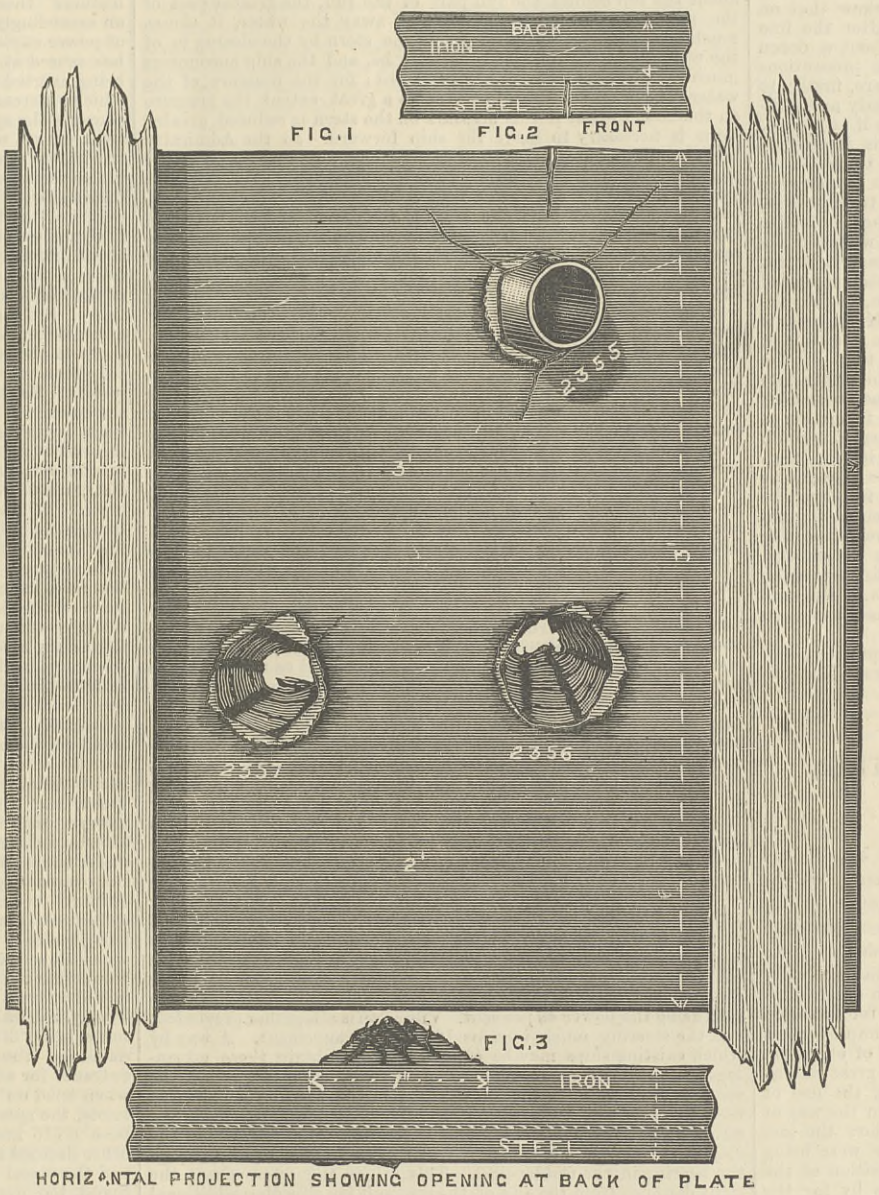
TRIAL OF IMPROVED PALLISER PROJECTILES AT SHOEBURYNESS.

ON Tuesday last, June 6th, the projectiles last designed by the late Sir W. Palliser were tried at Shoeburyness. A description of these projectiles, with cuts, will be found on page 421. They were made for the 13-pounder gun, for which the ordinary chilled projectiles have a diameter of 2·985in. The ordinary chilled shot for a 13-pounder gun have been fired by the sub-committee at wrought iron plates of different thicknesses, proportioned to the charge and velocity of the shot. According to Colonel Inglis, the 13-pounder shot with a velocity of 1550ft. would be a match for about 4·6in. of wrought iron unbacked. Taking 9½in. of good compound armour as equivalent to 12in. of wrought iron, a compound plate of 3¾in. would be a match for a 13-pounder shot for a single round. For the plate to be fired at repeatedly, it would need perhaps 4in., but on the above data, that, we think, ought to be more than a match for single rounds of the service shot. If the shot, however, were found to show extraordinary powers, a 4½ plate might be advisable, especially as it will be seen in the description that the diameter of the new projectile is slightly decreased, being 2·585in. instead of 2·985in.; 4in. ought, however, to show any superiority well, although not to measure the amount of it if it should be very marked. Captain Edward Palliser wished to get a 4½in. plate, we believe, but had to content himself at the time with a compound steel-faced plate of 4in., supplied by Messrs. Cammell. The firing took place with a charge of 3¼ lb., giving a velocity of about 1550ft. roughly, the weight of the shot being about 13lb. The point to which the Committee specially directed their attention was the action of the ribs, having made some experiments already with some steel jacketted chilled projectiles which had been suggested before now. We believe that Colonel Nicholson, R.A., wrote a proposal for the trial of wrought iron coiled jackets in 1875. Nothing was carried out, however, until comparatively recently.

The plate was 3ft. square; it was set up and held firmly by timbers, as shown. The first round fired at it was No. 2355, which struck a point 5in. from the top edge and 13in. from the proper left edge. The projectile was that with a double jacket, shown in Fig. 1 of the description on page 421. The result was very remarkable. The entire body of the shot passed through the compound plate, striking, indenting, and breaking itself against an old iron-plated target behind. The outer coat tore open and became detached, and the inner coat was left standing at the mouth of the hole—see Fig. 1 herewith. The shot struck a rather weak place, because it was too near the edge, as is seen in the crack of the edge of the plate at the top, which, however, at the time only bent, and did not actually crack until after the subsequent rounds had been fired—Figs. 1 and 2. The effect is remarkable in more than one way. Round the edge of the steel jacket in the plate may be seen the cuts in the plate effected by the hits of the projectile. It will be seen that the plate is cracked in four places at least. Fig. 2 herewith shows the crack through the steel face, and Fig. 3 shows the character of tear or opening in the back.

The second round was fired with a projectile differing from the first in having only a single steel jacket on it. In order as far as possible to prevent the shot being broken up by the face of the old armour plate behind, the bracket of an old gun carriage, 6in. thick, was pushed in behind the part of the plate aimed at. The shot struck a spot 12in. from the proper left edge, and 17½in. from the bottom, *vide* No. 2356 on Fig. 1. The jacket flew to pieces on impact, the projectile passed entirely through the plate, the point entering to a depth of about 1¼in. in the old target in rear, and the mass of the body remaining broken in two or three pieces in the wood bracket pushed behind the front plate. The third round was fired with the same charge and velocity as the others. The projectile differed from them in having only a short steel ring to hold it together—*vide* Fig. 3 in page 421—being, in fact, the projectile actually designed by Sir William, two others having been modified, and we think we may say improved, by Captain Edward Palliser. This shot passed entirely through, like its predecessors, but it broke up into much smaller pieces, although wood had been placed behind the plate to receive it.

It was obviously most desirable to fire an ordinary chilled projectile for comparison, but unfortunately it was found that all those supplied for the Sub-committee on Plates and Projectiles had gone back to Woolwich. The character of the holes and appearance of the plate were most remarkable. We hope that this may in a measure be seen in Fig. 1 herewith. Each hole showed six grooves sharply and cleanly cut through the plate by the ribs of the shot, and further, the hole seemed to be so far misshapen as to look hexagonal. The ribs remained almost unbroken on the projectiles, although the heads were scored and polished by the violent friction. At first sight the plate looked as if it was very soft. It may be unwise to give an opinion before it can be submitted to the test of firing an ordinary chilled projectile at it, but we think it is nevertheless generally right to do so. Even mistakes may be instructive afterwards as showing what impressions were produced at the times. We may say then that we do not expect the plate to prove to be at all events a very soft one. The scaling and burring round the holes at the face do not look to us like very soft steel. Then the plate continued "talking," and cracks continued to develope until after the Committee left the ground. This, at all events, was fully characteristic of steel. Eventually there were three radial cracks at 2355, as well as one at the edge, *vide* Figs. 1 and 2, and one radial crack at each of the other holes. We think also that the openings at the back looked like good iron, fine and perhaps slightly hard—*vide* Fig. 3. To our minds there is every appearance of the ribs having assisted in a remarkable way to open the plate and help the passage of the shot; and undoubtedly there is evidence of the steel jackets having held the projectiles very well together, the shot having certainly kept much better up to its work in the case of the longer and more complete jackets than in the case of No. 2357. No doubt there is some advantage in the sharp points which these shot have—viz., an ogival of 2·5 diameters radius—in direct impact; but this is an advantage which only tells much when the shot penetrates, and it remains to be seen whether the ordinary chilled shot will penetrate well enough to be capable of benefiting by such a point if they had it. The Sub-committee reported that chilled projectiles were useless against steel and steel-faced plates, and we have long since noticed the same thing in reporting on experiments—*vide* report of firing at compound plates in THE ENGINEER of August, 1880. The metal of the projectiles appeared to us to be fine and good. The heads were well chilled and the bodies mottled. We believe it is contemplated to chill the shot throughout, and we believe rightly; because any bulging—as we point out in the description, page 421—tends to tear the steel jacket from front to rear instead of pressing evenly on it, as we think a shot would do that did not set up, however much it split.



