifications; but Cleveland makers are offering both bars and plates freely at as low as £5 12s. 6d. per ton delivered here.

All branches of the ironfoundry trade are in a very depressed condition, and in most cases works are only kept going with reduced staffs of men. Of heavy builders' work there is extremely little giving out, and there is so keen a competition for any orders that do come into the market, that cast iron columns can be bought for £5 to £5 5s. per ton, whilst ordinary pipe castings, turned and bored, are offered at as low as £4 10s. to £4 12s. 6d. per ton, delivered into the Manchester district.

As regards the engineering trades there is no material change to report. With a good deal of keen competition some works are kept fairly supplied with orders. Tool makers are still moderately employed, and a few special branches are busy. Generally, however, orders are thinning down, and prospects for the future are not encouraging.

The quarterly meeting of the Manchester Association of Employers and Foremen was held on Saturday, Mr. Thos. Ashbury, C.E., the president, in the chair. Four candidates for election were proposed, and of these eleven were elected members. The resolution in favour of the Manchester Ship Canal, of which I gave an abstract last week, was unanimously adopted.

Business in the coal trade of this district has shown a slight improvement during the past week. At the reduced rates, which come into operation this month, the better classes of round coal are moving off rather more freely for house fire purposes, and although pits in most cases have still to be kept on about four days a week, the accumulation of stocks has been checked. Common round coals still move off only slowly for iron making and steam purposes, and the tendency of requirements for general trade purposes continues more in the direction of contraction than expansion. The present small production of engine fuel continues to move off freely at full current rates. At the pit mouth prices remain at about 9s. to 9s. 6d. for best coal, 7s. 6d. for seconds, 6s. for common house coals, 5s. 6d. to 6s. for steam and forge coals, 4s. 6d. to 5s. for burgy, 4s. to 4s. 3d. for best slack, and 3s. 3d. to 3s. 6d. per ton for good ordinary qualities.

In the shipping trade a rather better inquiry is reported with a moderately increased weight of business doing, but 7s. 6d. per ton remains about the full average figure obtainable for ordinary Lancashire steam coal delivered at the high level, Liverpool, or the Garston Docks.

Barrow.—I have to report this week a slight falling off in the business doing in hematite pig iron. The market is much quieter than it has been for sometime past, and owing to the lack of business, prices have seen a considerable fall. Buyers are slow in coming forward, and they do not place much confidence in makers. The present business doing is mainly to supply more immediate wants, and not with any idea of speculation. The orders coming to hand from home consumers are both inextensive and inconsiderable, and the business doing on foreign account is considerably restricted. Prices this week have seen a great change, and quotations are made at 1s. per ton reduction on all qualities of Bessemer. Now I hear that mixed parcels of Bessemer iron are offered and selling at 46s. per ton net at works, prompt delivery. Steel makers find the trade in a very quiet position, and they are not consuming large parcels of Bessemer. The orders being booked are anything but satisfactory. Rails are but in quiet demand at from £4 10s. per ton net at works and upwards. Greater activity is displayed in the merchant department. Shipbuilders are also remarkably quiet, and few new contracts are reported as having been booked. Engineers and boilermakers are but indifferently employed. Iron ore is quiet at last week's quotations.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

According to the official statistics for February, our trade in coal, coke, &c., has increased from £676,427 to £739,695; but last month's exports in hardware and cutlery were only £231,090, as compared with £294,633 in February, 1883. Every market shows a decrease except Holland and the United States; the former has increased from £5636 to £7030, and the latter from £28,024 to £29,359. These increases are very slight, and compare most unfavourably with the falling-off shown by Russia, from £2559 to £1727; Foreign West Indies, from £8571 to £2324; Brazil, from £18,786 to £12,967; Argentine Republic, from £10,536 to £5645; British North America, from £12,556 to £8872; British Possessions in South Africa, from £10,410 to £5938; British East Indies, from £27,598 to £22,209; Australasia, from £67,557 to £43,354.

Pig iron also shows a serious falling-off during the month, from £224,352 to £164,361. The increasing markets are Russia, Germany, and Holland. Belgium shows an immense falling-off, from £32,643 to £4291; France has dropped from £38,156 to £25,444; Italy, from £14,739 to £9574; the United States, from £58,933 to £34,591. In steel rails there is another heavy decline. In February, 1882, the value exported was £365,999; in February, 1883, the value fell to £301,670; and for last month there was a further fall to £230,886. Holland, which took rails to the amount of £9550 in February of 1883, had none at all last month; Italy fell from £32,295 to £6119; Mexico, from £18,823 to £1655; the Argentine Republic, from £33,068 to £21,708; British North America, from £9239 to £685; British Possessions in South Africa, from £20,161 to £4827; British East Indies, from £80,528 to £26,531. Australasia, on the other hand, has increased from £36,610 to £80,513.

In unwrought steel there is also a considerable decrease, the value last month being £79,672, as compared with £105,612 for the corresponding period of 1883. The falling off in the United States trade is sufficient to account for the whole of the decrease, last month's exports to that market being only £22,720, while for February, 1883, they were £49,853. It does not make the figures any more pleasant reading when it is remembered that in February, 1882, we exported unwrought steel to the value of £181,856.

Machinery and mill work—other than steam engines—show a gratifying increase, the value for February last being £318,164, or nearly £103,000 in excess of that for February, 1883. Brazil shows a remarkable increase, from £8936 to £26,858, and British East Indies from £25,640 to £86,413, Australasia from £32,508 to £44,134. The decreasing markets are Russia, Egypt, United States—which had only £1755—British North America, and British Possessions in South Africa.

Generally, the trades of the town continue very quiet. The leading cutlery houses are fairly well employed; but there is no pressure in any department. The lesser houses are short of work, and there is undoubtedly a good deal of distress in the town, though it is endured in silence. There is not much prospect of any great change for the better this side of the next winter.

There is some movement in the silver trades. Messrs. James Dixon and Sons, of Cornish-place, have been remarkably busy during the whole of the season, and they have just received a splendid order from Australia, which includes a general assortment of their chief products in the silver and plated wares. This firm are also doing a capital business in the Indian markets, as well as for South America, especially in the Spanish Possessions. Messrs. Walker and Hall, of the Electro Works, Howard-street, have succeeded in carrying off some good Government orders for the Admiralty. They report an increasing demand in their sterling silver department, which does not look as if the general public anticipated any early repeal of the silver duty. Messrs. Walker and Hall are bringing out an instantaneous plate cleaner, which is certain to be appreciated in every household where there is any quantity of silver to be kept bright, and particularly by shopkeepers who have but limited time in which to maintain their goods in a condition to attract customers.

The Limerick Wheel, famous in the days of the Sheffield flood—just twenty years to a day as I write—is the site of extensive new works, which Messrs. Ward and Payne, the well-known edge tool, carving tool, and sheep shear manufacturers are erecting specially for the production of sheep shears on a large scale. The firm are adding another and a new department at Limerick Wheel for the manufacture of spades and shovels.

Messrs. Taylor Brothers, Adelaide Works, Sheffield, have been awarded a first-class certificate and gold medal for their exhibit of saws, &c., at Calcutta Exhibition.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

A fair amount of business was done at the Cleveland iron market, held at Middlesbrough on Tuesday last, and prices were somewhat higher than ruled a week previously. Buyers appear more inclined to place their orders than they have been for some time past; and so far as pig iron is concerned, the market is much firmer since the stoppage of furnaces commenced. For this month's delivery 37s. was on Tuesday freely given for No. 3 g.m.b. For special brands makers ask 37s. 6d. to 38s. per ton, and will not take less. Owing to a deficient supply, the price of forge iron has risen to 35s. 6d. per ton, and below this figure none can be had; some makers even ask 6d. to 1s. per ton more for it.

The stock of Cleveland pig iron in Messrs. Connal and Co.'s Middlesbrough store continues to decrease. The quantity held on Monday last was 61,050 tons, being a reduction of 200 tons for the week. In their Glasgow store they hold 594,006 tons.

There is no change for the better in the manufactured iron trade. But few mills are kept at work without intermission, and there is the greatest difficulty in procuring specifications. Fresh orders are exceedingly scarce. Prices remain about the same, ship plates being £5 2s. 6d. to £5 5s. per ton, shipbuilding angles £4 15s. to £4 17s. 6d., and common bars, £5 to £5 2s. 6d., all free on trucks at makers' works, less 2½ per cent. discount. Puddled bars are offered at £3 5s. per ton net, free on trucks at makers' works. The steel rail mills are tolerably well employed, but new orders are difficult to get, and prices do not improve.

It will be remembered that most of the steel rail makers, both British and Continental, are now confederated, in order to keep up prices. They have managed to do this in some degree, but only at the cost of remaining to a considerable extent idle.

The value of the goods exported from the Tees in February—exclusive of coal and coke—was £146,436, being a decrease of £6296 compared with February, 1883. The exports from Newcastle last month are valued at £159,667.

A new shipping company, to be called the County Steamship Company, Limited, is being organised at Middlesbrough. The capital is £48,000 in £10 shares, and arrangements are being made for the purchase of two screw steamers of 2400 tons capacity each. There are only forty-two steamers owned in Middlesbrough, and, considering the large exports and the recent increase of the chemical and salt trades, it is thought that there ought to be room for further enterprise in that direction.

A meeting of the Board of Arbitration will be held at Darlington on Monday next to discuss the future wages of ironworkers. It is probable that the notice for a 10 per cent. reduction will be referred to an arbitrator.

The strike of platers' helpers at Stockton has come to an end, the men agreeing to a reduction of 1s. 6d. per week. At Messrs. Craggs and Son's shipyard at Middlesbrough a reduction of 1s. per week only has been effected, but the full reduction of 1s. 6d. per week has been agreed to at Messrs. Raylton Dixon and Co.'s yard. At Hartlepool the dispute has been settled by the men agreeing to a 5 per cent. reduction. On the Tyne the helpers came out on strike on the 4th, and still so remain. The platers desire to reduce outside men 2s. and inside men 3s. per week. About 100 men are affected. The helpers on the Wear are also on strike.

Mr. A. J. Dorman, managing partner of the firm of Dorman, Long, and Co., of the Moor Ironworks, and chairman of the North-Eastern Steel Company is seriously out of health through overwork. He is ordered three months' rest by his medical attendant.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

Since the report of the committee on pig iron in Connal's stores was issued, there has been considerable animation in the warrant market, a large quantity of iron having changed hands at advancing prices. There have also been some additions to stock, amounting in all to about 900 tons for the week. The number of furnaces in blast is 97, as compared with 113 at this date last year.

Business was done in the warrant market on Friday up to 42s. 8d. cash. On Monday transactions occurred in the forenoon at 42s. 6d. to 42s. 10½d. cash and 42s. 8d. to 43s. one month, the afternoon quotations being 42s. 10½d. to 42s. 9½d. and 42s. 10d. cash, and 43s. 0½d., 42s. 11d., and 43s. one month. The market was strong on Tuesday, with transactions at 42s. 11d. cash. Business was done on Wednesday at 42s. 9½d. cash, and to-day—Thursday—transactions took place at 42s. 9d. to 42s. 9½d. cash, and 42s. 11½d. one month.

The market values of makers' iron are firmer, as follow:—Gartsherrie, f.o.b., at Glasgow, per ton, No. 1, 53s.; No. 3, 51s.; Coltness, 57s. 6d. and 51s.; Langloan, 54s. 6d. and 51s.; Summerlee, 52s. and 48s. 6d.; Calder, 53s. 6d. and 48s.; Carnbroe, 52s. 6d. and 48s. 6d.; Clyde, 48s. and 45s. 6d.; Monkland, 44s. 3d. and 41s. 6d.; Quarter, 43s. 9d. and 41s.; Govan, at Broomielaw, 44s. 3d. and 41s. 6d.; Shotts, at Leith, 53s. 6d. and 52s.; Carron, at Grangemouth, 48s. 6d.—specially selected, 54s.—and 47s. 6d.; Kinneil, at Bo'ness, 46s. and 45s.; Glengarnock, at Ardrossan, 52s. and 46s.; Eglinton, 46s. and 43s.; Dalmellington, 49s. and 45s. 6d.

Nearly 7000 tons of iron ore were received in the Clyde from Spain last week.

Evidences are accumulating as to the increasing slackness in the manufactured iron trade of the West of Scotland. Several hundreds of workmen have been paid off at the Lanarkshire rolling mills, and it is feared that the business will be very quiet during the remainder of the spring and summer.

There is a better feeling in the coal trade of the West of Scotland. It is now all but apparent that the lowest point in prices for the season has been touched, and on this account there is likely to be a substantial increase in the demand on the parts of consumers who have been holding back for still lower rates. The shipments at the different ports exhibit a slight increase. Among the cargoes despatched from Glasgow were 1300 tons to River Plate, 1400 to Odessa, 3060 to Bordeaux, 1100 to Savona, 900 to Passages, 800 to San Francisco, and smaller quantities to other places. There is a want of animation in the coal trade in Fife and Clackmannan. Prices are now reduced to 6s. 6d. to 6s. 9d. per ton f.o.b. at Burntisland, and even at these low figures it has been difficult to obtain orders for cargoes. The week's shipments at Leith amount to 3000 tons, while 1143 tons left Grangemouth.

In Fifeshire the colliery owners have a great deal of trouble with the union, which is now the only one of any consequence remaining in the mining industry of Scotland. The men are kept continually in a ferment, and their conditions for the last twelve months contrast most unfavourably with that of the colliers in the principal West of Scotland mining districts, where no union worthy of the name exists. Mr. Thomas Barr has dismissed 100 miners from his Orchard gas coal pit at Carlisle in Lanarkshire. Meetings have lately been held in the Hamilton and Dalsery districts, at which resolutions were passed that the colliers should restrict the output of coal. At one or two collieries efforts are being made to carry this resolution into effect, but it will be impossible to obtain unanimity among the miners on the subject.

In the past two months 97,710 lb. of gunpowder were exported from the Clyde, as compared with 53,200 lb. in the corresponding period of 1883.

During January and February 242 vessels with an aggregate tonnage of 202,593 arrived in the Clyde, as against 227 vessels and 185,545 tons in the corresponding two months of last year. The sailings embraced 245 vessels and 244,220 tons, against 251 vessels and 241,038 in the corresponding period.

The shipbuilding trade of the Clyde is quiet, with few fresh orders coming to hand, and it is anticipated that in some departments of labour further restrictions will have to be made.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

The prominent subject of discussion throughout the district during the week has been the alleged overtures from the promoters of the Barry Dock scheme to buy the Bute Docks. That the Marquis is not indisposed to sell is a fact, and equally true that the Cardiff coal and shipowners would gladly hail a harbour trust the same as at Swansea, and get the docks into their own hands. One of the conditions, I am told by one interested, is that no opposition should be offered by the Marquis of Bute to the Barry scheme. This would be essential, they say, as the Barry Dock would constitute one of the material guarantees to be held by the Marquis. The matter is one of the most important brought under notice of late years, and at Cardiff is discussed with avidity. Anything that would bring about a peaceful working must be hailed with satisfaction; but I am afraid anticipation of a purchase is premature. It is a big question, and would necessitate a long time for discussion and arrangement of details. The Marquis is at Athens at present.

The coal trade continues to flourish, and not only is the demand as well sustained, but prices are as firm as ever.

The men have been looking forward to the result of the audit of the last four months' sales, and have been expecting an advance. This hope, however, has not been realised, the auditors having announced "No change in wages justified."

No one moving through the great coal districts can close his eyes to the strong probability that, so far as our best coal is concerned, there will be no more fluctuations. Every acre of coal land in the Rhondda is secured; the last sinkings are beginning, and as the area narrows and outputs lessen, prices must advance, and wages, of course, follow. The period we are now entering upon may be one of fifty or a hundred years, but it is the last as regards the valuable No. 3 Rhondda and 4ft. steam coal. When the owners of these coals—and they might all go into a small London parlour—can be sufficiently trustful of each other to associate for the purpose of getting proper value, some return will be obtained fo the disastrous years and sunken capital of the past.

The question of obtaining the Fleuss life-saving apparatus ha been before the coalowners, and has been relegated to the Sliding-scale Committee. A few will very likely be obtained in the more fiery districts. There can be little doubt that, if some had been used after the last explosion, the rescuers would have been saved.

Some of Vipond's men, Monmouthshire, are on strike. The cause is that the "croppings" reduce the earnings of the men below a living standard. It is a pity that the men, instead of striking, had not appealed to the Arbitration Committee.