HORIZONTAL PROJECTION SHOWING OPENING AT BACK OF PLATE

Yesterday—Thursday—an ordinary chilled shot was fired at the plate. Its velocity was 1600ft. per second. It broke up on the face of the target, which was moderately bulged in the rear.

Altogether, Captain Palliser must be congratulated on the very remarkable success of his shot. Both bands and ribs have apparently done excellently, and this is the more important because we hear that the manufacture of steel shot even of 10in. calibre is at a standstill. Those fired at Spezia by Armstrong in 1879 from the 100-ton gun were apparently very good. They were made by Whitworth, who, for some reason, cannot be induced to make them now. There seems, then, a special opportunity for chilled shot if they can be got to stand up now.

We need hardly point out that there are many points to be considered. It remains to be seen whether the shot can be prevented from breaking across about the junction of body and head, which would prevent the hope of fire being carried into the interior of a ship—at best a very difficult task. Then the ribs may prove to interfere with accurate flight; but all this can be tried in time, and we must not put difficulties in the way of so successful an attempt as Captain Palliser is engaged in, and in a direction in which success is much needed. Further experiments are needed, and it is to be hoped that the Government may see their way to carrying out some at least of these experiments on an adequate scale.

THE EXPANSION OF RAILS.

SHERIFF LEES, Glasgow, has just decided a case of some importance to railway companies. Annie Scott Reid, Rutherglen, sued the Caledonian Railway Company for £500, in consequence of injuries she sustained through a train in which she was seated leaving the rails between Strathaven Junction and High Blantyre on 17th July, 1880. The principal defence of the railway company was that on the day of the accident there was extraordinary heat in the Blantyre district, which caused the rails to expand and get distorted so much as to cause the engine to run off them. The accident was thus caused through circumstances over which they had no control, and for which they were not responsible. After hearing evidence, the sheriff awarded the pursuer £250. In a note the sheriff says:—The pursuer maintains that the defenders were at fault in the laying of the line, or at any rate, in omitting to maintain a sufficient space between the ends of the rails. Nothing is more familiar in railway construction and maintenance than that provision must be made for the expansion of the rails through temperature. A 24ft. rail at a heat of 130 deg. is almost exactly $\frac{3}{16}$in. longer than it is when at a temperature of 32 deg. Now as a rail in use could not, owing to its conductive capacity, be raised to 130 deg. by any solar heat that occurs in this country, the defenders are, I think, justified in maintaining that if in laying the line they left $\frac{3}{16}$in. between the ends of rails laid in frosty weather, they took adequate precautions against accidents occasioned by expansion of the rails. The rails here were laid in May, 1880, and therefore if an interval of $\frac{3}{16}$in. were observed, it would probably be ample. This is no direct proof that, as matter of fact, this amount of interval was observed or maintained, and the pursuer found on the absence of such proof. But it is to be remembered that the mere fact of the train going off the line does not necessarily infer liability on the company's part. There are certain circumstances, such as collision between different trains on the same line, where *res ipsa loquitur*, both presumes and proves fault. But in the case of a train going off the line, the inference is not so strong. "It is impossible," said the Court of Exchequer Chambers, in the case of Bird *v.* the Great Northern Railway Company, 4th December, 1858, "to say that the accident itself, even if *prima facie* proof of negligence was conclusive proof of it. And if not, then, as there was evidence on both sides, the question was for the jury." In other words, if it be alleged that the railway was badly constructed, the fact that the train went off the rails will be *prima facie* evidence of fault on the company's part, and it will be for them to rebut this presumption. Now, here the defenders have brought a considerable amount of evidence to show that they were thoroughly aware of the necessity for laying and keeping the rails properly apart, and took elaborate precautions to ensure their being kept so. And, therefore, what the defenders have to show is that in what they did they took all reasonable care to see that all proper precautions were taken. In Redhead *v.* the Midland Railway Company, a railway company were held not responsible for an accident to their train through a latent defect in a wheel that could not have been discovered by them or the makers. In Nugent *v.* Smith, Lord Justice Mellish pointed out that "In order to prove that the cause of the loss was irresistible, it is not necessary to prove that it was absolutely impossible for the carrier to prevent it, but that it is sufficient to prove that by no reasonable precautions under the circumstances could it have been prevented." And in many English and Scotch cases, proof that skilled men, good materials, and proper regulations had been used, of itself went far to negative the presumption of fault. Therefore, if matters stood thus on this point, I should not hold fault proved. But they do not do so. It will not do to say such proof *must* be sufficient. If precautions which should suffice for safety, and suffice for safety under the like circumstances everywhere else, fail in one particular spot, there is room for the presumption that these precautions were not duly taken then. Now, the defenders maintain and make it part of their defence that the train went off the line through the expansion of the rails caused by the great heat of the sun; and here two important facts have to be noticed. About two hours before the accident a train had gone up the line safely, and shortly after the accident the down line was found to be impassable at a point about twenty yards further back, as the rails had so expanded with the heat that on any attempt being made to force them straight they sprang into a bend the opposite way of 3¼in. to 4½in. off the straight; and before they could be used 4½in. were taken off the rails, and the gap at their extremity distributed by shifting several adjoining rails to a greater or less extent. It was explained that 4½in. were taken off, not as being the excess in length over that required for safety, because if more or less were taken off a new hole would require to have been drilled through the rails for the bolts where the rails are fished. The engineers who were examined by the defenders were all of opinion that the expansion had made the rails bend upwards, and that they were broken by the engine before the train left the line. There is also evidence to show that the heat of the day was great. At Glasgow Observatory the maximum temperature was 129 deg.; there were $11\frac{1}{10}$ hours of sunshine, and no rain fell that day. In this state of matters the defenders say that circumstances were so unprecented that the occurrence was a *damnum fatale* for which they are not responsible. It is therefore necessary to consider what is a *damnum fatale*, and whether the circumstances were unprecedented. Erskine, III., 1·28, terms *damnum fatale* an accident which can neither be foreseen nor withstood, and in the case of Tarrant *v.* Earl of Glasgow, 3rd March, 1804, the Lord Chancellor—Westbury—describes such a calamity in the law of Scotland as being the result of "occurrences and circumstances which no human foresight can provide against, and of which human prudence is not bound to recognise the possibility." Plainly, therefore, a *damnum fatale* is a loss due to the occurrence of something that could not reasonably have been expected, and not to the recurrence of something that might reasonably have been expected. Now, the expansion of the rails from heat is admittedly a circumstance which is expected, and which is able to be provided against, and is, as matter of fact, so capable of being provided against that the engineers of the London and North-Western, North British, Caledonian, and various other railways, who were examined, had in all their experience met with only three instances of railway lines being distorted by expansion from heat, and of these three cases the present case is the only one that was not timeously obviated. Nothing is shown why heat should have affected the rails of the High Blantyre line more than those of any other line in the kingdom, and the absence of bad effects elsewhere favours the presumption that there must have been fault of some kind here. In the case of the Great Western Railway Company of Canada *v.* Fawcett and McBraid, it was held that "a railway company in the formation of their line are bound to construct their works in such a manner as to be capable of resisting all violence of weather which in the climate through which the line runs might be expected, though perhaps rarely, to occur."

But was the heat unprecedentedly great on the 17th July, 1880? There have been put in evidence tables showing fully the maximum of heat recorded at the Glasgow Observatory during May, June, July, and August in 1879, 1880, and 1881, and less fully for some years before. On 1st July, 1880, the maximum temperature was 129 deg. In 1872 there were two occasions on which the maximum temperature equalled or excelled this—3 in 1873, 0 in 1874 and 1875, 9 in 1876, 13 in 1877, 17 in 1878, 4 in 1879, 5 in 1880, prior to 17th July, and 7 after it, and 19 in 1881. If it be assumed that the heat at Glasgow Observatory is a fair indication of the relative heat of the days at High Blantyre, there is thus no room for the idea that the heat was anything abnormally great there on the 17th July, 1880. But I have also been furnished with tables showing the maximum temperature in the shade at the Glasgow Observatory, and the amount of moisture and of rainfall during July, 1880. On 17th July of that year the temperature in the shade was higher than in any other day that month. There was probably, therefore, less breeze. On the four other days of July, when the temperature was as high as on the 17th, the data are as follows:—

	Mean tem. deg.	Do. in shade. deg.	Hours of sun.	Rainfall.
4th July	132 ..	65·2 ..	12·1 ..	0
17th ,, ...	129 ..	73·2 ..	11·1 ..	0
20th ,, ...	133·9 ..	66·3 ..	10·3 ..	0
25th ,, ...	130·4 ..	71·0 ..	10·5 ..	0
30th ,, ...	130·1 ..	61·2 ..	9·7 ..	0·22

There is of course no certainty that the heat was similar and not greater at High Blantyre. Mr. Blyth is led to think that it must have been greater that day, but making all charitable allowance for an inference of this kind, I think there is no reason which would justify me in holding that the heat was, in the words of Lord Westbury's definition, such that no human foresight could provide against it, and that no human prudence was bound to recognise the possibility of it. Indeed, the tables show that on three or four occasions before 17th July, 1880, and after the line had been formed, the maximum temperature was about a dozen degrees above what it was on that day. Now the precautions taken to prevent injury by expansion of the rails are, firstly, to lay them properly; secondly, to examine them regularly and sufficiently; and, thirdly, to shorten or readjust the rails if necessary. Mr. Dundas, one of the defenders' engineers, in his intelligent evidence, fully explained the tendency of the rails to travel or creep together owing to the passage of the trains. It is not very clear whether the rails travel in the direction the train goes in, dragged by the wheels which are thought to skid along the line to some extent, or whether they are pushed back by the wheels in the opposite direction. But for the decision of this case it is not necessary to inquire. It seems to be thought that this creeping of the rails, owing to the gradient, slow pace of the train, and expansion, would be down hill from High Blantyre. If so, and if gradually they crept together, one would expect the buckling of the line to occur further downhill on the down line than on the uphill; and this was what actually did occur. When therefore this circumstance is borne in mind, that the heat was no greater that day than on fifty-three previous days since the formation of the line, that on almost all of these days it was greater and on some much greater, that on no other line of railway in the kingdom, is it shown that the rails were similarly affected to a dangerous extent, that on this line they have not since then got into the like dangerous condition, that to guard against such danger is in practice a matter of no difficulty, and that on the down line the distortion is so great as it is owned to have been, this conjunction of circumstances points, I fear, with unmistakeable distinctness to the view that the proper intervals between the ends of the rails reasonably required for the safe use of the line had not been adequately preserved.

Mr. Robert Bird, writer, Glasgow, acted for the pursuer, and Mr. Alex. Kennedy, writer, Glasgow, for the defenders. The case will be carried to the Court of Session.

NAVAL AND SUBMARINE EXHIBITION LECTURES.

SCREW PROPULSION.