February totals of work are satisfactory. Cardiff sent away 582,000 tons of coal; Newport, 140,000 tons; Swansea, 80,000 tons; and Llanelly, 5000 tons in round numbers. In addition 200,000 tons were sent away from the various ports by coastwise shipment. Iron does not show so well. Cardiff sent away 9900 tons, Newport 5494 tons, and Swansea 573 tons. Patent fuel, on the contrary, is in good form. Since January 1st Cardiff has sent away 29,000 tons and Swansea 55,395 tons. Swansea is decidedly looking up in importance as a port, and the rumour there this week is that Liverpool steamers are going to call there for America. This has reference to the tin-plate trade, which is fairly maintained. Good steel plates are in demand. Steel rails are in feeble requirement. In fact, all the works are not half so vigorously employed as they might be, and prices remain in the same inanimate state. Some large machinery has been placed in the new Troedyrhiod Works this week, and the skill exercised in getting it into position on the side of a hill was creditable.

The report of the Permanent Relief Fund is satisfactory. In 1881 the members were only 5634; in 1883, 22,541. In 1881 the claims against the fund were five, last year fifty-seven.

There is no movement of any account in iron ore. An average quantity has come to hand at Newport and Swansea, but sales are slow. One vessel in the trade, owned by a Cardiff firm, has gone down near Bilbao.

In connection with the International Health Exhibition to be held at South Kensington, is to be an exhibition to illustrat the operations and influence of schools of art.

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.

4th March, 1884.

4305. WATER-CLOSET, A. Emanuel, London.
4306. SAFETY HYDRAULIC BEARINGS, D. Stewart, Glasgow.
4307. TRAM-CAR PROTECTOR, S. G. Lingham, Liverpool.
4308. VENTILATOR for FODDER BAGS, W. P. Thompson.—(*F. Wheaton, New York, U.S.*)
4309. ELECTRIC TIMEPIECES, W. P. Thompson.—(*F. Baumann, Waldenburg.*)
4310. TRIMMING WICKS, F. R. Baker, Birmingham.
4311. HANDLES for CARRYING PACKAGES, A. A. R. Gibbs, Birmingham.
4312. REGENERATIVE FURNACES, J. W. Newall, Ongar.
4313. KILNS, J. W. Newall, Ongar.
4314. HORSESHOES, E. Bray, Halifax.
4315. MACHINE for PEELING OSIERS, J. Rowlatt, Leicester.
4316. WHEELS, J. Browning, Strand.
4317. SECURING PULLEYS to AXLES, &c., W. Cook, sen., and T. Cook, Attercliffe.
4318. GROOVING IRONS, W. Cook, sen., and T. Cook, Attercliffe.
4319. LAMPS, C. Campbell, Sheffield.
4320. MAKING MATS, J. Whiteley, Salford.
4321. HOLDING, &c., PAINTERS' PIGMENTS, H. J. Allison.—(*F. S. Dellenbaugh, New York.*)
4322. STRAIGHT-WAY STOP VALVES, H. J. Allison.—(*J. H. Blessing, Albany, U.S.*)
4323. FUR-CLIPPING MACHINE, H. J. Allison.—(*O. Simonson and E. Schott, New York.*)
4324. REVOLVING RIFLE, G. Shepheard, Ivy Bridge.
4325. MAKING AERATED LIQUIDS, R. A. Mossman and J. M. Mayelston, Brough.
4326. SIZING, &c., YARN, L. Simpson, Preston, and H. Livesey, Blackburn.
4327. TRANSMITTING SOUND by means of ELECTRICITY, F. V. Stead and E. R. Hedgman, London.
4328. OVAL MIRRORS, H. Besson and E. Kent, London.
4329. LAMP BURNERS for VELOCIPEDES, F. Spencer, Northfield.
4330. MINERS' SAFETY LAMPS, G. A. Haworth and E. Jones, Cawthorne.
4331. SEWING MACHINERY, A. G. Brookes.—(*W. F. Beardslee, Boston, U.S.*)
4332. SIMULTANEOUS OPENING LIGHTS or SASHES of GARDEN FRAMES, D. McKellar, London.
4333. EXTRACTING METALS, J. Miles, London.
4334. MEASURING, &c., the QUANTITY of WATER PASSING through a MACHINE, F. Chambers, London.
4335. ADJUSTING the WICK in LAMPS, G. Charman, London.
4336. BRAKES, W. Davis, London.
4337. TAPS and VALVES, J. Blackburn, Bushey.
4338. DIES and TAPS, T. Vollkommer, London.
4339. DYNAMOMETER, R. H. Brandon.—(*E. A. Gleason and J. H. Swartz, New York, U.S.*)
4340. DOUBLE DRIVING GEAR for TRICYCLES, V. A. Wraight, South Hornsey.
4341. COPYING TRACINGS, &c., W. R. Lake.—(*P. H. Mandel, Astoria, U.S.*)
4342. KNEADING DOUGH, &c., H. H. Lake.—(*O. R. Chase, Boston, U.S.*)
4343. STRIKER, &c., for PAPER-RULING MACHINES, W. C. Pellatt, London.
4344 VELOCIPEDES, W. T. Crooke, London.
4345. FARE-REGISTERING APPARATUS, W. R. Lake.—(*J. J. Wesselman, Weteringschaus, Amsterdam.*)
4346. INSULATING MATERIALS, W. R. Lake.—(*T. S. Leigh, Philadelphia, U.S.*)
4347. WINDOW SASHES, G. Pelling, Hornsey.
4348. ANTIFOULING, &c., PAINTS, H. J. Haddan.—(*W. D. Folger, Calcutta.*)
4349. SPINNING MULES, J. Wardle, Oldham.
4350. SEPARATING MACHINE, J. C. Mewburn.—(*C. F. F. Frohberg, Roswein, Saxony.*)
4351. STRAIGHTENING, &c., LENGTHS of WIRE, J. Shelton, Wolverhampton.
4352. RAKES, W. R. Lake.—(*J. Moore, Greeley, U.S.*)
4353. JEWELLERY, &c., E. E. Atkins, Birmingham.
4354. SASH FASTENERS, W. Watson, London.
4355. PNEUMATIC CANNON, W. A. Bartlett, U.S.
4356. PRODUCING CASEINE PEPTONE, &c., T. Weyl, Berlin.
4357. PIPE JOINT, W. Hassall, Beeston.
4358. TRICYCLES, W. Hillman, Coventry, and W. B. Powell, London.
4359. PLANING, &c., MACHINES, W. R. Lake.—(*F. Meisel, Boston, U.S.*)
4360. GLAZING ROOFS, &c., J. D. Mackenzie and W. Atchison, London.
4361. SUBSTANCES for PRODUCING COLD, A. D. Cohen and H. J. Emanuel, London.
4362. CREAM of TARTAR, F. Wirth.—(*F. Dietrich, Munich, Germany.*)
4363. FIRE-EXTINGUISHING APPARATUS, W. R. Lake.—(*C. C. Walworth and O. B. Hall, U.S.*)
4364. BOX, E. Eskell, London.
4365. LEAD-ARMOURED ELECTRIC CABLES, R. S. Waring, Pittsburg, U.S.
4366. LEAD-ARMOURED ELECTRIC CABLES, R. S. Waring, Pittsburg, U.S.
4367. ELECTRIC CABLES, R. S. Waring, Pittsburg, U.S.
4368. ELECTRIC CABLES, R. S. Waring, Pittsburg, U.S.
4369. REPAIRING DEFECTS in LEAD-ARMOURED ELECTRIC CABLES, R. S. Waring, Pittsburg, U.S.
4370. MANDRELS and DIES, R. S. Waring, Pittsburg, Pennsylvania, U.S.
4371. MANDRELS, R. S. Waring, Pittsburg, U.S.
4372. FIRE-ARMS and ORDNANCE, J. P. Onderdonk, Philadelphia, U.S.
4373. TOY FURNITURE, D. W. Childs and J. Bush, London.
4374. METAL LOOPS, E. Edwards.—(*A. A. J. Menaut and P. H. J. Menaut, Paris.*)
4375. BRACELETS, E. Edwards.—(*J. H. Beaupied, Paris.*)
4376. APPARATUS for FACILITATING the TEACHING of ARITHMETIC, E. Edwards.—(*T. Verkoyen, Belgium.*)
4377. TURNING CONICAL SURFACES, E. Edwards.—(*F. Pichot, Angers, France.*)
4378. HORSESHOES, E. Edwards.—(*F. B. Greifenhagen and A. Schnitzer, Zittau, Germany.*)
4379. HOSE COUPLINGS, E. Edwards.—(*J. Grether and G. Witte, Germany.*)
4380. FIRE-EXTINGUISHING APPARATUS, W. R. Lake.—(*C. C. Walworth, Boston, U.S.*)
4381. HEATING DISHES, &c., W. R. Lake.—(*E. Blay, Gien, France.*)
4382. GALVANIC BATTERIES, &c., C. J. D. Oppermann, Leyton.

5th March, 1884.

4383. BELTING and HOSE, H. Vogel, London.
4384. HOLDING the SLEEVE of an UNDER-GARMENT, T. E. Pritt, Leeds.
4385. COMPOUND MARINE STEAM ENGINES, W. Brock, Dumbarton.
4386. RAILWAY MILK CHURN, J. Hanson, Tipton.
4387. FASTENING PACKING-CASES, T. R. Johnston, Edinburgh.
4388. MEASURING the STRENGTH of ELECTRIC CURRENTS, J. Wimshurst, London.
4389. SECURING VINE RODS to the WIRE in GLASS HOUSES, E. Delataste, Jersey.
4390. FASTENING for HAND BAGS, &c., J. B. Brooks, Birmingham.
4391. GAS MOTOR ENGINES, T. M. Williamson, J. Malam, and C. W. King, Southport.
4392. PHOSPHATES and PHOSPHORIC ACID, A. Adair, Egremont.
4393. HAT and other BOXES, G. Downs, Hoole Hill, near Birmingham.
4394. ROLLER SKATES, W. P. Thompson.—(*E. H. Barney, Springfield, U.S.*)
4395. REGULATING the SPEED of GUIDE SCREWS of LATHES, W. Darling and R. Sellers, Keighley.
4396. APPARATUS to be ATTACHED to the HOLLOW SPINDLES of LATHES for HOLDING WORK to be OPERATED upon, W. Darling and R. Sellers, Keighley.
4397. CONDENSING STEAM or other VAPOURS, R. Howarth, Wolverhampton.
4398. VALVE, B. G. Martin, South Mall, Cork.
4399. TURNSTILES, C. Isler, London.
4400. HANDLES of TABLE CUTLERY, &c., C. Ibbotson, Sheffield.
4401. BEARINGS for LOCOMOTIVE ENGINES, &c., J. Willis, Sheffield.
4402. CUTTING OFF LENGTHS of METALLIC and other TUBES, S. W. Challen, Birmingham.
4403. DEODORISING FŒCAL MATTER in WATER-CLOSETS, T. Welton, London.
4404. COLOURING PHOTOGRAPHS, &c., B. P. Stockman, Westminster.
4405. SASH-BARS and ASTRAGALS, G. C. Warden, Tynemouth, and J. Ferguson, Edinburgh.
4406. ANTI-COLLISION APPARATUS for RAILWAY TRAINS, E. Cornelis, London.
4407. SUPPORTING BOOKS, &c., G. A. Carozzi, London.
4408. PRIMARY VOLTAIC BATTERIES, I. Lucas, Upper Edmonton.
4409. ENGINE GOVERNORS, T. Summers, Gloucester.
4410. DYEING FIBROUS MATERIALS, J. C. Mewburn.—(*J. Stoltz, France.*)
4411. DRILLING, &c., MACHINES, J. C. Mewburn.—(*V. E. Prétot, Paris.*)
4412. PENCIL CASES, S. Dünkelsbühler, Nuremburg.
4413. MALT, &c., KILNS, W. Lawrence, London.
4414. TWO-SPEED GEAR for VELOCIPEDES, W. Simpson, Hastings.
4415. NEW PIGMENTS, G. W. von Nawrocki.—(*P. Böttiger, Russia.*)
4416. STOCKINGS, &c., A. P. Sheffield and A. W. Wills, Leicester.
4417. CHLORIDE of SODIUM, W. S. Richardson and W. J. Grey, Gateshead.
4418. PREVENTING WASTE of WATER, T. Penn, London.
4419. MINCING MACHINES, T. Williams, jun., London.
4420. MITRE CRAMPS, T. J. Syer, London.
4421. CARTRIDGES, C. S. Bailey, London.
4422. DISH COVERS, C. W. Blackman, London.
4423. STEAM TRAPS, J. F. Johnstone, Belvedere.
4424. LASTING BOOTS and SHOES, F. Harrison, London.
4425. STEEL INGOTS, J. Gjers, Middlesbrough-on-Tees.
4426. FIRE LIGHTER, R. Day and R. Ward, London.
4427. TAKE-UP MECHANISM for SEWING MACHINES, G. Sawyer.—(*The White Sewing Machine Company, U.S.*)
4428. CLOCKS, J. M. Richards.—(*G. B. Webb, U.S.*)

6th March, 1884.

4429. VELOCIPEDES, F. W. Gerhard, Wolverhampton.
4430. PRESERVING MEATS, &c., B. Harlow, Macclesfield.
4431. WATERCOCKS, A. & T. Vaughan, Wolverhampton.
4432. PLATES for SECONDARY CELLS, N. C. Cookson, Newcastle-on-Tyne, and J. Swinburne, Brockley.
4433. SWIVELS, &c., R. Collard, Birmingham.
4434. SPHERICAL JOINTS, J. Thomson, Glasgow.
4435. STOP-MOTION for TWISTERS, H. Tee, Tipperary.
4436. KEEPING TOBACCO from MOULDINESS, W. H. Barnard, Stroud.
4437. CASTORS for FURNITURE, W. H. Richards, Birmingham.
4438. VENTILATING SIPHON TRAPS, J. Miller, Glasgow.
4439. SOCKET WASHER, H. James and G. Robinson, Sheffield.
4440. STEERING GEAR of TRICYCLES, &c., F. Baker, Southampton.
4441. FENCES, W. Garland, East Molesley.
4442. PARTURITION INSTRUMENT, G. Heighes, Stevenage.
4443. TRAM-CARS, G. A. Newton, Liverpool.
4444. STOVES, F. Wood, Wexford.
4445. BIRD CAGES, H. Brittain, Birmingham.
4446. STEAM DERRICK CRANES, J. and E. Gledhill, Lindley, near Huddersfield.
4447. ARTIFICIAL FLY MAKING, J. Macnee, Perthshire.
4448. PRODUCING RAW MATERIAL for ASPHALT PAVING, E. Dietrich, Berlin.
4449. BEAMING FRAMES, R. Turner, Burnley.
4450. TABLE CUTLERY, &c., T. H. Heard, Sheffield.
4451. SHAVING, H. and W. Edley, Sheffield.
4452. SALT, G. C. Denison & J. E. Higgin, Northwich.
4453. CHECKING, &c., APPARATUS, W. S. Laurie, Withington, near Manchester.
4454. RAILWAYS, E. Gregory and A. Kissam, London
4455. STOPPERS for BOTTLES, &c., W. Brewer, London.
4456. KETTLE, H. Barron, London.
4457. RAILWAY VEHICLE, R. Hill and J. Darling, Glasgow.
4458. BREECH-LOADING SPORTING FIRE-ARMS, T. Southgate, London.
4459. SAFETY LOCK, &c., J. C. Garrood, Folkestone.
4460. PRIMARY ELECTRIC BATTERY, H. Binko, London.
4461. SOAKING PITS, T. Doughty, Glasgow.
4462. MINERAL OIL LAMPS, F. W. Bach, London.
4463. ABSORBING SHOCKS in RAILWAY TRAINS DURING COLLISION, R. Hill and J. Darling, Glasgow.
4464. CATCHING VERMIN ALIVE and UNINJURED, J. Beer, Blizewood Park.
4465. PRODUCING AERATED WATERS, &c., T. Hogben, London.
4466. HEATING WATER and GENERATING STEAM, A. H. Hearington, London.
4467. GAS BURNERS, A. H. Hearington, London.
4468. SHEEP SHEARS, W. Packard, Sheffield.
4469. FLEXIBLE SPOUT for OIL FEEDERS, W. H. Rusden, Cardiff.
4470. FIRE-ESCAPES, O. Hansen, California.
4471. REDUCING FRICTION in BEARINGS, A. Osborn, London.
4472. BEATING CARPETS, S. Child, Brighton.
4473. PRESERVING FERMENTED LIQUORS, R. G. Bell, Oxford.
4474. TWEED HATS, S. Simmons, J. and J. C. Buckley, Leeds.
4475. ELECTRIC PILES or BATTERIES, F. de Lalande and G. Chaperon, Paris.
4476. STOPPER LOCKING DEVICES, J. D. Mattison, New York.
4477. IRON or STEEL CASTINGS, J. D. Ellis, near Rotherham.
4478. PORTABLE SHOW-CASE, G. B. Baugham, Walthamstow.
4479. COMBINED WALKING or UMBRELLA STICK and SMOKERS' CASE, J. E. Jones, Bristol.
4480. MORDANTS and COLOURING MATTERS, W. L. Wise.—(*C. H. Knoop, Dresden.*)
4481. BOOTS, J. L. Ward, Leicester.
4482. CEMENTATION FURNACES, J. H. Johnson.—(*A. Berthomieu, Paris.*)
4483. CLOSING and RE-OPENING SOFT METAL, D. T. Bostel, Brighton.
4484. FOG-HORNS, J. Bryceson, London.
4485. HAYMAKERS, E. C. Blackstone, Stamford.
4486. BREAD, BISCUITS, &c., J. L. Thudicum, London.
4487. VELOCIPEDES, W. Hillman, Coventry.
4488. COUPLING and UNCOUPLING, C. W. Lee, London.
4489. BEER TAPS or VALVES, A. T. Booth, London.
4490. ELEVATORS or LIFTS, R. M. Ordish, London.
4491. SUPPLYING WATER to STEAM BOILERS, &c., T. Thomson, London.
4492. MELODIONS, &c., C. Pietschmann, Berlin.
4493. ELEVATORS or LIFTS, W. Beck.—(*V. Valette, Paris.*)
4494. DYNAMO-ELECTRIC MACHINE, W. H. Beck.—(*A. J. Cote and E. F. Lesobre, Paris.*)
4495. SHUTTLES for WEAVING, H. Smith, Bradford.
4496. PENCIL SHARPENERS, W. R. Lake.—(*J. Jenkins, New Jersey, and —. Smith, Brooklyn.*)
4497. PRINTING MACHINERY, B. W. Davis, London.
4498. SAFETY FOOT STRAPS for LADIES' RIDING HABITS, H. Nicoll, London.