A LECTURE on screw propulsion was delivered by Mr. Robert Griffiths, inventor and patentee of the Griffiths screw, on the evening of Saturday, the 15th April. The lecturer began by saying that although during the half century that has elapsed since the propulsion of ships by the screw propeller was regarded as little more than an experiment, and during which its use has gradually extended until it has become the only means by which ocean ships are propelled, numerous patents have been taken out for so-called "improvements in screw propellers," very little real improvement has been effected, notwithstanding the large amount of attention which the subject has received. Possibly this is to a great extent due to the prevalence of erroneous ideas respecting the loss of power which occurs, for one of the chief difficulties in the way of effecting improvements has been the uncertainty of how the loss was occasioned, and hence, while endless attempts were being made to discover the best form for the screw, the position of the screw with respect to the hull of the ship, which is by far the most important factor in the result, was overlooked. Until recently the slip of the screw was regarded as the measure of the loss of power that occurred. From the time of the lecturer's earliest acquaintance with the subject he held this theory to be wrong, and indeed proved its fallacy on H.M.S. Flying Fish in 1856. The screw with which she was then fitted gave an unsatisfactory result, as it showed more than 20 per cent. of slip. Mr. Griffiths was ordered to make a propeller, which was to be of gun-metal, and he offered to supply a pair of experimental blades of cast iron, guaranteed to give negative slip, though the speed would not be increased in consequence. The offer was accepted, and the cast iron blades were made from the same pattern as the others, the only difference being that the shanks were put at an angle, so that when the blades were inserted in the boss they inclined towards the ship. When his screw had been tried, and gave a favourable speed compared with the previous screw, though showing some 15 per cent. positive slip, the blades were inserted, and were found to propel the ship with 6 per cent. negative slip, though the speed was not so satisfactory. Though this clearly proved that the slip by no means indicated the efficiency, or rather the inefficiency, of the propeller, it was of little assistance in helping to ascertain what became of the power that was applied to the propeller. That the power actually necessary to propel a ship was small in proportion to the power which had to be exerted through the screw to do it, he ascertained by some model experiments which he made. These models were fitted with clockwork for driving the screw, and he found that if the clockwork was removed from the boat, and applied to tow it, the trim being kept the same by putting in weight equal to that of the clockwork taken out, it was capable of giving it nearly half as much speed again as when propelling it by means of the screw. This showed that since the power necessary to produce any given speed is proportional to the cube of that speed, the power actually required for propulsion was less than one-third of that which was expended on the screw. Consider what actually takes place when the screw is working in the ordinary position. Suppose a screw ship were being towed; then of course the water flows through the screw's disc, but the velocity at which it flows varies considerably at different parts of the disc. In 1875 he had an opportunity of making some experiments with regard to this with one of H.M. steam launches at Devonport. The launch was towed at the speed at which she was capable of being propelled by her own engines, which was 7 knots, and the speed at which the water was flowing through the disc which the screw described when working was ascertained by apparatus which had been specially applied for the purpose. The experiment showed that while the velocity of the current through the bottom half of the discs, and at the outsides for some distance above the level of the screw shaft, was approximately that at which the boat was being towed, a great falling off was indicated on going higher, until at the top, 3in. on each side of the middle of the boat, the speed at which the water went through the disc was only $3\frac{1}{2}$ knots, or half the speed at which the boat was being towed. The screw pushes the ship forward by pushing the water back, and accelerating the currents to a velocity approaching that due to the pitch and revolutions of the screw. Hence there is a very unequal distribution of power over the screw's disc, for most of the power is, of course, expended at the top of the disc where the velocity of the current is naturally slow, and consequently is greatly accelerated, and very little over the bottom part of the screw's disc, where the velocity is but slightly accelerated. And since the blades of the screw meet with little resistance in passing over the lower part of the disc, but very great resistance as they approach the top, a series of jerks is given to the screw shaft, which is the cause of vibration. He has frequently met with persons who were under the impression that the bottom blade met with more resistance and gave more thrust than the top blade, an impression which is entirely contrary to fact, and which seemed to arise from the idea that the screw was affected by hydrostatic pressure. But that is not the case. The dynamometer diagrams obtained from H.M.S. Rattler showed very clearly the great increase of resistance the blades encountered when they were vertical, for with her two-bladed propeller the thrust was found to vary from 2·9 tons, when the blades were horizontal, to 4·1 tons when vertical; and, as in the latter position, the blade at the bottom could encounter no more resistance than when horizontal, this great increase of thrust must have been entirely due to the extra resistance offered to the top blade. Hence we see that at those parts of the screw's disc where the water is being dragged with the ship, and which are about the top behind the full part of the run, the greater part of the power is exerted, and, dragging away the water, it causes much less pressure to be given to the stern by the closing in of the water than there would otherwise be, and the ship encounters much more resistance in moving forward; for the pressure of the water closing on the stern balances to a great extent the pressure on the bow, so that if this pressure on the stern is reduced, greater force is necessary to move the ship forward. In the Admiralty model experiments, conducted by the late Mr. Froude, a model was towed and its resistance ascertained; then the screw was worked behind the model in a frame quite independent of the boat, and it was found that the towing resistance of the boat was increased 40 per cent. The experiment was repeated with the models of several successful merchant ships, and with those the increase of resistance caused by the screw was very nearly as much. The enormous suction that the screw is capable of causing was shown by a working model which was exhibited some four or five years ago at the Royal United Service Institution. This was fitted with a telescopic pipe, which led from a compartment inside the vessel, and could be pushed out close to the screw. The water would, it was found, flow in by gravity through this pipe and fill the compartment in ten seconds; but if the pipe was pushed out to the screw, the screw when propelling would cause such a suction that it would empty the compartment in eight seconds, a loss of only 19 per cent. of speed being occasioned while the operation was going on. The long course of experiments which he carried out on working models enabled him to ascertain that whenever a screw was working, as in existing ships, within a short distance of the wedge of the stern, it caused the water to close with very much less pressure on that part of the wedge, and in consequence considerably more thrust was necessary to cause the ship to move forward than would otherwise be required. He then tried the effect of moving the screw away from the wedge of the stern, and found that when the screw was placed further aft more speed was obtained, and that the speed increased as the screw was moved aft until it was placed two-thirds of its diameter from the ends of the wedge of the run. With the screw in this position a maximum speed was obtained of at least 12 per cent., and in some cases as much as 15 per cent. more than with the ordinary arrangement. Again, when the screw was moved further aft than this, the speed fell off gradually. The increase of speed was owing to the screw retarding the vessel less as it was moved away from the tapered surface of the hull; but when it had been moved more than two-thirds of its diameter it got behind the place where the currents from each side met, and as the flowing together of these currents offers considerable resistance to the screw, a falling off in the thrust takes place if it is fixed further aft than this, and its efficiency is reduced. The lecturer exhibited a model to show how the stern of a ship should be constructed so that the screw may be in the position which he regards as the most efficient, and by means of which a speed is obtained at least 12 per cent. more than with the ordinary construction, this being equal to increasing the power 40 per cent. Vibration is altogether prevented, and the steering much improved by this arrangement. A way by which existing ships may be altered so as to obtain these advantages was shown by a second model, and also by a diagram. The screw is removed from the screw-frame, and the rudder-post having been cut, a bearing is inserted in it. The screw shaft is lengthened either by putting a short piece between the couplings inside the ship or by welding a piece on the end so as to pass right through the bearing in the rudder-post. This brings the screw about the right distance from the end of the run, and for affording additional strength to the rudder-post the bottom part of the screw frame may be plated over. A new rudder is used, the form of which is such that it leaves room for the screw to work. He has found that this form of rudder requires much less surface than the ordinary rudder to give the same effect in turning the ship, for when the surfaces of the two rudders were of the same area, the rudder of this form would turn the boat equally as fast, and in the same space, though put over only a little more than half the angle that the other was. Another advantage connected with this form is that when the screw is not working the rudder is able to steer the ship efficiently. The difficulty of steering many screw ships under the same conditions is well known, and has led in cases of machinery breaking down to disastrous results. He has another arrangement, the essential difference compared with the former one being that the ordinary rudder is used, it being suspended on a new frame placed behind, and firmly attached to the ordinary screw frame. In either case the increase of speed would be the same, as it depends simply on the screw being moved away from the run. The cost of carrying out either of these alterations would be small in comparison with the value of the increased speed that would result. To take a rough estimate, to increase the speed of a ship 12 per cent. requires the engine-power to be increased 40 per cent. Now, taking the value of marine engines at £45 per nominal horse-power for the first cost, the coal required for their consumption, the space occupied in the ship by the coal, the cost of repairs, &c., would, at a very moderate calculation, amount to a similar sum, so that an increase of 12 per cent. in the speed of a ship would be equivalent to an increase in the value of the ship of £3600 for every 100 nominal horse-power of the engines that are in her; and, compared to this, the cost of the alteration becomes insignificant. The lecturer also exhibited a diagram showing a screw propeller which can be applied to ordinary ships without any alteration being required. This screw comes close to the rudder-post, and he states that with an ordinary width of screw frame the substitution of a screw of this form for an ordinary screw gives an increase of 5 to 8 per cent., or about half the advantage of the complete alteration. Several screws like this have been made, and have given a highly satisfactory result in each of the cases in which they have been applied. The ships that have already been fitted with them are the Retriever, Elephant, Great Northern, John Pender, and a small steamer at Penang, and one has been made for the Mercedes, but has not yet been put on. In the cases of the Retriever and the Elephant a knot and half a knot were gained respectively. Measured mile trials were not made in the other cases. In addition to the increase of speed in each case there was a decided improvement in steering, and the vibration was much reduced. In building the Adjutant, Messrs. Barclay, Curle, and Co. adopted the system more fully by making the screw frame considerably wider than usual and placing the screw close to the rudder-post; but the only comparison that could be made in this case was that in her first voyage out, carrying half as much cargo again as the other vessels of the same line, she made a quicker passage with a lesser consumption of coal. When the enormous resistance encountered by the blades of a screw when passing through the retarded currents is borne in mind, considerable light is thrown upon some results which have been obtained recently from screw ships by reducing the diameter of the screw propeller. In three Atlantic steamers, the particulars respecting which are given in the paper read by Mr. Maginnis at the Institution of Naval Architects, new propellers, smaller in diameter than their original screws by 2ft. 6in. in two cases and 1ft. 4in. in the other, were fitted, and a gain in speed of a half, a third, and a half of a knot per hour respectively resulted, with a considerable saving of coal on the voyage. This advantage was entirely due to the smaller screws acting less on retarded water at the top of the disc. But the most conclusive proof was given by H.M.S. Iris, which was fitted with 18ft. 6in. diameter four-bladed screws, the blades having wide points; and the resistance encountered by these in their passage through the retarded currents close to the top of the run was so great that considerable negative slip resulted, in consequence of which the currents would press on the back of the blades at the outside of the disc, and neutralise part of the thrust, causing an unsatisfactory speed to be obtained; for when the ship was fitted with four-bladed Griffiths' screws 16ft. 3in. diameter, and afterwards with two-bladed Griffiths' screws 18ft. $1\frac{1}{2}$in. diameter, which, owing to their narrower points, would experience much less resistance there, a gain of nearly two knots in speed resulted, the slip increasing to 5 per cent. positive. The lecturer then drew attention to what he claimed to be an exceedingly simple and inexpensive plan of preventing the waste of power explained in the earlier part of the lecture, namely, the loss caused at the top part of the screw's disc by most of the power being exerted there on the retarded currents, the dragging back of which increases the ship's resistance so enormously. Models showing the application of the apparatus to a single screw, and to twin screws, were exhibited. The single screw model consists of two plates attached to the top part of the screw frame. These plates form part of cylindrical surfaces, the upper one being at a distance equal to about $\frac{1}{12}$ the diameter of the screw from the points of the blades, the surface extending in the fore and aft line from some distance in front of the screw to the rudder-post, and about one-third of the screw's diameter on each side of the screw frame. The lower surface comes as close as possible to the points of the blades of the screw, and extends the same distance on each side of the screw frame, but in the fore and aft direction only extends from opposite the middle of the points of the blades of the screw to the rudder-post. From these plates, which as yet have only been tried in a model, the lecturer anticipates very favourable results. So far they showed a very marked influence in increasing the current of water through the top of the screw's disc, and this leads to the vessel being less retarded by the action of the screw, the evil being diminished not simply in proportion to the increase in the velocity of the current, but, owing to the more equal distribution of power over the screw's disc, in a very much higher ratio. In fact, the experiment showed, though it might seem incredible, that this apparatus increases the speed of a ship 7 to 8 per cent. The apparatus for twin screws is similar, the only difference being that the plates in this case, instead of being over the tops of the screws, are placed more on the sides next the ship, which is the part of their discs through which retarded currents pass. With regard to the protection of the screw propeller from being fouled and injured by ropes, wreckage, or floating substances, the officers of the Royal Navy are fully aware of the liability of ships becoming disabled, and are most anxious that steps should be taken to prevent what, in all probability, will prove a most fruitful source of disaster whenever a naval engagement occurs. The application of a cylindrical cover over the screw propeller has been proposed at various times, but has invariably, when tested, caused a very considerable loss of speed, and the problem remained in this condition until the lecturer made some experiments in 1873 and 1874, by which he ascertained that the loss had resulted from the screw being unable, under those circumstances, to obtain sufficient water to act upon. For overcoming this defect he tried the application of an enlarged entrance or funnel mouth which should gather in water into the cylindrical part of the casing. This led to a much better speed being realised, the casing then increasing the speed slightly, except when the screw was unusually large in proportion to the ship. These results having been brought before the Admiralty, the Lords determined to try a casing of this form on H.M. gunboat Bruiser in 1875. The cylindrical part of the casing was made 6ft. 1in. diameter, the screw being 6ft. diameter, and the funnel mouth was made 7ft. diameter, thus giving an area about 35 per cent. larger at the entrance for allowing the water to get to the screw. The Bruiser when tried on the measured mile made a mean speed of 8·280 knots, the speed previous to the application of the casing having been 8·016 knots; and, in addition to this increase, there were other decided advantages, for the vibration was very much reduced, and the vessel answered her helm much more quickly. It was found, too, during some heavy weather that she encountered in the Channel, that the screw had no tendency to race when the vessel was pitching. To obtain additional proof of the advantage in speed, the Lords of the Admiralty afterwards ordered two more trials to be made with the casing and two without, and these fully confirmed the first results. Though this casing gave a decided advantage, Mr. Griffiths has since found that it was not by any means the best form that could have been used, for the experiments that he has since made have shown that a screw draws in water opposite the forward part of the periphery for about half the width of the points of the blades, and opposite the after half drives it out. If this driving-out action is prevented, which can be done by fixing a cylindrical ring over that part, more resistance is offered by the water to the propeller, and more thrust is obtained; but if the drawing-in action of the front part of the periphery is prevented, the whole of the suction of the screw is concentrated on the stern of the ship. This increases the ship's resistance very much. Hence it is necessary that the casing, if it is to extend further forward than the middle of the points of the blades of the screw, should be enlarged there. One of the models in the lecture hall was fitted with a casing over the screw which, while giving most complete protection to the propeller, is better suited for speed than the one which was applied to the Bruiser. This casing consists of two cylindrical rings, one, which is just large enough for the screw to work in, extending from the middle of the propeller to the rudder-post; and the other, which is about one-eighth larger in diameter, is attached by suitable fastenings, so that its after edge overlaps somewhat the forward edge of the smaller ring. By this arrangement, though the screw is completely covered, the drawing-in action of the forward part of the periphery of the screw is in no way checked, and should the forward ring take in more water than the screw requires, the excess can pass between the rings without causing a resistance to the forward movement of the ship. Radial bars can be fixed in the forward ring so as to reach from the run to the outside of the casing at a convenient angle for turning off floating substances, which would otherwise enter and foul the propeller, and the casing may be stiffened by fixing struts between the rudder-post and the small ring at the after end. The screws of some steam trawlers now being built for the National Fishery Company will be protected in this manner; but when it becomes generally known that by this arrangement the screw can be protected without loss of speed, which will be proved by those boats, it will be well worth the consideration of shipowners whether the safety resulting from its application would not render it worth while for all ships to be fitted with it.

LETTERS TO THE EDITOR.

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

THE FOUNDATIONS OF MECHANICS.

SIR,—It is asked why does a train move when the power and the resistance are equal? Your correspondent "Φ. Π." says the pull on the draw-bar is "always precisely balanced," and that the resistance is the measure of the pull. Not at all; the resistance is only the measure of the strain on the bar. Though the weight of the train is an unvarying quantity, yet the resistance varies with the speed; if, then, the resistance of a train at rest be 5 and the pull 6, a speed is soon gained at which the pull and the resistance are balanced; but if the resistance be 5 and the pull 10 a high speed will be attained before they are balanced; at all speeds the resistance will determine the strain on the bar, but in no case will it determine the power employed—not exerted—to overcome such resistance. If we put the resistance in one scale and call it 5 lb., and the power or pull in the other and call it 10 lb., the strain or pull on the balance at both ends is the same, that is 5 lb.; yet the pull and the resistance are not equal, but are as 10 to 5, unless it be that 10 lb. becomes 5 when it has only a resistance of 5 to overcome. If one half of a train breaks away from the rest when the engine has a pull of 2 tons, the strain on the bar is suddenly lowered to 1 ton, but the pull of the engine is 2 tons as before, except means be used to shut off steam in proportion. In a tug of war the strain on the rope is simply the resistance offered by the weaker party. If all the resistance the weaker party can offer be 10 cwt., and the strength of the rope be 10 cwt. and 1 grain, the stronger party can never break the rope, though their power be 12 cwt.; but though we have only a strain on the rope of 10 cwt. we have an unbalanced force of 2 cwt., which produces motion in the particular direction in which it is exerted. It follows from what I have said that the assertions of "Φ. Π." are untrue when he says that "a pull cannot by any possibility be greater than the resistance, because the resistance is the measure of the pull."

Todmorden, June 5th. EDWARD HOYLE.

SIR,—In Mr. Browne's letter which appeared on page 405 of the last number of THE ENGINEER will be found the following remarkable passage:—"The force exerted by a steam engine is measured, as every practical engineer knows, by the area of the cylinder multiplied into the steam pressure—*a quantity quite independent of the resistance.* Suppose we have two engines and trains exactly alike and starting from rest at the same moment, but one of them having 150 lb. pressure in the cylinder, and the other 100 lb., does 'Φ. Π.' really hold that the one is exerting no more force because the resistances are equal?" The italics are mine.

Mr. Browne has very properly given his readers a list of authorities which may be consulted on the laws of matter and motion. Permit me in turn to direct Mr. Browne's attention to Pambour's "Theory of the Steam Engine," which he has overlooked. That work was written many years ago, and the author had for one object the oversetting of the very view which Mr. Browne would now endeavour to galvanise again into life. He will find that Pambour supplies elegant and ample mathematical proof that the power exerted by an engine is determined, not by the pressure of steam and area of the piston, but by the resistance. In other words, the pressure in the cylinder is always precisely equal to the resistance offered to the piston—no more and no less; and if Mr. Browne had been in the habit of working out diagrams from the trial of portable engines on the brake dynamometer, he would have very quickly discovered that the pressure in the cylinder is invariably determined by the load on the brake, which has to be kept in suspension. I am, of course, supposing that there is sufficient pressure in the boiler to keep the engine at work. As regards the two locomotives, if the resistance is the same, one engine cannot have 100 lb. in its cylinders and the other engine 150 lb. Mr. Browne suggests a case which is impossible of occurrence. He will find my arguments in favour of resistance invariably equilibrating force so admirably dealt with by Pambour—especially as regards this very point concerning the pressure in the cylinders of a locomotive—that I shall at present say nothing more on this aspect of the subject. I feel sure that Mr. Browne has overlooked Pambour's investigations, or he would not have written as he has done.

Turning to the last paragraph of Mr. Browne's letter, in which he says that motion is never destroyed without producing some equivalent effect, I reply that motion can produce no effect but one, namely, motion. Thus when a projectile splits an armour-plate, its motion produces motion in the pieces of the plate. When the wind blows on the sails of a ship it loses motion, which is transferred to the ship, and so on. I asked Mr. Browne to cite a single instance in which motion is destroyed without reproducing motion, and he replies that when heat is applied to ice it does not melt the ice, and yet the ice is no hotter. He must, indeed, have been in a great hurry when he wrote this. Is he aware that the specific heat of ice has been determined by direct experiment, and that it is ·504, that of water being unity? If ice has a less temperature than 32 deg., it can be heated. Take a pound of ice congealed round the bulb of a thermometer; let the temperature of the ice be 20 deg. If now the ice be cautiously warmed the thermometer will go on rising steadily to 32 deg., none of the ice being liquefied. This heat once reached, the further application of heat will not cause the thermometer to rise; but it does not rise *because the ice is melting.* In a word, the example of motion destroyed without producing motion cited by your correspondent, has no existence outside his own imagination.

Thus, then, in reply to my arguments, Mr. Browne has cited three impossible cases: (1) That the work done by a stationary engine is independent of the resistance; (2) that in the case of two locomotives with an equal resistance and the same in all respects, one could have a pressure in the cylinder 50 per cent. greater than the other; and (3) that the communication of heat to ice will neither melt it nor make it hotter—a statement so absurd that I anticipate the appearance of a letter next Friday in your columns withdrawing it.

If an able mathematician like Mr. Browne can adduce no more formidable arguments than these against my views, my victory is complete.

I am quite at a loss to understand what is the difficulty which Mr. Browne finds in accepting my views. They are identical in all respects with Clerk-Maxwell's, only Maxwell, as I have shown in my last letter, refers to heat alone, while I extend the analogy to every form of motion.

Let me point out to Mr. Browne, that although it is as certain as anything can be that electricity is not a fluid, yet it has been found so convenient to deal with as though it were one, that it is always treated as such. Electricity is no doubt a mode of motion just as heat and light are. Thus electricians are really dealing with quantities of motion, and treat it as Clerk-Maxwell treated heat. If only *all* forms of motion were dealt with on the same basis, the teaching of dynamics would be simplified, puzzles would be solved, and real progress would be made. While we adhere to the old-fashioned methods, nothing of the kind is possible. They had to be abandoned before any real progress could be made with the mathematical theory of heat; they had to be abandoned before progress could be made with the mathematics of electricity. Why Mr. Browne should so ardently oppose my suggestion, that all dynamical questions should be treated on the same system, I am, as I have said, at a loss to understand. Perhaps he will enlighten me. Φ Π.