7th March, 1884.

4499. BRAKES for STOPPING LOOMS, W. Haythornthwaite, Blackburn.
4500. SAFETY SASH FASTENER, H. Wyatt, Redhill.
4501. PICKER for LOOMS, T. Westley, Fulwood.
4502. STARTING GEAR for TRAM-CARS, &c., A. M. Vereker and S. M. Yeates, Dublin.
4503. COMPOUND ELECTRIC CONDUCTORS, W. P. Thompson.—(*F. L. Pope, Elizabeth, New Jersey, U.S.*)
4504. WOOD SCREW, W. P. Thompson.—(*S. Montgomery, New York, U.S.*)
4505. METAL BOXES, D. and S. Timings, Birmingham.
4506. BRACKETS, G. F. Durose, Birmingham.
4507. SELF-CLOSING HINGE, W. Johnson, Dunfermline.
4508. FASTENINGS for DRIVING BANDS, G. Robson, Newcastle-on-Tyne.
4509. HAY COLLECTORS, H. Lander, Mere.
4510. ROOFING and VENTILATION for HAY, &c., PRODUCE, H. Lander, Mere.
4511. TOBACCO PIPES, D. T. Lee, London.
4512. PRODUCING CHROMO ILLUSTRATIONS of STOVE GRATES, &c., J. Lockwood, Glasgow.
4513. MUSICAL WIND INSTRUMENTS, E. Barnes, Handsworth.
4514. DRYING GRASS, &c., F. Erskine, Hulme, and D. Walker, Manchester.
4515. PRESERVING MANILLA ROPES, J. Brown, Higher Tranmere, and T. R. Robertson, Birkenhead.
4516. RECOVERY of AMMONIA from WASTE GASES, W. Scott, Glasgow.
4517. DOUBLE DRIVING DIFFERENTIAL GEAR of VELOCIPEDES, F. C. Wrighte, Birmingham.
4518. CONVERTING RECTILINEAR into ROTARY MOTION, J. Kirk, Sheffield.
4519. AXES and ADZES, T. Myers, Tinsley.
4520. CONVERTIBLE DINING and BAGATELLE TABLE, E. W. Barnsley, Edgbaston.
4521. BREAD, M. Croydon, Walsall.
4522. COUPLING, &c., RAILWAY TRUCKS, W. H. Holt, Halifax.
4523. HOT-WATER BOILER, H. Wheelwright, London.
4524. HOSIERY COMBINATIONS or DRESSES, T. Walker, Leicester.
4525. MIXING TEA, &c., J. Dick, Glasgow.
4526. STOP-BELL for VELOCIPEDES, F. W. Jones, Exeter.
4527. MOVING ADVERTISEMENTS, H. Y. Dickinson, Newbury.
4528. SHIPS, &c., G. H. T. Beamish, Ireland.
4529. STABLE FITTINGS, A. Pye-Smith, O. W. White, and R. Elliot, London.
4530. OBTAINING, &c., MOTIVE POWER, A. M. Clark.—(*G. Ghisi, Genoa.*)
4531. RAISING SUNKEN VESSELS, W. Atkinson, London.
4532. SELF-TIGHTENING HOSE, &c., R. Gosling, Ipswich.
4533. CHIMNEY COWLS, &c., J. King, Reading.
4534. OBTAINING ROTARY MOTION, G. Shann, London.
4535. CASTING GRANULAR METALS upon FIBROUS METALS, &c., P. Barry, London.
4536. METALLIC and other SHIVES or BUNGS, W. Rose, Halesowen.
4537. KNITTED WIRE FABRICS, E. de Pass.—(*E. Popp, Vienna.*)
4538. FUNNELS, E. de Pass.—(*J. T. Cartier, Paris.*)
4539. VENTILATORS for WEARING APPAREL, D. Pick, London.
4540. METAL RAILWAY SLEEPERS, E. de Pass.—(*P. Sévérac, Paris.*)
4541. BRAKES or WEIGHTING MOTIONS, J. Parkinson, Bradford.
4542. VALVE-CAPS of BRASS MUSICAL WIND INSTRUMENTS, D. J. Blaikley, London.
4543. AUTOMATIC CAR COUPLERS, G. W. Smillie, Newark, U.S.
4544. BRICKS, W. Johnson, Leeds.
4545. RAILWAY BRAKES, J. B. Sharp, Odcomb.
4546. FACILITATING the TRAVELLING of ENGINES, &c., J. A. and A. A. Clarke, London.
4547. GYMNASTIC EXERCISING APPARATUS, F. W. Giebeler, West Brighton.
4548. BAND for GENERATING ELECTRICITY, A. H. Byng, Southsea.
4549. BARBED FENCING, P. M. Justice.—(*T. V. Allis, New York, U.S.*)
4550. ROWING-BOATS, H. H. Lake.—(*W. J. James, Nussdorf, Austria.*)
4551. CORSET, H. T. Sykes, London.
4552. ELECTRIC LAMPS, H. H. Lake.—(*F. H. Werner and L. Ochse, Ehrenfeld, Germany.*)
4553. REVERSING GEAR for ROTATING SHAFTS, C. Scholes, Low Harrogate.
4554. PRINTING in COLOURS, J. Imray.—(*La Société Anonyme d'Impression simultanées en plusieurs Couleurs.*)
4555. STEAM-TRAP, E. Edwards, London.—(*J. Koenig, Rosenthal, Germany.*)
4556. TYPE-WRITERS, T. G. and H. Daw, Sevenoaks.
4557. SUPPORTING or KEEPING OPEN PERAMBULATOR HOODS, E. H. Baxter, Birmingham.
4558. MELTING SOLDER by GAS, &c., T. Gorton and S. Verity, Lower Broughton.
4559. CALORIC ENGINES, H. Long, Bristol.
4560. TELEPHONIC TRANSMISSION, A. M. Clark.—(*L. Maiche, Paris.*)
4561. WOOD BUTTONS, &c., A. Martin, Witton.
4562. BALING PRESSES, A. M. Clark.—(*J. M. Tichenor, Irvington, U.S.*)
4563. COOLING BEER, &c., H. A. Dufrené.—(*N. Duboc-Barilly, Sedan.*)
4564. STAIR-ROD EYES, E. Taylor, Birmingham.

8th March, 1884.

4565. CENTRE-POCKET CUSHION, J. Anderson, Glasgow.
4566. RING SPINNING and DOUBLING FRAMES, &c., G. Shepherd and H. Midgley, Bacup.
4567. ADJUSTING SHAFTS of TWO-WHEELED VEHICLES, E. H. Julian, Cork.
4568. RAILWAY COUPLINGS, I. Davies, Manchester.
4569. WEATHER STRIPS for DOORS and WINDOWS, S. Slater, Oldham.
4570. DOOR SILK BRASSES, S. Slater, Oldham.
4571. PISTONS and PLUNGERS, H. Lancaster, Pendleton.
4572. WINDOW ROLLERS for BLINDS, R. McTaggart, Crossmyloof.
4573. BARREL CHURNS, J. Brooks, Sheffield.
4574. STOP VALVES, J. Dewrance and G. Wall, London.
4575. VASES and FLOWER STANDS, J. T. Page, Bury St. Edmunds.
4576. HINGES, A. W. Chesterman, Sparkbrook.
4577. PORTABLE GAS LAMP, J. E. Keirby, Swinton.
4578. SUBSTITUTE for WHALEBONE, &c., J. Royle, Manchester.
4579. MOVABLE SLIDE SPRING TRUSS, C. Lea, Silverdale.
4580. SAVING PROPERTY at SEA, &c., C. Sutton, Salford.
4581. FISH HOOKS, R. Wright, Redditch.
4582. SELF-ACTING BRAKE for CARRIAGES, &c., J. Toplis and C. J. Chidley, Manchester.
4583. COMBINATION TRAVELLING HAMMER, W. Reynolds, London.
4584. SPECTACLE FRAMES, S. Z. de Ferranti, London.
4585. TWO-SPEED GEAR for TRICYCLES, &c., H. S. Jackson, London.
4586. GARMENT ENTITLED "RETSLU," H. N. Benjamin, London.
4587. LOCKING the BARRELS of FIRE-ARMS, A. Lancaster, London.
4588. JOINTED SAFETY STIRRUPS, T. Rines, Scarborough.
4589. RAILWAY SIGNALLING, J. Enright, London.
4590. RESERVOIR PENS, J. E. Cousté, London.
4591. GAS MOTOR ENGINES, W. J. Munden, London.
4592. CARTRIDGES, G. Kynoch, Witton.
4593. SAFETY PAPER for CHEQUES, F. Nowlan, London.
4594. OBTAINING INCISED or RAISED DESIGNS on STEEL, &c., J. Brown, Chelsea.
4595. CONVERTING RECIPROCATING into CONTINUOUS ROTARY MOTION, &c., H. J. Haddan.—(*E. Boettcher, Leipzig.*)
4596. CUTTING SHIVES, J. Harper, London.
4597. STARTING TRAMWAY CARS, &c., J., W., and J. Gillespie, Paisley.
4598. DRIVING GEAR for VELOCIPEDES, &c., B. Carr, Walthamstow.
4599. PREVENTING ROBBERY from LETTER-BOXES, J. Johnson, London.
4600. MOULDS for PRESSED GLASSWARE, W. Haley, Ravenna, U.S.
4601. MACRAME LACE, W. Anyon, Manchester.
4602. SEATS of TRICYCLES, J. R. Taunton, Birmingham.
4603. WATER-CLOSET APPARATUS, W. D. Scott-Moncrieff, Fulham.
4604. WINDOW FASTENERS, E. Newman, Birmingham.
4605. GAS COOKING STOVES, T. Redmayne, London.
4606. SELF-LUBRICATING PULLEY BEARINGS, J. T Carr, Bagillt.
4607. SASH FRAME PULLEY, S. Guinery, Epsom.
4608. CHANDELIERS, J. B. Sharp, Ilminster.
4609. WEAVING REVERSIBLE FABRICS, A. Rothwell, Bury.
4610. BOTTLE STOPPERS, W. R. Lake.—(*G. D. Corey, Lowell, U.S.*)
4611. BRAKE and SUPPORT for ROAD VEHICLES, H. Grist and M. Steel, Horsham.

10th March, 1884.

4612. RABBIT TRAP, &c., W. Hornsby and W. Shepherd, Grantham.
4613. RAISING and LOWERING BOILER CHIMNEYS, W. Hornsby and R. Edwards, Grantham.
4614. VERTICAL STEAM BOILERS, W. Hornsby and J. Clapham, Grantham.
4615. MARINE ENGINES, T. J. Turner, Bootle.
4616. FASTENING MACHINE BELTS, T. H. Perrott, Cork.
4617. GOVERNOR CUT-OFF STEAM VALVES, T. Kavanah, Birmingham.
4618. BRASS BRACKETS, S. Harris, Birmingham.
4619. BALANCE INDICATOR, J. Giffen, Govan.
4620. CARVER FORK GUARD, J. Dawson, Sheffield.
4621. SAFETY BOAT PLUG, F. G. Lovewell, Brighton, and H. Brittain, Shoreham.
4622. PREVENTING CONTAMINATION of WATER, C. Ridealgh, Sunderland.
4623. PERMANENT WAY, W. Morris, London.
4624. TROUSER BRACES, R. Baird, London.
4625. CYCLING, E. Boy, London.
4626. STEERING LIGHTS, G. W. Mallet, Greenwich, and H. Rolfe, London.
4627. SEWING MACHINES, W. Jenkins, Wednesbury.
4628. PRINTING on CLOTH, &c., A. C. Henderson.—(*La Société Schrameck et Levy, Paris.*)
4629. FOLDING BOX for CARRYING PIGEONS, E. P. Moreau, Kingston-upon-Thames.
4630. FENCES, G. Sargent, Ditton.
4631. CULTIVATING LAND, J. Edmonds, Compton Greenfield, and W. H. Jefferis, Henbury.
4632. CASTING IRON, &c., C. A. Caspersson, Sweden.
4633. MARINE, &c., ENGINES, J. J. May, Exeter.
4634. BRACES, G. Ceuchman, London.
4635. CONCRETE BUILDING, W. J. E. and E. J. E. Henley, Anerley.
4636. LIFTING EARTH, &c., F. W. P. Parker, Oxford.
4637. COATING and FINISHING TIN-PLATES, J. H. and W. A. Johns, London.
4638. COMBINED FAUCETS and TAP VALVES, C. L. Eyre.—(*J. L. Spafford, New York.*)
4639. GAS ENGINES, R. Pollock, Paisley.
4640. BREWERS' MASH TUNS, &c., F. W. Crickmer, London.
4641. SHEEP SHEARS, J. C. Mewburn.—(*F. Guillaume, Paris.*)
4642. ENVELOPES, A. J. Boult.—(*F. Torretta, Turin.*)
4643. WATCHES, A. B. Weber, Switzerland.
4644. SCREW-CUTTING TOOL, L. A. Groth.—(*J. H. Lancaster, New York.*)
4645. TOOTH-BRUSH, J. Parry, London.
4646. OPENING or CLOSING SWING DOORS, C. J. Poole, London.
4647. STEERING APPARATUS for TRICYCLES, J. M. Taylor, Seer Green.
4648. CASTORS, A. A. Barratt, Thames Ditton.
4649. OPENING and CLOSING SWING SASHES, &c., G. Paine, Worthing.
4650. TREATING TEXTILE MATERIALS, H. J. Haddan.—(*O. Obermaier, Bavaria.*)
4651. DYNAMO-ELECTRIC, &c., MACHINES, A. N. Thorin, Stockholm.
4652. KILNS or FURNACES, H. H. Lake.—(*W. Eckardt, Dortmund, Germany.*)
4653. DOMESTIC STOVES and GRATES, H. Thompson, London.
4654. HEATING SLABS, &c., T. Smith, Spennymoor.
4655. MAKING, BREAKING, &c., ELECTRIC CONNECTIONS, W. Thomson, London.
4656. BRAKES, H. Booth, Leith.
4657. BOILERS, J. Witherspoon, Chester-le-Street.
4658. PREVENTING GALVANIC ACTION in IRON and STEEL SHIPS, B. L. Thomson, London.
4659. MUSICAL INSTRUMENTS, J. Stuttaford, Barnet.
4660. THRUST BLOCK CASINGS, H. Barrett, London.
4661. MOTIVE POWER ENGINES, W. King, London.
4662. AIR-TIGHT JOINTS for LIDS of PAILS, &c., E. Edwards.—(*J. H. Beaupied, Paris.*)
4663. SEPARATING BENZENE from LIQUIDS, &c., C. H. G. Williams, Hounslow.
4664. AFFIXING and DETACHING HORSES from VEHICLES, F. J. Bingham, Potton.
4665. REGULATING ELECTRIC MOTORS, C. J. Bosanquet, Spilsby, and W. A. Tomlinson, Folkingham.

ABSTRACTS OF SPECIFICATIONS.

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

3392. ELECTRIC ARC LAMPS, *F. M. Newton, Belfast.*—*9th July*, 1883. 6*d.*

The upper carbon is fed by a brush lined with a number of elastic fingers axially inclined to the carbon in the direction in which motion is to be produced. The brush is rocked by an electro-magnet placed in a shunt circuit. A solenoid surrounding the lower carbon-holder serves to draw it down, and so establish the arc. The carbon-holders are split balls held in sockets and tightened together by suitable cap pieces.

3399. FASTENINGS for DOORS, *F. Newman, Ryde.*—*10th July*, 1883. 8*d.*

The object is to enable doors to open outwardly when pressure is applied to the inside, and it consists in providing the door with bolts at top and bottom, and connecting such bolts with a leaf applied inside the door in such a manner that when pressure is applied to the leaf the bolts will be withdrawn from their sockets.

3475. RECORDING and CONTROLLING a SUPPLY of ELECTRICITY, *J. Hopkinson, London.*—*13th July*, 1883. 6*d.*

This relates to a meter which shall automatically deduct the amount of current which flows back from a secondary battery when it is discharging. The meter is driven by a small motor, the connections being reversed when the current changes. The meter gives a signal when the accumulator charge reaches a certain amount. To give the meter greater range two solenoids, one of thick and the other of thin wire, are used in connection with an automatic switch, which causes the current to pass through one or the other according to its amount.

3478. APPARATUS for CONNECTING or DISCONNECTING PORTIONS of ELECTRIC CONDUCTORS, *C. A. C. Wilson, London.*—*14th July*, 1883. 6*d.*

The conductors pass through stuffing boxes and glands into a box filled with mercury. Means are provided for filling and emptying the box of its mercury, so making or breaking the connection.

3487. APPARATUS for SOLDERING JOINTS of WIRE of ALL SIZES and of DIFFERENT DESCRIPTIONS, &c., *J. T. Neighbour, London.*—*16th July*, 1883. 4*d.*

This relates to a spirit lamp and a casing having

small trough across its top, in which the solder and the parts to be joined are laid.

3495. Chemical Deposit Current Meters used in Charging and Discharging Accumulators employed for Storing Electricity, *Sir D. Salomons, Tunbridge Wells.* —16*th July*, 1883. 4*d*.
A resistance is placed in the shunt circuit of the meter when charging the accumulators, and removed from the circuit while they are being discharged.

3498. Colouring Matter, *F. Wirth, Germany.*—16*th July*, 1883.—(*A communication from H. Baum, Germany.*)—(*Not proceeded with.*) 4*d*.
This relates to the production of two isomeric alphanaphtholmonosulpho acids from alphanaphthol, and in the manufacture of azo colours therefrom.

3505. Telephonic Apparatus, *J. Graham, London.*—17*th July*, 1883. 8*d*.
This relates to apparatus for long-distance telephony, and comprises a direct transmitter, a relay transmitter, and a local receiver.

3514. Breaking up Balls of Slag, &c., *R. Dalgliesh and F. G. Lynde, Leicester.*—17*th July*, 1883.—(*Not proceeded with.*) 2*d*.
The molten slag is run into boxes or holes, and while it is still running small pieces of limestone are introduced. When turned out of the boxes water is poured over the slag, and acting upon the limestone breaks up the slag.

3515. Bicycles, Tricycles, &c., *G. Warwick, Aston-juxta-Birmingham.*—17*th July*, 1883. 6*d*.
This relates, First, to the construction of hollow rims for the wheels of velocipedes by drawing sheet steel to the required form with the edges abutting on the underside, and over the edges a strengthening piece is soldered or brazed; Secondly, to an improved method of detaching one or both driving wheels to enable the tricycles to be taken through a narrow passage; it consists in forming grooves in the axle and catches in the hub of the wheel to engage such grooves, and which can be disengaged therefrom by means of a lever.

3516. Electrical Signalling Apparatus chiefly for Telephonic Purposes, *W. R. Lake, London.*—17*th July*, 1883.—(*A communication from J. H. Carey, Boston, Mass., U.S.*) 1*s*.
This relates to means for calling any sub-station, where a number of sub-stations are located on one line, and consists in the employment of magneto currents varying in direction. The signal mechanism described in patent No. 4246 of 1882 is used.

3520. Apparatus for Supporting or Holding the Drawing Rolls used in Spinning or similar Machinery, *W. R. Lake, London.*—17*th July*, 1883. —(*A communication from J. H. Congdon and W. and A. Sprague, Rhode Island, U.S.*) 6*d*.
Relates to stands for holding the rolls used in drawing out the sliver in spinning and other machinery, and has for its object the regulating of the distance between the rolls to suit the different lengths of staple that may be used.

3521. Water-wheels, *A. J. Barlow, London.*—17*th July*, 1883.—(*A communication from F. Pallansch, Vienna.*) 6*d*.
Consists principally of an air-tight drum, through the centre of which passes the main shaft, upon which said drum is fastened. Upon the circumference of this air-tight drum curved float boards or wings are hinged in such manner as to lie all in one direction close over each other, and around and against the circumference of said air-tight drum when at rest.

3522. Fixing Aniline Colours upon Fibrous Materials Composed of either Animal or Vegetable Fibre, *L. Heppenstall, jun., Huddersfield.*—17*th July*, 1883. 4*d*.
Relates to the employment of mordants or ingredients to be used in conjunction with the aniline colour.

3523. Colouring Matter, *F. Wirth, Frankfort.*—17*th July*, 1883.—(*A communication from H. Baum, Höchst-on-the-Main.*)—(*Not proceeded with.*) 2*d*.
Relates to the preparation of a betanaphtholdisulphoacid from betanaphtholmonosulphoacid, and also to the method of preparing the azo colours from this disulphoacid.

3524. Preparing Match Sticks for the Application of Igniting Material, *W. R. Lake, London.*—17*th July*, 1883.—(*A communication from W. H. H. Sisum, Brooklyn, U.S.*) 8*d*.
A hopper is provided with a vibrating back or front, and a roller carries the splints from the hopper and transfers them to a second roller rotating in the opposite direction. A roller in the hopper straightens the splints. The splints are delivered between two webs, which are wound upon a roller, the roller being removed when full and taken to the place where the igniting material is to be applied.

3525. Regulators of Level in Steam Boilers, *P. Gauchot, Paris.*—17*th July*, 1883.—(*Not proceeded with.*) 2*d*.
Relates to the arrangement of a float which controls a valve for the admission of water.

3527. Colouring Matter, *F. Wirth, Frankfort.*—17*th July*, 1883.—(*A communication from H. Baum, Höchst-on-the-Main.*)—(*Not proceeded with.*) 2*d*.
Relates to the preparation of colouring matters by the action of the organic anhydrides on the halogen salts of the primary, secondary, and tertiary aromatic amines, with or without the application of dehydrating agents.

3528. New or Improved Refractory Material, *W. R. Hutton, Partick, and A. Granger, Cardross, N.B.*—18*th July*, 1883.—(*Not proceeded with.*) 2*d*.
Consists in compounding together the substances commonly known as steatite or soapstone and fireclay.

3529. Apparatus for Raising Sunken Vessels, &c., *B. P. Wylie, London.*—18*th July*, 1883.—(*Not proceeded with.*) 2*d*.
Relates to air pumping apparatus for raising vessels.

3530. Reels or Machinery for Winding Yarn or Thread into Hanks or Skeins, *G. Bernhardt, Radcliffe.*—18*th July*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to a system for simultaneously taking all the threads to be reeled, and securing them while being reeled, and releasing them simultaneously when the hanks are wound.

3532. Apparatus for Sounding a Bell or other Sounding Body or Bodies on a Buoy or other Moving Body, *C. J. Harrison, London.*—18*th July*, 1883. 6*d*.
A ball rolls upon a disc or table attached to the bell.

3533. Electric Meter, *W. McWhirter, Glasgow.*—18*th July*, 1883. 6*d*.
The needle is deflected by the current passing through two helices, a small electro-magnet, excited by part of the current to be measured, tending to maintain it in its normal position.

3534. Velocipedes, *G. de M. Soares, London.*—18*th July*, 1883.—(*Not proceeded with.*) 2*d*.
The object is to utilise the weight of the driver for assisting in the propulsion of the vehicle.

3536. Elimination of Nitrogenous Matters from Fermentable or Fermented Substances, *E. R. Moritz and H. C. Lee, London.*—18*th July*, 1883. 2*d*.
This consists in adding to fermentable or fermented substances phosphotungstic acids or their corresponding salts for the destruction of germs.

3537. Hose and other Couplings, *R. Gosling, Ipswich.*—18*th July*, 1883.—(*Not proceeded with.*) 2*d*.
The female portion of the coupling is provided with a number of lugs or projections, and the male portion has inclined projections round its periphery with spaces between. The female portion has a spring bolt adapted to pass into one of the spaces.

3538. Machines for Obtaining Fibres and Juices from Vegetable and other Substances, *A. W. L. Reddie, London.*—18*th July*, 1883.—(*A communication from J. Kennedy, Jamaica.*) 6*d*.
The machine consists of an arc-shaped bed or concave and a rotary drum having a circular series of bars extending approximately parallel with its axis, and provided with teeth slightly inclined relatively to the direction of rotation. The bars have the teeth arranged alternately in opposite directions so as to move the fibres alternately towards opposite sides. Hinged beaters are also arranged to swing outward and strike the material under treatment.

3539. Apparatus for Ascertaining the Distance of an Object from an Observer, *C. E. Kelway, London.*—18*th July*, 1883.—(*Not proceeded with.*) 2*d*.
A flat plate has a longitudinal slot divided into spaces representing miles, knots, or other distances, and at one end of the plate is a centre on which turns a straight edge, one edge of which passes through the centre, and a graduated sector by which the angle which such edge makes with the slot can be measured and indicated. A second straight edge with a graduated edge turns on a centre capable of being moved along the slot, and a second sector indicates the angle it makes with the slot.

3540. Sash Weights, &c., *W. Ayres, London.*—18*th July*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to inserting in the mould in which sash weights are to be cast a tapered core to form the holes to receive the sash line.

3541. Cans or Vessels for Containing Milk, &c., *W. R. Lake, London.*—18*th July*, 1883.—(*A communication from E. Burnett and A. P. Browne, Boston, U.S.*) 8*d*.
One part relates to the closing devices, which allow the milk to be withdrawn, but which prevent liquids being introduced into the vessel surreptitiously; a second feature relates to means for preventing the removal of the closing devices; and a third feature relates to an improved carriage for transporting the cans or vessels.

3542. Apparatus for Feeding and for Gumming, Varnishing, Colouring, Sizing, Pasting, and Oiling Sheets of Paper and Labels, *J. J. Allen, Halifax.*—18*th July*, 1883.—(*Not proceeded with.*) 2*d*.
This relates to improvements on patent No. 2096, A.D. 1881, and consists, First, in apparatus for cleaning the rollers from any superfluous gum; Secondly, to apparatus for supporting and guiding endless bands which carry the paper; Thirdly, to apparatus for applying the gum, size, varnish, or colour on both surfaces of sheets of paper; Fourthly, to apparatus for feeding and guiding gummed or pasted labels to bottles; and, Fifthly, to apparatus for removing the sheets from the gumming roller.

3543. Rocking Furnace Bars, &c., *J. Hampton, Loughborough.*—18*th July*, 1883. 6*d*.
The bars are made with a considerable camber or rise in the centre, and the two ends are bevelled off to an angle of about 30 deg., and one end is cast with a jaw to receive the rocking bars. The bearer bars at each end of the furnace are bevelled to receive the ends of the furnace bars, which are placed with the jaw ends alternately next to the dead plate and next to the bridge. Under the jaws at each end is a rocking bar, which is caused to vibrate.

3544. Magazine or Repeating Fire-arms, *W. R. Lake, London.*—18*th July*, 1883.—(*A communication from the Larsen Rifle Company, Belgium.*) 8*d*.
The magazine is inside the stock, and may consist of one or more chambers, according to the cartridges to be used. The cartridges are superposed in the chamber, in front of which is a rectangular tube, in which works a propeller connected to and actuated by the breech bolt. An elevator raises the cartridges to the breech.

3545. Freezing or Refrigerating Apparatus, *J. H. Johnson, London.*—18*th July*, 1883.—(*A communication from E. Fixary, Paris.*) 6*d*.
A continuous freezing is produced by the employment of compressed volatile refrigerating agents, capable of absorbing a large quantity of heat abstracted from adjacent heat-yielding bodies during the process of vaporisation. The cylinders of the compressing pump are cooled by arranging the pump close to the refrigerating chamber. The vapour leaking past the piston, and exerting counterpressure thereon, is collected in an intermediate chamber communicating with the pump, and similarly cooled by the refrigerator, the counterpressure being controlled by a regulating valve communicating with the intermediate chamber, the functions of the valve being to allow the gas that has been cooled, and become impregnated with the lubricating oil contained in the bottom of the chamber, to escape at a certain pressure and return to the vessel containing the liquefied refrigerating agent, after passing through and lubricating the valves of the pump and along the condenser coil.

3546. Moulds or Receptacles Employed in the Manufacture or Refining of Sugar, *J. Duncan and B. E. R. Newlands, London.*—19*th July*, 1883. 6*d*.
The object is to construct moulds into which sugar is cast, so that currents of air can circulate through the moulds and rapidly dry the sugar, and for this purpose conical spaces or passages are formed through the moulds.

3547. Appliances for Withdrawing Beer or other Liquids or Fluids from Barrels, &c., *H. C. Trenery and J. Naylor, Sheffield.*—19*th July*, 1883.—(*Not proceeded with.*) 2*d*.
A valve is fitted inside the barrel, and a tap when screwed into a bush opens the valve, which closes again when the tap is removed.

3548. Apparatus for Expressing the Juices of Various Matters, &c., *A. C. Henderson, London.*—19*th July*, 1883.—(*A communication from A. Désgoffe and L. A. di Giorgio, Russia.*) 6*d*.
A screw with a thread decreasing from one end to the other is caused to revolve in a tube pierced with holes and furnished with spirals placed in a position opposed to the blades of the screw, and having at one end a hopper into which the material to be treated is fed.

3549. Washing Machines, *J. Heselwood, Leeds.*—19*th July*, 1883. 6*d*.
A boiler fed with water from a cistern above is heated by gas, and contains a corrugated drum, which is caused to revolve, buckets being provided to lift the water from the bottom of the boiler, and allow it to fall on to the clothes in the drum.

3550. Beetling Machines, *C. J. Webb, Antrim.*—19*th July*, 1883.—(*Not proceeded with.*) 2*d*.
The beam on which the cloth is wound is arranged so that one can be filled while the other is being acted upon by the hammers, which are made with long handles, and at the end of the shaft where they are connected with a rocker or pitman, a piece of steel is arranged to act as a spring. Two sets of hammers can be arranged to act on opposite sides of the beam. Each pitman or rocker is actuated by a separate excentric on a shaft passing through the machine.

3551. Pocket Knives, *J. H. Johnson, London.*—19*th July*, 1883.—(*A communication from J. Thurmauer and Co., Paris.*)—(*Void.*) 2*d*.
This relates to the combination with the knife of a sliding device to enable thicknesses or external diameter to be measured.

3552. Folding Hoods of Double Perambulators, &c., *J. T. Shaw, Manchester.*
The joint of the folding hood is connected at each side to a ferrule capable of sliding along a guide rod at the sides of the vehicle, so that it can be folded back at either end of such vehicle.

3554. Bottle Stoppers, *M. F. Roberts, London.*—19*th July*, 1883. 6*d*.
Consists in the combination of a body having distinct planes formed in its head with a rod having a stop or crosshead (or equivalent) to rest on either plane, and a disc compressing an expansible collar, the closure and opening of the joint formed by the stopper in the neck of the bottle being controlled manually or by mechanical devices, by moving the stop from one plane to another, and thereby causing expansion or permitting relaxation of the collar, and locking or retaining same in position.