London, June 6th.

SIR,—Mr. Browne is mistaken in saying, in reply to "Φ. Π.," that ice cannot be heated by the application of heat. This is only true when the ice is melting, liquefaction absorbing all the heat applied and converting it into water. Ice absorbs in this way 142·4 units of heat per pound. If the ice was not liquefied the same amount of heat would have raised its temperature to 313 deg. Up to the melting point ice behaves like any other solid, and can be made sensibly warmer by the application of heat. It seems strange that your correspondent should have fallen into so obvious an error.

It may interest some of your readers if I reproduce here from a "Practical Treatise on Heat," by Thomas Box, 2nd edition, 1876, the following data concerning the number of units of heat absorbed by 1 lb. of each of the various bodies named during the process of liquefaction:—

	Latent heat in units.	Increase of temperature if heat had not been rendered latent by liquefaction.
Ice to water	142·2	281 deg.
Sulphur	16·8	83 ,,
Tin	25·6	450 ,,
Lead	9·7	309 ,,
Zinc	50·6	530 ,,
Bismuth	22·8	740 ,,
Silver	38·0	665 ,,
Cast iron	233·0	1574 ,,
Beeswax	78·7	175 ,,
Spermaceti	46·4	145 ,,

Mr. Browne would have been quite as accurate if he had cited any one of the substances named in the table as ice. Ice is so often referred to as an example of heat becoming latent in liquefaction, that some people appear to have quite lost sight of the fact that there is nothing exceptional about its behaviour.

Surbiton, June 6th. T. W.

BOILER INSURANCE.

SIR,—Perhaps you will kindly allow me to express my surprise at your article in last week's ENGINEER, on the "Morality of Boiler Assurance."

Allow me to say that you need not have quoted Mr. Fletcher and singled him out particularly for censure, &c., as I can give you a greater authority and name than Mr. Fletcher, viz., the late Sir W. Fairbairn, who told his own nephew that in starting a "Boiler Assurance Company," he was holding out a premium—offering a premium I believe he said—on boiler explosions!

In your remarks, Sir, you seem to lose sight of the great fact that these boiler assurance companies do not insist upon examination of the boilers at all before insuring them, but to allow them to go on from bad to worse, and ultimately to explosions, receiving all the time the premiums; and not content with doing this, they endeavour, and do do it, to discountenance honest and *bonâ fide* inspection—I have more than once experienced it, Sir—and delight in snatching boilers already under inspection, in order to "insure them." There are great numbers of boilers insured that have never been inspected at all efficiently, and boilers that I have myself condemned have been eagerly taken hold of by these companies by means of their travelling and touting agents.

At this very moment one of these boiler assurance companies are burning their fingers I hope by interfering in the case of a boiler I have myself condemned for very good reasons, and of which you will hear more anon in all probability. JOHN SWIFT.

400, Monument-road, Birmingham,
June 7th.

SIR,—I see in last week's edition, in reference to the late boiler explosion near Manchester, you make reference to boilers having a thorough examination by competent men frequently. I would like to ask some of your readers what they would think of an insurance company after promising to come at once and examine boilers which would be all clean and cool for them, as we had been standing all the week, writing letters or saying there was no need of an inspection this time, and yet I have knocked several holes in, and we are compelled to have a new bottom put in the same boiler through the plates being corroded away. The thickest part of any plate was not more than $\frac{5}{16}$ and several not more than $\frac{3}{16}$ thick, and carrying 50 lb. pressure. I may say that I mentioned it to the inspector the last time he was here about the same boiler getting rather thin, and he seemed to treat the matter very light, saying there was no danger with such a boiler at that pressure, yet if he had only taken the time to have given the boiler a good hammering he would have driven the hammer through several of the plates. Then I have not had one inspector from this company yet that has hammered the boilers at all, yet I have seen the Midland inspectors thoroughly hammer them all over. I have this week advised my firm to give up inspection altogether, or change to the Manchester Steam User's or the Midland, as these are the only two companies, in my opinion, that have trustworthy inspectors. I may say that the boiler is of the Rastrick type, with two puddling furnaces working into it. By inserting this in your next issue you will much oblige. ENGINEER.

June 6th.

HYDRAULIC SHIP LIFTING DOCKS.

SIR,—My attention has just been called to the engravings and description of hydraulic ship lifting docks which appeared in your journal on the 19th May last, having the names of Messrs. Clark and Standfield as engineers attached to them.

As this article may convey the idea that Messrs. Clark and Standfield were the constructors and engineers of the hydraulic docks described in it, I beg leave to inform your readers that the firm in question were not even in existence at that time, and had nothing whatever to do with the designs of either the Bombay or Malta Docks, which were manufactured and erected by the firm of Messrs. Emmerson, Murgatroyd, and Co., engineers, Stockport.

Mr. Standfield was simply employed to superintend the erection of the Bombay Dock, but took no part in the erection of the Malta one.

I think it right also to mention that a very large share of the credit of the Bombay Dock is due to Mr. Sydenham Duer, who devoted a great amount of time and ability to the design and direction of all the details of this work.

I may also add that I have a share in some of the improvements described in this article, and that I am acquainted with others much more important, which before long will be shown to make the hydraulic dock competes very favourably as to price with the depositing docks, while they retain all the advantages of the former system. J. T. EMMERSON.

Peover, Knutsford, Cheshire, June 5th.

UNIVERSITY COLLEGE, LONDON.—Mr. L. F. Vernon Harcourt, M. Inst. C.E., has been appointed Professor of Civil Engineering and Surveying. Mr. Kenedy retains the Professorship of Engineering and Mechanical Technology.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending June 3rd, 1882:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 19,761; mercantile marine, building materials, and other collections, 13,744. On Wednesday, Thursday, and Friday, free, from 10 a.m. till 6 p.m., Museum, 5096; mercantile marine, building materials, and other collections, 4288. Total, 42,889. Average of corresponding week in former years, 50,130. Total from the opening of the museum, 20,997,721.

THE INSTITUTION OF CIVIL ENGINEERS.

COAL WASHING.

AT the meeting on Tuesday, the 9th of May, Sir Frederick Bramwell, vice-president, in the chair, the paper read was "On Coal Washing," by Mr. Thomas F. Harvey, Assoc. M. inst. C.E.

The object of this communication was to describe the operations and the machinery employed in connection with the separation of coal from the schistose and other impurities associated with it, having special reference to the manner in which this was accomplished in South Wales. The necessity for a discussion of the question was shown by a consideration of the effects resulting from the use of impure coal in metallurgical operations, and in generating steam in boilers. The loss due to a given percentage of incombustible impurities in the fuel was estimated, and it was shown that, from purely economical considerations, coal washing should not be neglected. Attention was drawn to the present practice of working chiefly the purer seams of coal, leaving the thin shaly seams to be won at a future time. Coal washing had been forced upon the attention of neighbouring Continental States, owing to the coal being less pure than in this kingdom. The difficulty of extracting coal, without at the same time extracting shale from the mine, was next stated. The relative proportion and value of lump and small coal was noticed, and the manner in which the whole of the coal was treated, from its first appearance on the pit bank and previous to washing. The broad principle underlying all systems of coal washing was enunciated, and reference made to the earliest and simplest method, consisting in placing the mixture of coal and shale in a current of water. This system was illustrated by the action of a stream, depositing in its course solid matter according to certain laws, from which was deduced the corollary that, in order to separate bodies according to their specific gravities, preparatory sizing must be effected. The trough system at Tredegar, a development of this method, was described, and a sketch was given of the means adopted for raising and conveying the coal from the colliery screens to the heads of the troughs. The chief objection to trough washing was that a fair result depended not upon the regularity of mechanical motion, but upon the assiduity and care with which the operations were conducted. The method was characterised by simplicity of construction, economy in first cost, and moderate efficiency when conditions favoured it. But the question of cost was secondary, the primary object being the attainment of clean coal, the difference in value as fuel between clean and dirty coal being so great as to warrant the expenditure of extra capital for the object in view. In the instances named, the operations were carried out in the vicinity of the colliery, but frequently the output from several collieries was dealt with at one central establishment, to which the coal had to be conveyed. It was necessary to consider various reasons for and against carrying coal in a particular class of railway wagon, and the opinion was given that an end-tipping wagon had several advantages which, taken as a whole, would probably determine it to be superior to those of the hopper-bottom class.