3555. Slabs and Coverings for Building and Decorative Purposes, *C. J. Marson, London.*—19*th July*, 1883.—(*Not proceeded with.*) 2*d*.
Relates partly to the use of Brazil bagging, scrim, muslin, or other textile fabrics in combination with Portland cement and plaster formed into slabs or mouldings.

3556. Locking the Screw Nuts and Bolts of Rail way Fish-plates, *T. Johnson, London.* — 19*th July*, 1883.—(*Not proceeded with.*) 2*d*.
The screw nut has a groove or set-off on the side which comes against the fish-plate, and a locking plate passes over the head of the nut and is pressed against the fish-plate, the edge of the plate entering the groove in the nut.

3557. Closing of Canisters or Receptacles for Coffee, &c., *A. W. Jaeger and C. A. Farwig, London.*—19*th July*, 1883. 6*d*.
The lid is provided with a groove into which is inserted a yielding material which is caused to enter a groove on the canister.

3558. Apparatus for Producing Patterns upon or in Wood, Marble, Leather, &c., *H. C. Webb, Worcester.*—19*th July*, 1883.
One part relates to the use of steel knives or blades formed or arranged in ornamental shapes or designs, such knives or blades being intended to be used chiefly in the decoration of wood cut, or what is known in the timber trade as "the plank," to form an ornamental work for various purposes. Other improvements are described.

3559. Machines for Lasting Boots and Shoes, *W. R. Lake, London.*—19*th July*, 1883.—(*A communication from J. R. Scott, New York.*) 6*d*.
Comprises a spear or holdfast, against which the operator upwardly presses the bottom of the insole—which has been previously tacked to the bottom of the last. This spear pierces the insole, and forms a point of resistance to the action of a pair of gripping jaws, which seize the upper, and pull the same over the edge of the insole and last. At the instant that the pulling over is complete, a tack, fed by suitable mechanism, is driven through the upper and insole, thus "lasting" the shoe by securing the upper to the insole while on the last, as a needful step preparatory to sewing or attaching the outsole. The invention also comprises improvements in the spear, the gripping jaws, the means for adjusting the tension of the jaws, the tack feeding device, and the treadle and clutch device.

3560. Utilising the Rise and Fall of the Tide, &c., for Raising Water, &c., from One Level to another, *C. M. Walker, London.*—19*th July*, 1883. 6*d*.
Relates to the arrangement of vessels and the employment of compressed air.

3561. Motive Power Engines, *H. E. Newton, London.* —19*th July*, 1883.—(*A communication from G. Sweanor, Montreal.*) 6*d*.
Refers to that class of engines in which gas or vapour generated from ammonia or other liquid of low boiling point serves as the motive force; and consists in means by which the perfect liquefaction of such gas, when passing off from the exhaust, is attained; and also in devices for preventing the escape of the gas from the stuffing-boxes of the cylinder and elsewhere.

3562. Hot Air and Caloric Engines, *E. Field and H. Aydon, London.*—19*th July*, 1883. 6*d*.
In one arrangement, as applied to a hot-air engine, the inventors provide in the generator a plate or tray, on to which water is projected, so that it may flash into steam, and mix with the hot gases.

3563. Barrels or Vessels for Holding Liquids, &c., *C. L. Eyre, London.*—19*th July*, 1883.—(*A communication from G. S. Spofford, New York.*) 6*d*.
Relates especially to that form of metal barrel or vessel, in which an inner vessel of sheet iron or other suitable metal is enclosed within a corresponding exterior vessel of sheet metal, the space between them being filled with a material non-conducting of heat, and serving to preserve the interior vessel from injury.

3564. Tricycles, &c., *J. A. Griffiths, Liverpool.*—20*th July*, 1883. 6*d*.
Consists, First, in the manufacture of front-steering velocipedes with more than two wheels, having pivotted or hinged frames, provided with springs, to assist the balancing of the rider, and stops to insure safety from overturning, consequent on the automatic rotary motion of the one part of the frame about the other; Secondly, to the driving arrangement; and Thirdly, to a brake arrangement.

3566. Apparatus for Facilitating Ball Practice with Fire-arms, *J. H. Johnson, London.*—20*th July*, 1883.—(*A communication from E. Gaupillat, Paris.*) 6*d*.
Consists in the employment of a ball having the same diameter as, but preferably shorter than, the regulation ball, and a small central cartridge loaded with powder, in combination with a metal tube or socket.

3567. Construction of Spinning and Twisting Rings, &c., *B. Mayoh, Bolton.*—20*th July*, 1883.—(*Not proceeded with.*) 2*d*.
Consists in forming or making them of glass, in lieu of iron or other metallic materials as hitherto, with an improved method of lubricating the same from the ring or travelling rail.

3568. Gas Motor Engines, *C. T. Wordsworth, Leeds, and H. Lindley, Manchester.*—20*th July*, 1883. 10*d*.
Relates principally to improvements on patent No. 2181, A.D. 1880, and consists in an arrangement and construction of the several parts necessitating a modification in the cycle of operation.

3569. Water Spinn Machines, *F. C. Glaser, Berlin.*—20*th July*, 1883.—(*A communication from N. Schlumberger and Co., Gebweiler.*)—(*Not proceeded with.*) 4*d*.
At a slight distance from the thread passing down to the spool, is a rod or bar of metal or other material, to which rotary motion is given, so that when the thread breaks, the loose end falls on to the said bar, and is directly wound up thereon, and is thus prevented from being thrown on one side.

3570. Bottle Stopper Fastenings, *B. D. Marks, Louisville, U.S.*—20*th July*, 1883.—(*Not proceeded with.*) 2*d*.
The object is to provide both a lever, which operates the stopper, and an operating hand lever with cogs, so that the level having the stop attached thereto can be moved so as to open and close the stopper; and to so construct the parts so that no moisture will get upon the joints, and thus form rust which will prevent them from operating.

3571. Earthenware and Glass Vessels, *E. Harwood, Habergham Eaves.*—20*th July*, 1883.—(*Not proceeded with.*) 2*d*.
The vessels are provided with a handle, which is caused to slide into a dovetail groove.

3572. Shirt and Collar Studs, &c., *W. C. Alldridge, Birmingham.*—20*th July*, 1883. 6*d*.
The back is formed of a disc made in halves, which are hinged.

3574. File-cutting Machines, *L. A. Groth, London.* 20*th July*, 1883.—(*A communication from F. Bathe, Berlin.*) 10*d*.
Relates to a file-cutting machine constructed with a movable anvil, a movable chisel holder, a chisel, an adjustable tilt hammer, and the mechanism for effecting the requisite movements.

3575. Voltaic Batteries, *W. R. Lake, London.*—20*th July*, 1883.—(*A communication from J. M. Stebbins, New York, U.S.*) 6*d*.
Relates to a battery having receptacles in which a store of the exciting salt is placed. Hard rubber cups surround the zinc plates, and are drawn up or down, according as it is desired to put the battery in or out of action. The rubber cups contain mercury.

3576. Water Meters, *J. Imray, London.*—20*th July*, 1883.—(*A communication from A. Frager and Mme. Veuve Michel, Paris.*) 4*d*.
The inventors claim in water meters having the pistons of two cylinders reciprocating alternately, each piston governing the slide passages to the other cylinders, a method of testing tightness by altering from without the position of the slide or its facing, so as to stop the pistons and the counter worked by them, and ascertain if leakage takes place.

3577. Producing Embroidery, *C. F. Bally, Schoenenwerd, Switzerland.*—20*th July*, 1883. 6*d*.
Relates to producing in duplicate or single pieces embroidery with a velvet or cut pile face.

3579. Machines for Use in the Manufacture of Wood Screws, *W. R. Lake, London.*—20*th July*, 1883.—(*A communication from E. Nugent, New York.*) 10*d*.
This comprises improvements, First, in the hopper and means for delivering the blanks therefrom to the guide ways; Secondly, in the means for regulating the feed and delivery of the blanks to the clamping jaws; and Thirdly, in the mechanism by which the movements of the bars that carry the cutter formers or pattern cams and the movable portions of the jaw are controlled.

3580. Process of and Apparatus for Purifying Mineral Oils, *W. R. Lake, London.*—20*th July*, 1883.—(*A communication from A. André, Paris.*) 6*d*.
Relates to the application of centrifugal force to the separation of impure tarry or resinous substances, contained in crude or distilled oils after their treatment with sulphuric acid.

3581. Manufacture of Steam Packing, *J. V. Taylor, Warrington.*—21*st July*, 1883. 2*d*.
Consists principally in the combination with an india-rubber core packing (with either a solid or coiled core) of a casing made of asbestos cloth, cemented thereon, so as to form a complete covering or casing.

3582. Automatic Steam Traps, *T. Wilkins, London.* —21*st July*, 1883.—(*A communication from A. Gimbel, Berlin.*)—(*Not proceeded with.*) 2*d*.
Relates to that class of steam traps in which the expansion of a liquid, caused by the temperature of the steam, closes the inlet, which inlet opens again when the said liquid contracts, in consequence of the reduction of temperature which accompanies the condensation of the steam.

3583. Apparatus for Heating Water or Atmospheric Air, *M. Steel and T. Smales, Gosforth.*—21*st July*, 1888.—(*Not proceeded with.*) 2*d*.
Relates to one general construction of apparatus for heating water by coal, coke, or other fuels, or by gas, for various purposes.

3584. Frames for Photographs and other Pictures, *J. F. Cooke, London.*—21*st July*, 1883.—(*Not proceeded with.*) 2*d*.
Relates particularly to a metallic frame for attaching the photograph to a sheet of glass.

3585. Crucible Furnaces, &c., *B. J. B. Mills, London.*—21*st July*, 1883.—(*A communication from G. Fischer, Hainfeld.*)—(*Not proceeded with.*) 4*d*.
Consists in a heating stove, forming a constituent part of the furnace, and in which the charge that is to be melted in the crucible furnace is previously heated to such a degree that the bursting of the crucibles through the considerably higher temperature cannot occur.

3586. Furnace and Apparatus for Annealing Castings, and for Drying and Heating Casting Moulds, *B. J. B. Mills, London.*—21*st July*, 1883.—(*A communication from G. Fischer, Hainfeld.*)—(*Not proceeded with.*) 4*d*.
The furnace consists of several furnace chambers disposed one above the other in a slanting position in the form of inclined galleries; into these furnace chambers, are introduced vessels mounted upon wheels, and having a cylindrical or some other form suitable to the form of the chambers. These vessels contain the cast steel goods that are to be annealed.

3588. Appliances for Making Attachments to or Connecting Ropes or Cords together, &c., *J. D. Sprague, London.*—21*st July*, 1883. 6*d*.
Consists in the construction of metallic connections.

3589. Lithographic Presses, *H. J. Haddan, London.* —21*st July*, 1883.—(*A communication from A. Schapiro, Berlin.*)—(*Not proceeded with.*) 2*d*.
The principal object is to automatically vary the pressure on the printing surface of a lithographic stone while the latter is drawn through the press.

3590. Perpetual Calendars, *G. W. von Nawrocki, London.*—21*st July*, 1883.—(*A communication from O. Fleischhauer, Berlin.*)—(*Not proceeded with.*) 2*d*.
Relates to perpetual calendars, adapted to show the day of the week and month, as well as the month and seasons of the year.

3591. Machinery for Scouring, Washing, and Cleansing Wool and other Fibrous Materials, *J. and F. W. Petrie, Rochdale.*—21*st July*, 1883. 8*d*.
Consists in actuating the rakes, prongs, plungers, or pressers used in machinery or apparatus for scouring, washing, or cleansing wool or other fibrous materials by means of two cranks, used in conjunction with flanges or ribs.

3592. Gas Distributor in Plastic Material for Stoves, *H. Marlow, London.*—21*st July*, 1883. 4*d*.
Consists of a hollow body with the front or exposed portion perforated, and with projections to permit of the free exit of the flame to any substance that may be placed upon it to give the appearance of an ordinary coke or like fire.

3593. Cigar Making Machines, *W. Clark, London.* —21*st July*, 1883.—(*A communication from F. Haehnel, Paris.*) 8*d*.
Relates to several improvements in the general construction of the machine.

3594. Box or Case for Parcels Post and like Purposes, *R. B. Jackson, London.*—21*st July*, 1883. 6*d*.
Consists in the employment of two boxes or cases, one placed within the other, with a space between them for protecting packing.

2595. Military and other Small-arms, *H. C. Swft, London.*—21*st July*, 1883. 6*d*.
Consists in the combination with small-arms of a safety lever catch engaging with an indicator, and displaced by the pressure of the thumb upon a button on the head of the stock.

3596. Fans or Fanning Apparatus to be Attached to Chairs and Seats, *J. A. Farquhar, London.*—21*st July*, 1883.—(*A communication from H. P. Roberts and J. Town, New York.*)—(*Not proceeded with.* 2*d*.
The fanning apparatus is applied to or combined with a rocking chair or seat, and is actuated by the rocking movement thereof.

3597. Manufacture of Cotton Cloth or other Fabric Furnished with Size or Filling Material, *H. H. Lake, London.*—21*st July*, 1883.—(*A communication from P. C. J. Richter, New York.*)—(*Not proceeded with.*) 2*d*.
The inventor adds to the size or glue a quantity of paper pulp, finely ground or macerated.

3599. Treatment of Straw, &c., for the Manufacture of Pulp and Manure, *T. H. Cobley, Dunstable.*—23*rd July*, 1883. 4*d*.
Relates to the chemical treatment of the straw, &c.

3600. MANUFACTURE OF INK, *C. E. Bolton, Leeds.*—23rd *July*, 1883.—(*Not proceeded with.*) 2d.

Consists of 16 oz. of crushed blue gall, 8 oz. sulphate of iron, ½ oz. of blue vitriol, 2 oz. gum arabic, and ½ oz. white ginger, broken, to which is added 1 gallon of spring water. The whole is thoroughly mixed.

3601. PURIFYING AIR AND GASES AND APPARATUS TO BE USED THEREFOR, *F. Windhausen, Berlin.*—23rd *July*, 1883. 6d.

The air or gas is caused to rotate, and thereby submitted to the action of centrifugal force within a flowing layer of water or other liquid.

3602. PANTOGRAPHS, *C. Pieper, Berlin.*—23rd *July*, 1883.—(*A communication from A. Keller-Dorian, Mühlhausen.*)—(*Not proceeded with.*) 4d.

Relates to a pantograph for engraving printing rollers or plates.

3604. APPARATUS FOR DISTILLING COAL, &c., *H. L. Pattinson, jun., Felling.*—23rd *July*, 1883. 6d.

Consists partly in constructing apparatus for distilling coal or other like substances in such manner that in one continuous double process the illuminating gas, or so much gas as can be eliminated from the coal or other substances simply by the heat of the retorts, is obtained in the retorts, while the gas obtainable by oxidation of the carbon is formed in a producer or chamber below the retorts.

3605. LIDS OF BOXES, &c., *G. W. von Nawrocki, Berlin.*—23rd *July*, 1883.—(*A communication from H. Lorentz, Germany.*) 6d.

The lid is formed in two parts hinged together, and each end has a tongue, one tongue being inserted in a groove in the box, and then by straightening the lid the other tongue is caused to enter an opposite groove in the box. The two parts are then rigidly connected by turning an excentric plate.

3606. MANUFACTURE OF CERTAIN SULPHO ACIDS, *F. Wirth, Germany.*—23rd *July*, 1883.—(*A communication from the Farfabrik vormals "Brönner," Germany.*) 4d.

This consists in the preparation of beta-napthol sulpho acids, by the action of sulphurising agents on beta-dinapthylether.

3607. POCKET KNIVES, *G. W. von Nawrocki, Berlin.*—23rd *July*, 1883.—(*A communication from A. Copper, Germany.*)—(*Not proceeded with.*) 2d.

This relates to knives with blades made to slide into the handle.

3608. MANUFACTURE OF TURNBUCKLES, &c., *A. W. L. Reddie, London.*—23rd *July*, 1883.—(*A communication from E. W. Merrill, Brooklyn, U.S.*) 6d.

This consists in coiling the contiguous ends of two or more bars or rods together at the point where it is desired to form a socket, and in welding and boring the coil, so as to give it a tubular shape to form a socket, the welding being preferably accomplished in a divided die, which is subjected to the action of a drop press.