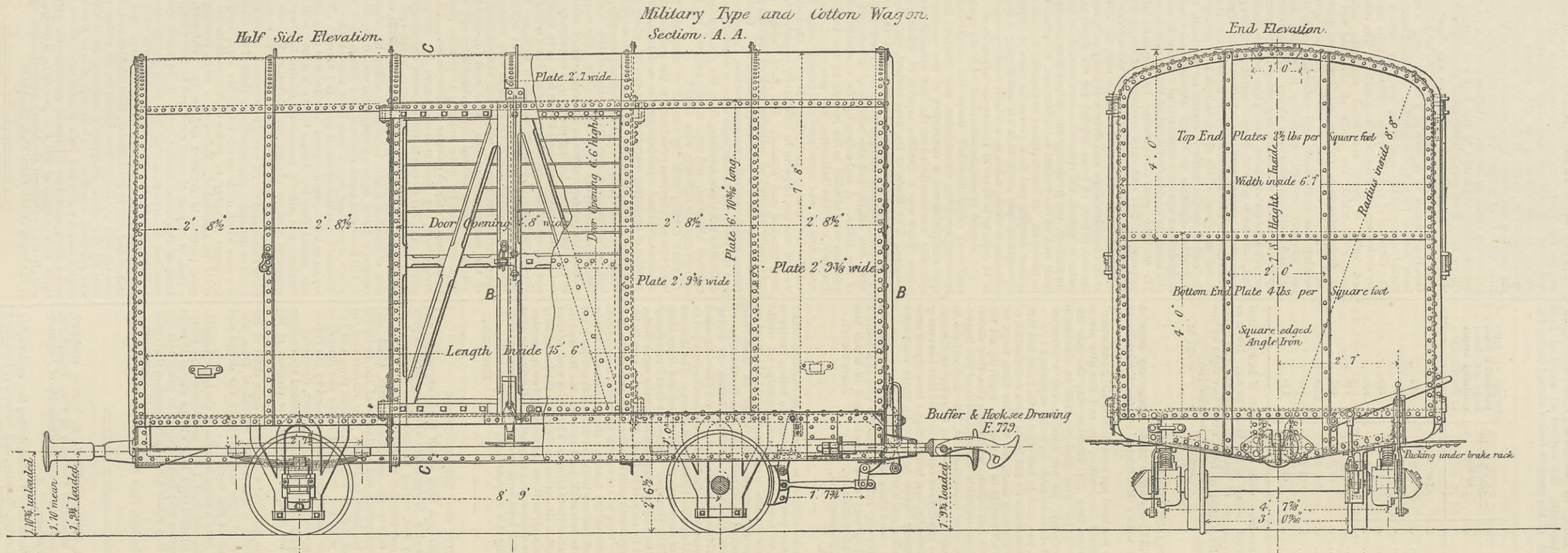
The several operations connected with the washing of coal by machinery were described under the subdivisions of tipping, screening, crushing, transmission, and washing, and appended to each subdivision was a description of the manner in which each operation was conducted at the new establishment at Dowlais, where there was a machine capable of washing about 300 tons per day. Two kinds of tip were noticed, viz., the power tip, or that actuated by mechanical means, and the self-acting tip, operated by the load brought on to it. The former needed somewhat less height, but the balance of advantages was in favour of the latter. A self-acting tip for discharging railway wagons sidewise was alluded to as in use at the Denain collieries in France; but the self-acting tip erected at the Dowlais new establishment was considered to possess some features which entitled it to minute description. Much of the coal required to be washed was too large to be effectually operated upon till it had been screened and crushed. The fixed flat-bar screen, almost universally adopted at collieries and at coal-shipping ports, was considered, and its defects pointed out. Guinotte's flat-bar screen, which received a swinging motion, the reciprocating screen, and the revolving screen were then successfully described. The difficulties arising in screening from the choking up of the spaces received attention, and some modes adopted for the purpose of overcoming the difficulty were stated.

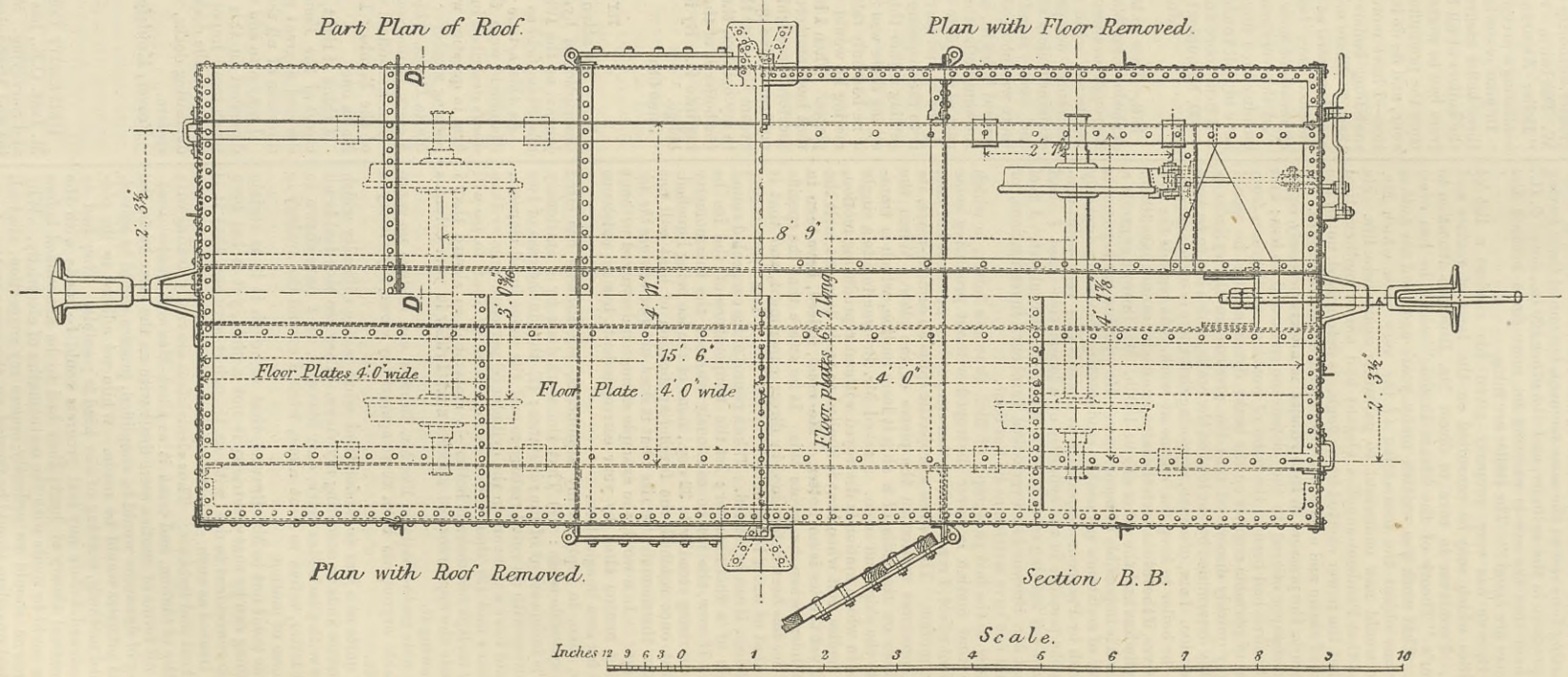
Before dealing with the subject of crushing, the method of hand-picking, previous to delivery to the crusher, was suggested as an economical and suitable adjunct to washing, and the continental practice of preparing coarse coal for market, where fine coal only was washed, was described. First, a circular revolving table, upon which the coal was carried slowly round; secondly, a flat endless belt, stretched over two drums, carried the coal forward, and operatives picked out the lumps of shale. The most suitable class of machine for general use in the operation of crushing seemed to be a roller-crusher, having one pair, two pairs, or three pairs of fluted rolls; but when small lumps had to be reduced to a coarse powder, experience was in favour of machines acting by percussion. Several varieties of crushers were dealt with, and the precautions taken to prevent damage being done to the rollers by pieces of iron getting accidentally between them were treated of. Some of the different methods by which coal was conveyed from one part of the washery to another were next discussed. (1) Transmission by simple inclined shoots, suitable for only short distances. (2) Conveyance by water running in troughs placed at a slight inclination. (3) Vehicular transmission. (4) Conveyance horizontally, by Archimedean screw, or creeper. (5) Chain carrier. (6) The elevator, which seemed an indispensable machine in all washing establishments, and in which coal was raised in buckets capable of holding from 20 lb. to 100 lb. each. The process of washing might be effected either by causing an upward current of water to pass through the coal, or by allowing the coal to fall through a great depth of still water. The principles upon which separation was effected by these methods were stated. Marsaut's machine operated by a fall through still water. The action of the upward-current machine was then described, and it was stated that the length of the washing bash in the latter machine was almost universally limited to about 5ft. It was suggested that by placing the piston at the side of the bash, instead of at the rear, its length would not be so restricted, and a more economical result would be attained. Endeavours had been made to determine theoretically the limit of the difference between the sizes which might be treated in the same bash, but owing to the great diversity of forms of the particles no universal rule could be established. Tables were given showing the result of good practice in America and on the Continent. Below one-eighth of an inch the coal could not be well washed in the above types of machines, neither could it be easily classified by the processes of screening that had been mentioned. Coppée's or Lurich's system for washing fine coal was next described, as carried out on the Continent; it was believed that this excellent system had not, in one instance, been adopted in this country. It was the only existing system known to the author as suitable for washing fine coal. Sheppard's machine, as erected at Dowlais, was minutely described. There was also at Dowlais a washing establishment which had been erected some fifteen years, and at which there were two "Bérard" machines of four bashes each, equal to an output of 480 tons per day. Finally, a description was given of extensive machinery erected about eight years ago at the works of the Ebbw Vale Company.