3609. PIANOFORTE ACTIONS, *C. Collard, London.*—23rd *July*, 1883. 4d.

This consists in adapting an escapement for the hopper fly from the sticker lever to ordinary sticker actions. To the under side of the sticker lever a bevelled abutment block is attached, which moves freely therewith, and the hopper fly is fitted with an adjustable escapement button, adapted to come in contact with abutment block when the key is struck, and thrust back the hopper fly at the proper moment.

3610. TUBES OR HOLDERS FOR CIGARS OR CIGARETTES, *G. T. Jones, Oxford.*—23rd *July*, 1883.—(*Not proceeded with.*) 2d.

The tube is provided with a plunger, which, when pushed forward, ejects the end of the cigar or cigarette.

3611. LOCKS, *G. W. von Nawrocki, Berlin.*—23rd *July*, 1883.—(*A communication from the Werkzeug und Maschinenfabrik Oerlikon, Switzerland.*)—(*Not proceeded with.*) 2d.

The case is pressed in one piece. The locking latch may be used for right or left-handed lock, and it is the only part protruding from the lock plate, and can only be moved by the handle, while the key can bring a locking device into position to prevent the handle actuating the latter.

3612. RAILWAY CHAIRS AND KEYS, *J. K. Thompson and G. R. Race, Leeds.*—23rd *July*, 1883. 6d.

The space between the edge of the chair and the rail to receive the key is tapered, and this side of the chair is serrated so that the key when driven in is firmly held.

3613. IMPLEMENTS FOR CULTIVATING LAND, *R. Hitchcock, Taunton.*—23rd *July*, 1883. 6d.

The implement is to be worked by steam power and is intended to pulverise the land after ploughing. A roller has bearings in a frame which it supports, and behind the roller the frame carries a second frame furnished with tines. On a tapering prolongation of the main frame in front of the roller is a lever to which the hauling ropes are attached, and this part of the frame rests in front on a turntable, in which is a steering wheel, controlled by chains passing back to a pinion upon a vertical steering axis fitted with a hand wheel.

3614. MANUFACTURE OF ARTIFICIAL MARBLE OR SIMILAR MATERIAL, *J. Heinemann, Hanover.*—23rd *July*, 1883.—(*A communication from Dr. H. Rothe, Hanover.*) 4d.

Relates chiefly to the conversion of gypsum into marble.

3615. TREATING LEATHER FOR ORNAMENTAL PURPOSES, *F. Wirth, Germany.*—23rd *July*, 1883.—(*A communication from L. Klöpfer, Germany.*)—(*Not proceeded with.*) 2d.

This relates to embossing leather and coating it with metal.

3617. COMPOUND FOR COVERING THE DRAWING ROLLERS AND OTHER CYLINDERS EMPLOYED IN SPINNING MACHINERY, *C. Edwards, London.*—23rd *July*, 1883.—(*A communication from J. Appelt, Austria.*) 4d.

This relates to a substitute for leather or india-rubber for coating drawing rollers and other cylinders employed in spinning machinery, and it consists in a composition composed of 50 lb. gelatine dissolved in 250 lb. pure warm water, and then to which is added 30 lb. glycerine of 26 deg. Beaumé, 15 lb. of a solution containing 3 per cent. tannin or bichromate of potash, 3 lb. spirit of camphor.

3618. STEAM BOILERS, *W. Clark, London.*—23rd *July*, 1883.—(*A communication from E. Delpech, France.*)—(*Not proceeded with.*) 6d.

The object is to avoid loss of heat due to accumulation of soot in boiler tubes, and it consists in making the tubes or flues of large dimensions, and providing metallic rods projecting on the inside and outside thereof.

3619. MANUFACTURE OF GLASS WARE, *A. G. Brookes, London.*—24th *July*, 1883.—(*A communication from W. L. Libbey, Newton, U.S.*) 6d.

Consists in the manufacture of glass ware composed of homogeneous stock having differing or contrasting colours blended or merged one into the other.

3620. ANTI-FRICTION ROLLER DEVICES FOR BEARINGS, WHEELS, PULLEYS, &c., *J. H. Johnson, London.*—24th *July*, 1883.—(*A communication from H. G. Yates, A. Shotwell, and L. W. Boyer, Philadelphia.*) 6d.

The object is to maintain two sets of anti-friction rollers—one set being larger than, and alternately with, those of the other set—in such relation to each other as to insure steadiness of action and freedom from friction, and it consists in providing the box with bevelled flanges, which bear continuously against the bevelled ends of the small rollers.

3622. SMOKING PIPES, *J. H. M. Locke. Chesterfield.*—24th *July*, 1883.—(*Not proceeded with.*) 2d.

The object is to prevent nicotine finding its way into the mouthpiece, or saliva from entering the bowl, and it consists in inserting in the tube of the pipe an inner tube having one or more traps arranged therein.

3621. TELEGRAPHIC AND TELEPHONIC APPARATUS, *H. H. Lake, London.*—24th *July*, 1883.—(*A communication from F. van Rysselberghe, Schaerbeck, Belgium.*) 6d.

This invention relates to a system of duplex telegraphy, or of simultaneous telegraphy and telephony.

3623. SHEEP SHEARS, *T. Birkhead, Sheffield.*—24th *July*, 1883.—(*Not proceeded with.*) 2d.

An adjustable guard is attached to the shanks of the shears, and through it the hand is passed, the guard being preferably of leather, and forming a support to the shears, while relieving the muscles of the hand from a portion of the strain.

3625. APPARATUS FOR PRINTING, NUMBERING, AND DELIVERING TICKETS, &c., *T. King and R. Wilson, London.*—24th *July*, 1883. 6d.

A strip of paper is wound on a reel, and as it is drawn therefrom is brought to bear upon a platen, and the ticket printed, numbered, and delivered, the whole being actuated by the movement of a lever. The apparatus is intended especially for the use of conductors of tram-cars and omnibuses.

3626. HAIR-PINS, *W. A. Anderton, Bradford.*—24th *July*, 1883.—(*Not proceeded with.*) 2d.

The object is to enable hair-pins to hold the hair more securely in position, and it consists in making the wire with curved heads of nearly circular shape, the prongs approaching close together at the heads and gradually increasing in width towards the ends.

3627. TREATING INSOLUBLE PHOSPHATES FOR RENDERING THE PHOSPHORIC ACID IN THE SAME AVAILABLE, *H. J. Haddan, London.*—24th *July*, 1883.—(*A communication from A. H. Hoeford and T. B. Stillmann, New York.*)—(*Not proceeded with.*) 2d.

This relates to the treatment of the insoluble phosphates of iron and alumina, and it consists in finely powdering the rock containing the phosphate and mixing it with powered dolomite, when it is calcined at a high temperature. When cool the mass is pulverised, and then subjected to the action of sulphuric acid.

3628. VELOCIPEDES, *M. D. Rucker and J. Winterschladen, London.*—24th *July*, 1883. 6d.

This relates to a velocipede with two wheels for two riders, each of whom drives and steers a wheel, one wheel being placed in front of the other, and the two connected by a jointed backbone.

3630. ORNAMENTAL OR DECORATIVE FABRICS OR MATERIALS, *W. Clark, London.*—24th *July*, 1883.—(*A communication from E. Barou, Paris.*) 4d.

This relates to the production of ornamental designs on fabrics or other materials by the application thereto of metallic crystallisations produced with alloys of bismuth, antimony, and tin.

3631. APPARATUS FOR STEAM CULTIVATION, *A. Greig, Leeds.*—24th *July*, 1883. 6d.

This consists, First, in causing the ropes to coil evenly on the vertically revolving winding drums of winding engines, by taking the rope forward to as great a distance as possible from the drum and passing it round a sheave fastened at a distance from the drum, then passing it back and around another sheave fastened to the tank at the hind end of the engine before passing to the implement. In winding engines with horizontal drums the coiling lever is arranged either to guide the rope when passing direct to the implement, or when the rope is led to the back of the engine, to admit of the implement being pulled even with the engine itself when required. The invention also relates to the manner of driving the vertical driving drums on the hind axle separately from the road gear of the engine.

3632. PREPARING INSULATED WIRES, *H. E. Newton, London.*—24th *July*, 1883.—(*A communication from A. A. Cowles, New York, U.S.*) 6d.

The wire is first covered with a fibrous substance saturated with bituminous waterproof material. This is protected by braided coverings having paint between them. Pressure is applied to the surface to consolidate the paint and the braiding.

3633. MACHINES FOR OBTAINING ELECTRIC CURRENTS, *E. Jones, Leeds.*—24th *July*, 1883. 6d.

The armature consists of an annular core divided radially by pole pieces into fan-shaped sections, in which the coils are wound. The field magnets are of ordinary construction. The axle of the armature is capable of adjustment endways. A compound or double-ringed armature may be used.

3634. HYGIENIC JOINTS FOR DOORS, WINDOWS, &c., *B. J. B. Mills, London.*—24th *July*, 1883.—(*A communication from J. Couturier, Lyons.*) 6d.

The object is to close doors, windows, and casements, so that air can only penetrate through the joints thereof in a slow and continuous manner, and it consists in the use of elastic bands which are pressed by springs against the surfaces to be closed when the door or window is shut.

3635. MACHINERY FOR INDICATING WEIGHTS AND FORCES, &c., *T. H. Ward, Tipton.*—24th *July*, 1883. 8d.

This relates to improvements on patents No. 3580 and No. 3581, A.D. 1881, in which spring plates are arranged to act on the principle of the parallelogram of forces. In one arrangement two curved or bowed spring plates are connected at their extreme ends with their concave sides facing each other, and one end of the combined plates has means for suspending it to a crane, while the opposite end has a device to receive the load. To one plate a rack is fixed, and gears with a pinion on the other plate, the axle of which carries a pointer. Other arrangements are described.

3637. RAILWAY RAIL JOINTS, *T. H. Gibbon, Albany, U.S.*—24th *July*, 1883.—(*Not proceeded with.*) 2d.

The object is to connect the adjoining ends of rails, so as to cover the joints and produce an unbroken line on the head, and hold the two adjoining ends inflexibly. The head is cut away for a certain distance, and a cast steel connecting device fits over the rails.

3638. MANUFACTURE OF CLOTH OR FABRIC MADE PARTLY OR ENTIRELY OF INDIA-RUBBER, &c., *W. R. Lake, London.*—24th *July*, 1883.—(*A communication from F. E. Aldrich, Boston, U.S.*) 4d.

This relates to the ornamentation of cloth made of india-rubber by printing or stamping designs thereon, a special ink or composition being described for this purpose.

3639. WATCHES, *W. R. Lake, London.*—24th *July*, 1883.—(*A communication from F. Fitt, Switzerland.*)—(*Not proceeded with.*) 2d.

This relates to detachable watch escapements, so as to facilitate their application and removal, and in which the act of disconnecting the escapement bed also locks the centre wheel and prevents the spring unwinding.

3640. BRAKE MECHANISM FOR THE WARP BEAMS OF LOOMS, *J. Wetter, Wimbledon*—24th *July*, 1883.—(*A communication from C. Sylander, jun., Germany.*) 6d.

The object is to effect the uniform winding off of the warp threads from the beam in proportion as the manufacture of the fabrics proceeds, and to give to the warp threads the necessary tension, and it consists of a spur wheel on the beam shaft gearing with a pinion on a shaft carrying a ratchet wheel, outside which an anchor is pivotted and connected by a rod with one end of a double armed lever, carrying a weight on its other arm. The lever is mounted on a shaft above the beam, and has secured to it an excentrically curved board or cam over which pass the warp threads from the beam. If the tension of the threads increases, the cam is drawn down and the tooth of the anchor is lifted out, so as to allow the ratchet wheel to turn until again arrested by the anchor.

3642. PURIFICATION OF COAL GAS, *M. Williams, Wigan.*—24th *July*, 1883.—(*Not proceeded with.*) 2d.

The objects are to supply sufficient air to revivify the oxide in the purifier, and at the same time carburate such air with a suitable hydrocarbon.

3643. PICKERS FOR LOOMS, &c., *J. H. Tullis, Glasgow.*—25th *July*, 1883. 6d.

This consists in constructing pickers of cotton canvas fabric, solid cotton woven fabric, camel-hair woven fabric, or fabric of linen, hemp, or jute, either in plies or solid woven, or of woollen, hair, textile, or animal fibres, or of tough grass with gutta-percha or gum or india-rubber, or they may be composed of india-rubber and cloth, or india-rubber with cloth and leather, or felted material or paper and cloth.

3644. VALVES OR BUCKETS AND ANALOGOUS APPARATUS SUITABLE FOR PUMPS OR OTHER MECHANISM, *J. K. Tullis, Glasgow.*—25th *July*, 1883. 4d.

This consisis in forming the valves of cotton canvas fabric, solid cotton woven fabric, camel hair woven fabric, or fabric of linen, hemp, or jute, either in plies, or solid woven, or of fabric of woollen, hair, textile, or animal fibres, or of tough grass with gutta-percha or gum or india-rubber, or of india-rubber with cloth and leather or felted material, or paper and cloth, such material being combined or not with wire gauze, thin metallic plates, or strips of thin sheet metal or wires.

3646. FLOATING PONTOON BRIDGES AND FLOATING BRIDGES WORKING ON CHAINS, &c., *S. Lampard, Portsea.*—25th *July*, 1883.—(*Not proceeded with.*) 2d.

This relates to a floating bridge running to a pontoon connected to the shore by a bridge of iron or other material, the bridge being so placed that the incline due to the rise and fall of the tide is divided into two parts.

3647. MANUFACTURE OF VENTILATING COWLS, &c., *A. Mechan, Glasgow.*—25th *July*, 1883. 6d.

The object is to manufacture open-mouthed cowls by machine power, for which purpose a press is used.

3648. FIRE-RESISTING DOORS OR SHUTTERS, *F. W. E. Braid, London.*—25th *July*, 1883. 4d.

This consists in the application of cotton slag covered on each side with asbestos, paper, or other similar material to fire-resisting doors or shutters.

3649. APPARATUS FOR FACILITATING THE GEARING AND CHANGING OF HEALDS EMPLOYED IN LOOMS FOR WEAVING, *S. H. Storry and S. D. Rhodes, Huddersfield.*—25th *July*, 1883. 6d.

Relates partly to the use in combination with a streamer, made with slots, holes, or openings, of a grooved fixing, with a headed stud or button, or headed studs or buttons.

3650. ATTACHING DOOR AND OTHER KNOBS AND HANDLES TO THEIR SPINDLES, *H. C. Webb, Worcester.* 25th *July*, 1883.—(*Not proceeded with.*) 4d.

This relates to a square spindle with a screw at one end, over which a separate rose is placed, and leaves a space between it and the spindle to allow the knob to be screwed on, and give the appearance of a combined knob and rose.

3652. TREATMENT OF COMPLEX ORES FOR THE SEPARATION OR EXTRACTION OF THE METALS CONTAINED THEREIN, *W. P. Thompson, Liverpool.*—25th *July*, 1883.—(*A communication from G. T. Lewis, Philadelphia.*) 6d.

This relates to treating complex ores to separate the metals therefrom, and consists in treating the ores at a high temperature with excess of air sufficient to thoroughly oxidise and volatilise the more volatile metals, and collecting the fumes in air filtering apparatus for subsequent treatment.

3654. INSTRUMENT FOR CURLING OR WAVING THE HAIR, *H. Roman, London.*—25th *July*, 1883. 4d.

The instrument consists of a small round rod or tube and two pieces of semi-cylindrical section, jointed one to each end of the rod or tube.

3657. TREATING SPENT LIME FROM GASWORKS, &c., *W. R. Lake, London.*—25th *July*, 1883.—(*A communication from A. T. Schnessler, Newark, and V. Zeis and M. D. Hanover, New York, U.S.*) 4d.

This relates to treating spent lime from gasworks for regenerating the same and obtaining potassium cyanide, and consists in dissolving and leaching the soluble substances from the lime; treating the mother liquor thus obtained with a stream of carbonic acid gas, and separating the sulphuretted hydrogen from the same; decomposing the residuum by adding thereto the commercial salt of sulphate of potash, and then removing the precipitate and finally evaporating the moisture.

3659. FALLERS USED IN THE PREPARING OF FLAX, SILK, WOOL, &c., *J. W. Bradley, Bradford.*—26th *July*, 1883. 4d.

Consists in the construction and employment of fallers having the stock partly cut out, leaving a bar, through which is drilled a series of holes, in which are inserted round, flat, or other shaped pins for single or double rows.

3662. BELT OR STRAP FASTENERS, *H. Greene, London.*—26th *July*, 1883. 6d.

The inventor unites belts or straps without overlapping by means of fasteners provided with pins, teeth, points, or tongues, which, after insertion through the strap end, are bent over, and thus secure the ends together. The fastener is generally made of the width of the strap (or for very wide straps two or more fasteners may be used), and in two parts, which are hinged together, the hinge coming at the butt end of the strap.

3663. APPARATUS FOR DISTRIBUTING BLAST TO BLAST FURNACES, CUPOLAS, &c., *Don P. P. de la Sala, Hackney.*—26th *July*, 1883. 8d.

Outside the walls the "blast distributors" have one or more holes or openings made into them, to which the mouths of the main blast pipes are adjusted. Two or more smaller holes or openings are also made at other convenient places into the said blast distributors, to which are adjusted tubes for the distribution of the hot or cold air to the interior of the furnaces.

3664. CONSTRUCTION OF GRINDING MILLS, *C. Duckering, Lincoln.*—26th *July*, 1883. 6d.

Instead of the ordinary horizontal millstones, the inventor uses a vertical mill wheel of hard chilled cast iron, and formed or approximating to the form of a prolate spheroid, mounted upon a horizontal axle. In close proximity to this mill wheel the inventor places another casting of similar material, which is concave to the mill wheel and surrounding a portion of its circumference and curved periphery.

3665. CONSTRUCTION OF METALLIC PACKING-CASES AND RENDERING THEM AIR AND WATER-TIGHT, *C. H. W. L. Brodersen, London.*—26th *July*, 1883.—(*A communication from Messrs. Braun and Bloem, Düsseldorf.*) 6d.

Relates partly to the means of attaching the lid.

3668. APPARATUS FOR REMOVING STONES FROM THE BLADDER, *W. P. Thompson, Liverpool.*—26th *July*, 1883.—(*A communication from Dr. N. Verguerio, Brazil.*)—(*Not proceeded with.*) 2d.

Consists essentially in an artificial bladder and the special instruments.

3670. TRACTION OR LOCOMOTIVE ENGINES FOR TRAVELLING ON COMMON ROADS, &c., *J. H. Johnson, London.*—26th *July*, 1883.—(*A communication from J. E. E. Pécourt, Paris.*) 6d.

Relates to the combination of a driving or crank shaft in separate parts, constituting independent crank shafts capable of being rotated independently of each other, with steering gear or means for transmitting motion to the axle of the fore carriage.

3673. BUNDLE CARRIER FOR HARVESTERS, &c., *W. McI. Cranston, London.*—27th *July*, 1883.—(*A communication from W. A. Wood, New York.*) 6d.

A spar or support is attached to the side of a grain straw binder or harvester. On this spar or support the bundle carrier of, preferably laths, is hinged so as to be tilted on end to allow of the bundles or sheafs sliding off at the rear part, or at right angles to that at which the bundles are received. The bundle carrier is balanced or nearly so, or it may be hinged at or near its front end, and is by means of rods and levers, one of which is within reach of the driver, held firmly until it contains the desired number of bundles, when the bundle carrier is released for discharging them at the rear instead of at the side.

3671. RAILWAY AND OTHER LAMPS, *J. Harbottle, Newcastle-upon-Tyne.*—26th *July*, 1883.—(*Not proceeded with.*) 2d.

Relates to the construction of the burner.

3674. CLIPPERS OR SHEARS FOR CLIPPING HORSES, &c., *J. Sabatier, London.*—27th *July*, 1883.—(*A communication from J. Bariquand and Son, Paris.*) 6d.

Relates to the arrangement, combination, and construction of parts comprising the clippers or shears in which the left-hand lever carries the axle or pivot on which the hand levers oscillate, holding and supporting the principal parts and passing through the bottom plate without being fixed to it.

3677. MACHINERY OR APPARATUS FOR MAKING CASKS, *S. Wright, Chester.*—27th *July*, 1883. 6d.

This relates to improvements on patent No. 3589, A.D. 1882, and consists in the use of an endless chain to feed the staves along the table to the collapsible core barrel, drum or form. The cutters for treating the ends of the staves are arranged upon a jointed support so that they can be moved out of the way. Hoops are employed acting both as encircling hoops about the collapsible core barrel to guide the staves into position and also as trussing hoops, formed in parts capable of being drawn together by a lever.

3678. PROCESS FOR REFINING OILS, *J. Imray, London.*—(*A communication from J. A. F. Bang and C. A. Sanguinetti, Paris.*)—27th *July*, 1883. 2d.

This consists in refining oils by mixing intimately with them monohydrate of lime or other alkaline earth in fine powder without addition of water, and, after reaction, filter pressing the mixture.

3691. APPARATUS FOR BAKING AND PRESERVING BREAD AND CAKES, *H. J. Haddan, London.*—28th *July*, 1883.—(*A communication from A. Klucke, Berlin.*) 6d.

Consists in the production of tinned or preserved bread or cake, by first baking the dough in a closed metallic box or vessel provided with apertures for the escape of the vapour, and then exposing the loaf or cake to a second or third lower heat in a hermetically sealed box or vessel.

3703. GAS ENGINES, *J. Pickering, Stockton-on-Tees.*—28th *July*, 1883. 6d.

Relates, First, to the arrangement of rotary and disc valves: Secondly, to the automatic regulation of gas with governors; Thirdly, improvements in circulating partitions annularly and longitudinally for effectually cooling cylinders of gas motor engines; Fourthly, for applying a pump (force or centrifugal) for giving immediate circulation to the water as soon as the engine commences to work.

3714. APPARATUS FOR FACILITATING THE TAPPING OF BEER CASKS, &c., *W. S. and W. A. Dackus, Birmingham.*—30th *July*, 1883. 8d.

The apparatus consists essentially of a seat plate faced with leather or other packing material, and a cap or case or cheeks, between which said seat plate and a cap or case or cheeks, a valve or closer works, air and liquid-tight.

3727. APPARATUS FOR USE IN PACKING AND PRESERVING POLISHING AND ABRASIVE PLATES, &c., *A. J. Brooker, London.*—31st *July*, 1883.—(*A communication from L. D. Shepard, Boston, U.S.*) 6d.

Consists in a package of flexible discs for dental purposes adapted for shipment, the discs being held together between rigid plates or followers pressed against the ends of the pile.

3737. UMBRELLAS, PARASOLS, &c., *E. G. Charageat, Paris.*—31st *July*, 1883. 6d.

Relates principally to the construction and arrangement of the runners and stretchers.

3748. BINDING BOOKS AND MACHINERY APPLICABLE THERETO, *A. Brehmer, Leipzig, and G. Brown, Glasgow.*—31st *July*, 1883.—(*Complete.*) 6d.

Relates partly to a machine for sewing books, consisting chiefly of a swinging arm, which serves to receive the sections for sewing, a shuttle-carrying mechanism, a needle mechanism, and a mechanism for cutting the ends of the sections.

3758. METHOD AND APPARATUS FOR COATING WITH GELATINOUS COMPOUNDS THE DRAWING ROLLERS AND OTHER CYLINDERS EMPLOYED IN SPINNING MACHINERY, *E. Edwards, London.*—31st *July*, 1883.—(*A communication from J. Appelt, Richenbery, Bohemia.*) 6d.

Relates partly to the process of covering the rollers with a fusible compound, by submerging the rollers in the melted compound contained in a cylindrical tube.

3817. MACHINERY FOR POLISHING AND GRINDING METALLIC TUBES, RODS, AND BARS, *C. Harvey, jun., Yardley, and W. Paddock, Birmingham.* — 4th *August*, 1883. 8d.

Relates principally to the combination in a polishing or grinding machine, of a series of hanging frames carrying the polishing buffs or bobs or emery or grinding wheels.

3818. RESERVOIR FOR METALLIC AND OTHER PENS, *M. Myers and J. Lowe, Birmingham.*—4th *August*, 1883. 6d.

A reservoir made of sheet metal is formed so that it can take up a large supply of ink and deliver it to the pen over which it is applied.

3832. DIE STOCKS FOR CUTTING SCREW THREADS, *H. J. Allison, London*—7th *August*, 1883.—(*A communication from C. Hart, Cleveland, U.S.*) 6d.

This consists partly in the devices for holding or guiding the stock in a central position on the bolt. The case has two arms to rotate it, and attached to the side is an adjustable spring, and provided with a pin and arms connected to the stock. On one side is connected an annular cam ring, with an index and a series of notches to adjust the dies in combination with a spring gauge and pointer.

3875. PROCESS OF MANUFACTURING SEWING NEEDLES, &c., *R. H. Brandon, Paris.*—9th *August*, 1883.—(*A communication from H. S. Ward, U.S.*) 8d.

This consists of a machine in which three intermittently rotating tables, provided each with a series of spindles, in the first of which the wires cut off from a spool are successively flattened, pierced, countersunk, and roughly trimmed and then passed to the spindles of the second table, in which their extremities are sharpened, after which they pass to the spindles of the third table and are polished.

3897. REGULATING THE SPEED OF MOTIVE POWER ENGINES, &c., *N. Macbeth, Bolton-le-Moors.*—11th *August*, 1883. 6d.

This relates to apparatus for recording variations in the speed of engines or revolving shafts, and it consists in arranging the index of a clock to revolve once in twenty-four hours, and carry a marker which is kept in contact with a strip of paper, the spindle of the index or of the marker being connected with a revolving pendulum apparatus driven by the engine or shaft.

4552. WATER METERS, *A. E. H. Johnson, Washington, U.S.*—24th *September*, 1883.—(*A communication from L. H. Nash, New York.*) 6d.

This relates to improvements on patent No. 166, dated 6th June, 1879, and it consists in the combination in a rotary water meter of a piston with circumferential projections and recesses, with a chamber having wall projections adapted to intermatch and form a division point with the piston on one side, the projections of the piston and of the chamber forming the division point on the opposite side of the piston.

The lower head of the case has the necessary ports, and is combined with a separate top head and a separate top enclosing case.

4020. Self-feeding Flat Forme Printing Machines, *William Brooks, London.*—*20th August*, 1883.—(*A communication from D. T. Simpson, New York.*)—(*Complete.*) 6*d*.

This relates to a machine in which one or more impressions are printed, then one or more impressions missed—leaving blanks between—the missed impressions being afterwards filled up. The printing is effected by a flat forme upon a web.

4802. Apparatus for Loading Vessels from Lighters, *T. E. Heath, Northlands, South Wales.*—*27th September*, 1883.—(*Complete.*) 6*d*.

Consists of various combinations and arrangements of apparatus constructed so as to be readily portable, and easily adjusted to the sizes of the vessels to be loaded.

4776. Heating and Controlling Gases for Motor, *W. A. Bartlett, Washington, U.S.*—*8th October*, 1883.—(*A communication from G. E. Haight and W. H. Wood, Connecticut, and W. E. Winsor, New York.*)—(*Complete.*) 6*d*.

The object is to produce rapid expansion of the gas after it leaves the holder, where it is held in a compressed state and before it enters the engine, and to prevent refrigeration due to such expansion. The gas is caused to flow through a coil of pipes, which is subjected to the heat produced by slaking lime in the chamber containing the coil of pipes.

4891. Machinery for Spinning and Doubling Textile Materials, *W. J. Kinder, Manchester.*—*13th October*, 1883.—(*Complete.*) 4*d*.

The ordinary revolving spindle carrying a flyer is abolished and the flyer is mounted to revolve in a part above the bobbin, upon which the yarn is wound, the bearing of the flyer running in an annular oil cup and the yarn passing through the centre of the flyer and cup.

4963. Bearing Blocks with Vegetable Parchment or Parchment Paper Bearings, *M. Frenkel, Germany.*—*17th October*, 1883.—(*A communication from F. W. Ulffers, Germany.*)—(*Complete.*) 6*d*.

Pressed packets of parchment paper are employed to form bearing surfaces, the leaves of the packets being arranged so that the friction bears on their edges. Water is supplied to the material to cause it to swell, and acts also as a lubricant in combination with a small quantity of oil.

4964. Transmitting and Re-producing Sounds at a Distance, &c., *A. G. Brookes, London.*—*18th October*, 1883.—(*A communication from T. N. Vail, Boston, Mass., U.S.*) 6*d*.

The electrical undulations are produced by vibrating a helix carrying a constant electric current in proximity to a secondary helix forming part of the receiving instrument circuit. Several methods of mounting the apparatus are described and illustrated.

5001. Telegraph Insulators, *H. J. Allison, London.*—*20th October*, 1883.—(*A communication from C. C. Hinsdale, Cleveland, Ohio, U.S.*) 6*d*.

The insulators are constructed from paper pulp and silicon, and are formed with their insulating head and supporting stem in one piece.

5047. Time Controlling System, *W. F. Gardner, Baltimore, Mass., U.S.*—*23rd October*, 1883. 8*d*.

This relates to a system of automatically controlling clocks and sending time signals; and comprises a standard mean time clock, a primary transmitting clock, a series of secondary controlling clocks, and a series of controlled local clocks.

5048. Machines for Manufacturing Blanks for Horseshoe Nails, *R. H. Brandon, Paris.*—*24th October*, 1883.—(*A communication from F. Myers, United States.*)—(*Complete.*) 6*d*.

A plate of metal is presented to dies which cut out the blanks for the nails, while a header spreads and thickens the heads of the blanks, the plate being held and turned by suitable mechanism so as to correctly present its end to the action of the dies and header.

5050. Machines for Finishing Horseshoe Nail Blanks, *R. H. Brandon, Paris.*—*24th October*, 1883.—(*A communication from F. Myers, United States.*)—(*Complete.*) 8*d*.

This relates to machines in which the nail blanks are moved forward intermittently by a chain to be acted upon by a roller die, and are then bevelled at the point and sheared to finish the point, and it consists in the construction of the chain of links and plates with pockets for the heads of the blanks; also in the sheaves to sustain such chain; the construction of the roller die and a die and die block; and a rest for the die block.

5060. Automatic Car Couplers, *H. J. Haddan, Kensington.*—*24th October*, 1883.—(*A communication from E. N. Gifford, Cleveland, U.S.*)—(*Complete.*) 6*d*.

The object is to enable the coupling pin to be locked in its raised position when desired to render the coupling non-automatic; further, to secure the pin in such position that the cars will be coupled by two of them coming in contact; also to prevent the pin being accidentally thrown into the locked position; and, lastly, to simplify the construction of automatic couplers. The pin is raised by a link coming in contact with its bottom inclined end, through an opening in the socket in which the pin is arranged. The pin can be raised so as to prevent its falling again, and also so that it will fall again upon concussion caused by trucks coming in contact.

5090. Subjecting Textile Materials in Filamentory or Band Form to the Action of Dyeing, Bleaching, and other Liquors, &c., *F. C. Glaser, Berlin.*—*26th October*, 1883.—(*A communication from E. Rümmelin, Alsace.*)—(*Complete.*) 6*d*.

Consists in subjecting the filaments or ribands in a separated and stretched condition to the liquids.

5136. Belt Cable Railways, *H. J. Allison, London.*—*30th October*, 1883.—(*A communication from the California Belt Railway Company, San Francisco.*)—(*Complete.*) 6*d*.

This relates to the employment of a belt formed of a number of lighter cables or wires instead of the single cable usually employed. A wheel has arms or teeth which engage the belt, and is capable of being braked so as to cause the car on which it is mounted to be moved along by the belt. A special arrangement of sheaves or wheels is described for propelling the car round curves.

5152. Plumber's Traps, *W. R. Lake, London.*—*30th October*, 1883.—(*A communication from F. N. Du Bois, New York.*)—(*Complete.*) 2*d*.

This consists of a plumber's trap of soft metal constructed without seams and having a series of seals or dips, by causing molten metal to be forced through a die by a press of special construction.

5200. Machinery or Apparatus for Use in Dyeing or Cleaning Yarn, *W. R. Lake, London.*—*1st November*, 1883.—(*A communication from J. H. Lorimer, Philadelphia.*)—(*Complete.*) 2*d*.

This consists of an apparatus in which wringing rollers are combined with two endless feed aprons composed of metal bars hinged at each end to endless chains, and feed rollers arranged so that their line of contact is considerably below that of the wringing rollers. The endless aprons are arranged so that they are separated to receive and discharge the yarns, but are pressed together by their own weight when carrying the yarn below the level of the liquid.

5268. Moulding Machinery, *J. Walker, Cleveland, U.S.*—*6th November*, 1883.—(*Complete.*) 1*s*.

This consists partly of a fixed pattern plate combined with an exterior flask supporting plate sustained by hydrostatic rams and means for operating same, so as to adjust the height of the flask supporting plate. The flask is placed over the pattern plate and seated on a yielding supporting plate surrounding the pattern plate, a compressing device being located above the flask.

5273. Machines for Grinding and Dressing File Blanks, *A. G. Brookes, London.*—*7th November*, 1883. 6*d*.

This consists in a machine for grinding or dressing a number of file blanks at once. The blanks are held in a frame, which is vertically reciprocated in a direction tangential to the periphery of a revolving grindstone, by means of screw and bevel gearing above the frame actuated alternately in opposite directions by belts automatically shifted upon a pulley. The grindstone is also reciprocated continuously in the direction of its axis of rotation and across the face of the frame. A device for dressing the grindstone face is vertically adjustable towards the surface of the stone, and can also be drawn laterally across it.

5282. Vacuum Brake Apparatus for Use on Railway Trains, *A. S. Hamand, London.*—*8th November*, 1883.—(*Complete.*) 6*d*.

Relates to improvements in the general construction of the apparatus.

5350. Nut Lock, *A. M. Clark, London.*—*13th November*, 1883.—(*A communication from H. Schwarzwalder, New York.*)—(*Complete.*) 4*d*.

The threaded end of the bolt is split and the nut is combined with a washer carrying a yoke that enters the slit and opens out the end of the bolt.

5362. Looms for Weaving, *W. R. Lake, London.*—*13th November*, 1883.—(*A communication from W. Brown and T. Lang, Georgia, U.S.*) 6*d*.

Consists partly in providing a loom with lease rods moving forward and backward, horizontally, or nearly so; also in mechanism for automatically oscillating or reciprocating the lease rods simultaneously with the movement of the lathe; also in making the couplers or clamps of the lease rods to rock on their levers or supports.

5423. Dredging Machinery, *W. E. Gedge, London.*—*17th November*, 1883.—(*A communication from H. B. Angell, San Francisco.*)—(*Complete.*) 8*d*.

Consists in improvements in the construction of the chain and buckets, the ladder, the tumblers, at each end over which the chain passes; a means for suspending the ladder, and also the pipe which conveys away the material received by it from the buckets.

5447. Telephones, *C. A. Jackson, Laurence, Mass., U.S.*—*19th November*, 1883. 6*d*.

This relates to a method of coupling-up so as to do away with the central office, and to enable two or more subscribers to communicate with different subscribers from the same instrument at the same time.

5454. Railway Rail Joint, *T. H. Gibbon, Albany.*—*20th November*, 1883.—(*Complete.*) 6*d*.

Relates to a joint for rails, in which the heads of the conjoining ends are cut away.

5455. Harrows, *S. Pitt, London.*—*20th November*, 1883.—(*A communication from F. Nishwitz, New Jersey, U.S.*)—(*Complete.*) 1*s*.

This consists in improvements in harrows in which trailing teeth arranged in gangs transversely to the line of draft operate upon the soil, and in the combination of such teeth with crushing bars or levellers. The gangs are hinged so as to follow undulations of the ground. Two gang bars may be employed, the rear one bearing open slotted curved trailing or dragging teeth, and being supported above the front bar so as to afford a large area of discharge for the earth cut up by the teeth of the first gang.

5476. Synchronising Clocks, *H. J. Allison, London.*—*21st November*, 1883.—(*A communication from R. W. Wilson, Newhaven, Conn., U.S.*) 6*d*.

This relates to means for automatically turning the minute-hand to a fixed point at a predetermined time. The impulses are transmitted from a standard clock.

5625. Explosive Compounds and Blasting Cartridges, &c., *S. R. Divine, New York.*—*4th December*, 1883.—(*Complete.*) 4*d*.

This relates to an explosive consisting of a liquid ingredient formed of a mixture of the heavy oil of coal tar, or nitro-benzole, or partly of both, and nitro-glycerine, and a solid ingredient—chlorate of potash—mixed together in the proportion of from four to five parts of the solid to one of the liquid.

5633. Gas Engines, &c., *L. H. Nash, Brooklyn, U.S.*—*4th December*, 1883.—(*Complete.*) 8*d*.

The inventor refers to a patent applied for November 27th, A.D. 1883, in which the gases, after compression, are caused to circulate over the heated parts of the engine on the way to the working cylinder. The present invention relates to improvements in the prior invention, the object being to enable the engine to be operated with a liquid fuel, from which the gas is made. The fuel is injected with air, water, and gas, into a compression chamber formed in the forward end of the cylinder, and is compressed by the forward stroke of the piston, and the heat produced by the compression tends to evaporate the fuel, the vapour of which, mixing with the air and gas, forms an explosive mixture. Provision is made to start the engine by the pressure of the working fluid in the storage chamber. Two or more co-acting cylinders are combined with the gas storage chamber, which communicates with the compression chamber of each cylinder, so that the compressed gases are discharged on the forward stroke of each piston into the storage chamber, where they accumulate and maintain sufficient pressure to be utilised as a starting power.

5637. Woven Fabrics and Apparatus for Producing the same, *A. M. Clark, London.*—*4th December*, 1883.—(*A communication from A. Urbahn, Passaic, and A. G. Jennings, Brooklyn, U.S.*)—(*Complete.*) 6*d*.

This relates, First, to a new woven fabric having on a plainly woven background ornamental cords arranged in suitable design; and Secondly, to an arrangement of loom for producing such a fabric. The ornamental cord is combined with the shuttle and twisted ground warp threads of the foundation fabric, and is held to the body by shuttle threads passing over the ornamental cord, the ground warp threads being all beneath the same. The figure thread is carried on opposite sides of the ground warp thread, so that a separate design is produced on each side of the fabric by one series of figure threads. The loom is provided with heddles having perforated needle-like projections, through which the ground warp threads and also the figure cords are drawn, The reed is made with doubly-looped pillars, the ground warp threads passing through the pillars, and the figure threads or ornamenting cords passing between them

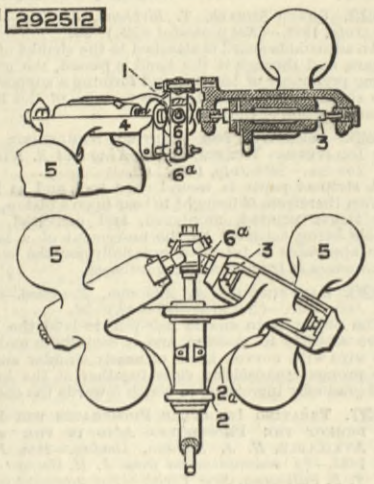
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

292,512. Centrifugal Governor, *Johannes Selwig, Brunswick, Germany.*—*Filed June 29th*, 1882.

Claim.—(1) An astatic centrifugal governor consisting of two or more oscillatory pendulums revolving with the regulator shaft, said pendulums consisting of a pair of balls mounted in different horizontal planes on an oscillatory axis, having suitable connections with the said regulator shaft, whereby said shaft will be operated upon by the oscillation of the pendulums, substantially as set forth. (2) In an astatic centrifugal governor, a pendulum consisting of a pair of balls mounted in different horizontal planes on an oscillatory axis, whereby their centrifugal force will cause said axis to oscillate, substantially as and for the purposes set forth. (3) The combination, with the regulator shaft 1 and the sleeve 2, carrying brackets 2a, of the pendulum, mounted upon axes secured in adjustable bearings in the said brackets, and having bearings in the said regulator shaft, substantially as described. (4) The combination, with the regulator shaft 1, having a cap 6, provided with bearings 6a, and the sleeve 2, carrying supporting brackets 2a, of the pendulum 5, secured laterally upon hollow semi-cylindrical castings 4, said semi-cylindrical castings having shafts 3, journalled in suitable bearings in semi-cylindrical bracket arms and loose connection with the cap 6, substantially as and for the purpose set forth. (5) In a centrifugal governor, the combination of an oscillatory pendulum mounted on suitable axis, substantially as herein described, and a support-

292512

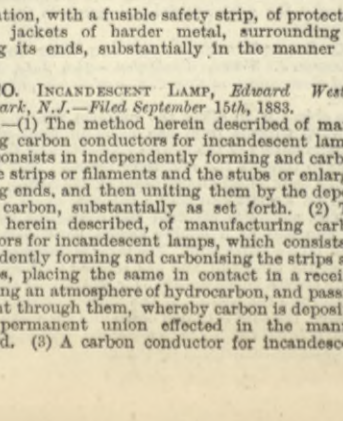


ing bracket having adjustable bearings for said axis, as set forth. (6) In an astatic centrifugal governor, the combination with an oscillatory pendulum substantially as herein described, of a lug or stop to arrest its oscillation, as and for the purpose set forth.

292,498. Dust Exhauster and Conveyer for Thrashing Machines, *David Logan, Hartstown, Pa.*—*Filed June 7th*, 1883.

Claim.—(1) The combination of the casing of the machine, a closet arranged to close the rear end thereof, and comprising a hinged lid or cover, a fan chamber having a rotary fan, and elastic exhaust pipes extending from the fan chamber to openings in the said cover, as and for the purpose set forth. (2) The

292498

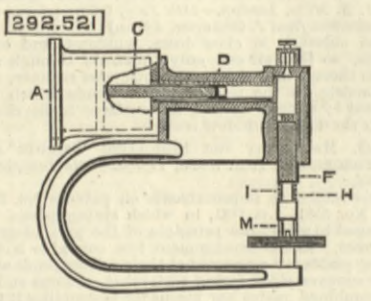


combination of the closet adapted to close the end of the casing to which it is applied, and comprising the hinged doors, the cap or cover of the closet hinged and formed with the flange that engages the doors to retain the same closed, a fan chamber secured near the closet and provided with a rotary fan, the elastic exhaust tubes extending from openings in the sides of the fan chamber to openings in the hinged cover, and the conveyor tubes extending from different ends of the fan chamber, up and in different directions, as and for the purpose set forth.

292,521. Hydraulic Rivetting Machine, *Wm. R. Webster, Athens, Pa.*—*Filed August 29th*, 1883.

Claim.—(1) The herein-described direct-acting rivetting machine, consisting of the cylinders A, D, and E, plungers C and F, and snap H, all arranged

292.521

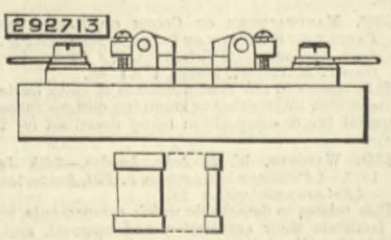


and operating substantially as and for the purposes set forth. (2) The herein-described device for holding the work firmly while being rivetted, consisting of the spring I and sleeve M, substantially as set forth.

292,713. Fusible Safety Strips for Electric Circuits, *Edward Weston, Newark, N.J.*—*Filed September 12th*, 1883.

Claim.—(1) A safety strip for electric circuits, having electro-deposited caps or jackets of harder metal on its ends, as and for the purpose set forth. (2) The

292713

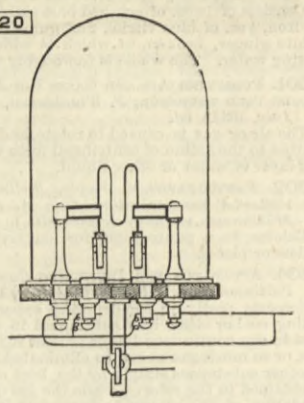


combination, with a fusible safety strip, of protecting caps or jackets of harder metal, surrounding or inclosing its ends, substantially in the manner described.

292,720. Incandescent Lamp, *Edward Weston, Newark, N.J.*—*Filed September 15th*, 1883.

Claim.—(1) The method herein described of manufacturing carbon conductors for incandescent lamps, which consists in independently forming and carbonising the strips or filaments and the stubs or enlarged clamping ends, and then uniting them by the deposition of carbon, substantially as set forth. (2) The method herein described, of manufacturing carbon conductors for incandescent lamps, which consists in independently forming and carbonising the strips and the stubs, placing the same in contact in a receiver containing an atmosphere of hydrocarbon, and passing a current through them, whereby carbon is deposited and a permanent union effected in the manner described. (3) A carbon conductor for incandescent lamps, consisting of a strip or filament, enlarged clamping ends, and connections of deposited carbon

292.720

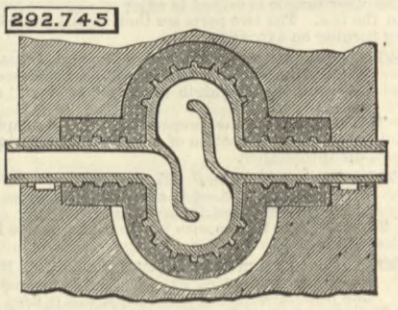


uniting the clamping ends to the strip, as herein set forth.

292,745. Heat and Fire Resisting Valves, *Watson A. Goodyear, New Haven, Conn.*—*Filed August 27th*, 1883.

Claim.—(1) The hereinbefore described fire and heat resisting valve, consisting of a cast or wrought iron

292.745

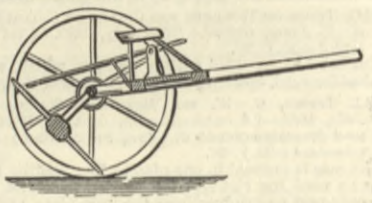


or other metal shell, coated with fire-clay or other fire and heat resisting material, constructed to rotate upon a hollow axis through which a continuous stream of water may be forced.

292,776. Horse Hay-rake, *John N. Wallis, Fleming, and Theodore Wallis, Scipio.*—*Filed August 4th*, 1883.

Claim.—(1) In a two wheel horse hay rake, the combination of a revolving rake, the cranked axles on which the rake head is journalled, thills connected by eye bearings to said axles, and devices for holding the rake to its work and tripping it, all constructed and adapted to operate substantially in the manner

292776



and for the purposes described. (2) The combination of a revolving rake, cranked axles affording bearings therefor, the feathers formed on the said axles, and grooves formed in the eyes of the thill irons to limit the vertical vibration of the axles, all constructed and adapted to operate substantially in the manner and for the purposes described.

CONTENTS.

The Engineer, March 14th, 1884. PAGE

The Chicago Railway Exposition. No. XII. (Illustrated.) .. 197
High-speed Locomotives. No. I. .. 198
Davy's Steel-making Plant. (Illustrated.) .. 199

Letters to the Editor—
Fuel and Water .. 200
The Clayton Brake again .. 200
Labour and Machinery .. 200
Creators of the Age of Steel .. 200
The Fastest Train in Great Britain .. 200
Efficiency of Fans .. 200
Works in Wood .. 200
Friction of Water in Long Pipes. (Illustrated.) 201
Boltless Rail Joints .. 201
Climbing Tricycles .. 201
Propeller Shafting .. 201
The Merchant Shipping Act. (Illustrated.) .. 201
Graphics .. 210
Chain Carriage Blocks .. 211
Bangor and Bethesda Contract Accident .. 211
Close Fire Ranges or Kitcheners .. 211
Clothing Steam Pipes .. 211
Steam Hammers .. 211
Electric Lighting for Mills .. 211
Currie and Timmis's Electric Railway Signals. (Illustrated.) .. 202
The Manchester Ship Canal .. 204
Shipbuilding in 1883 .. 204
Railway Matters .. 205
Notes and Memoranda .. 205
Miscellanea .. 205

Leading Articles—
The Sewerage of the Lower Thames Valley. 207
Tramways in Ireland .. 207
Brighton Beach .. 208
Armour Experiment .. 208
Quality of Scotch Pig Iron .. 209
Mining Lamp Tests .. 209
The Loadline Committee .. 209
Safety Lamp and Colliery Explosions .. 209

Literature—
Reminiscences of General Skobeleff .. 209
The Electric Light in our Homes .. 209
Books Received .. 209
Private Bills in Parliament .. 209
Burrell's Compound Semi-fixed Engine. (Illus.) 210
The Iron, Coal, and General Trades of Birmingham, Wolverhampton, and District .. 211
Notes from Lancashire .. 212
Notes from Sheffield .. 212
Notes from the North of England .. 212
Notes from Scotland .. 212
Notes from Wales and Adjoining Counties .. 212
The Patent Journal .. 213
Abstracts of Patent Specifications. (Illus.) .. 214
Abstracts of Patent American Specifications. 216

Paragraphs—
Electrical Engineering .. 199
Steel at the Royal Artillery Institution, Woolwich 204
Sir W. Siemens .. 204
Electrical Search Light .. 209