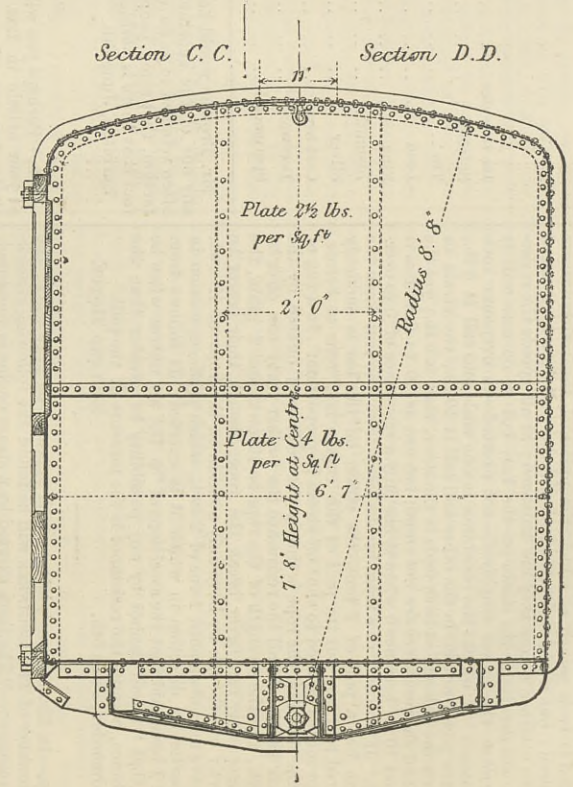
THE public debt on December 31st, 1881, in the Australian colonies:—New South Wales, £14,903,919; Victoria, £22,064,749; South Australia, £9,865,500; Queensland, £12,192,150; Tasmania, £1,943,700; Western Australia, £361,000; New Zealand, £28,583,231; total, £89,910,242.

CONTRACTS OPEN.—IRON COVERED GOODS WAGONS, RANGOON AND SITTANG VALLEY RAILWAY.

(For description see page 416.)



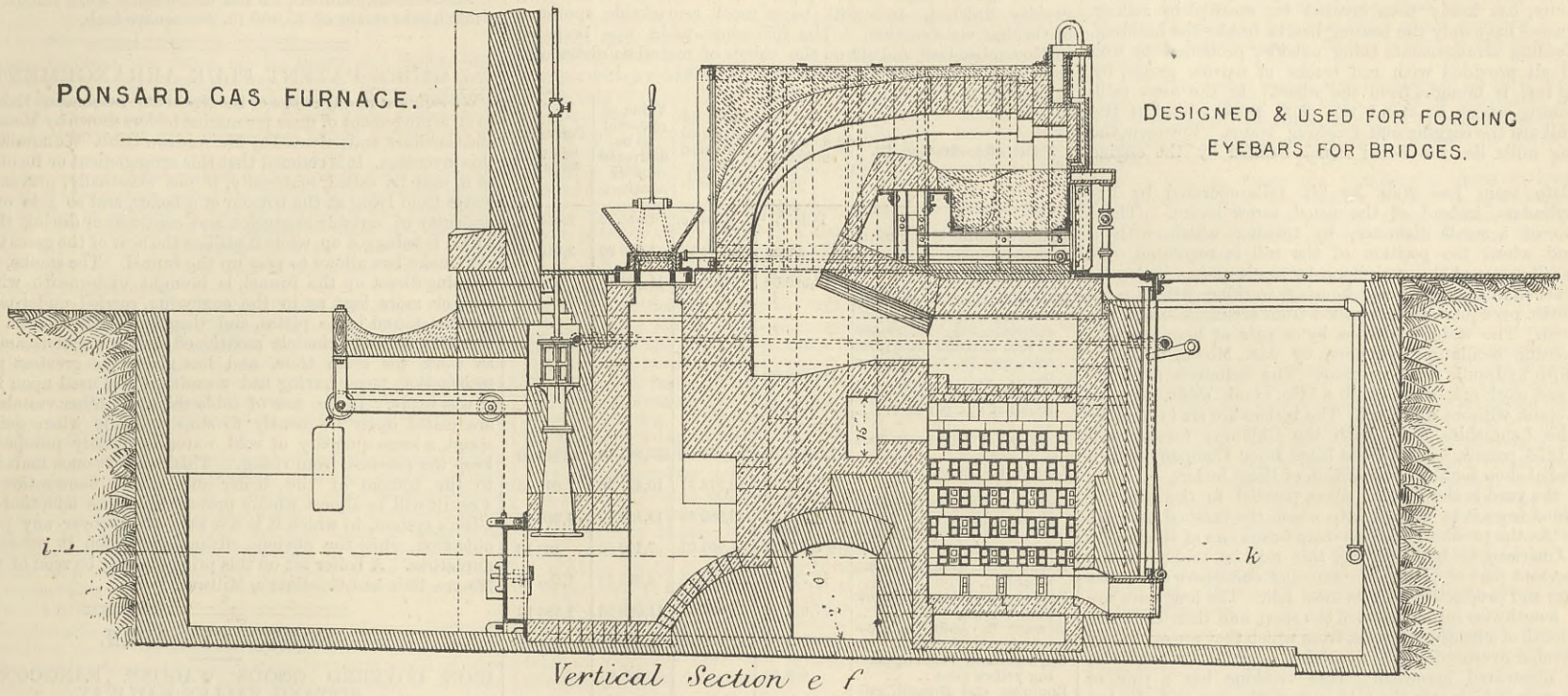




HEATING FURNACES, EDGE MOOR IRONWORKS, U.S.

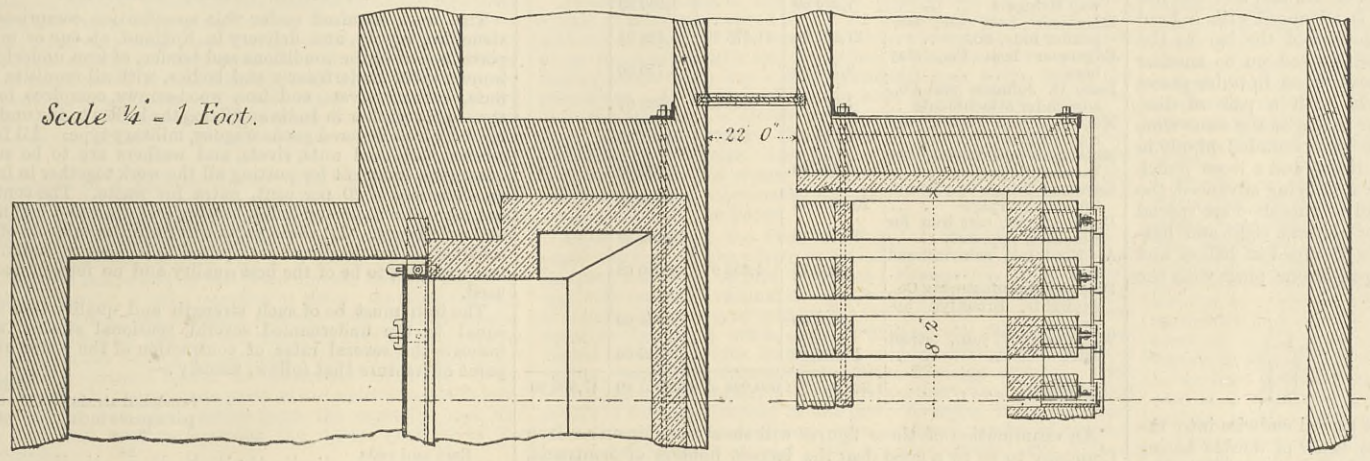
PONSARD GAS FURNACE.

DESIGNED & USED FOR FORCING EYEBARS FOR BRIDGES.

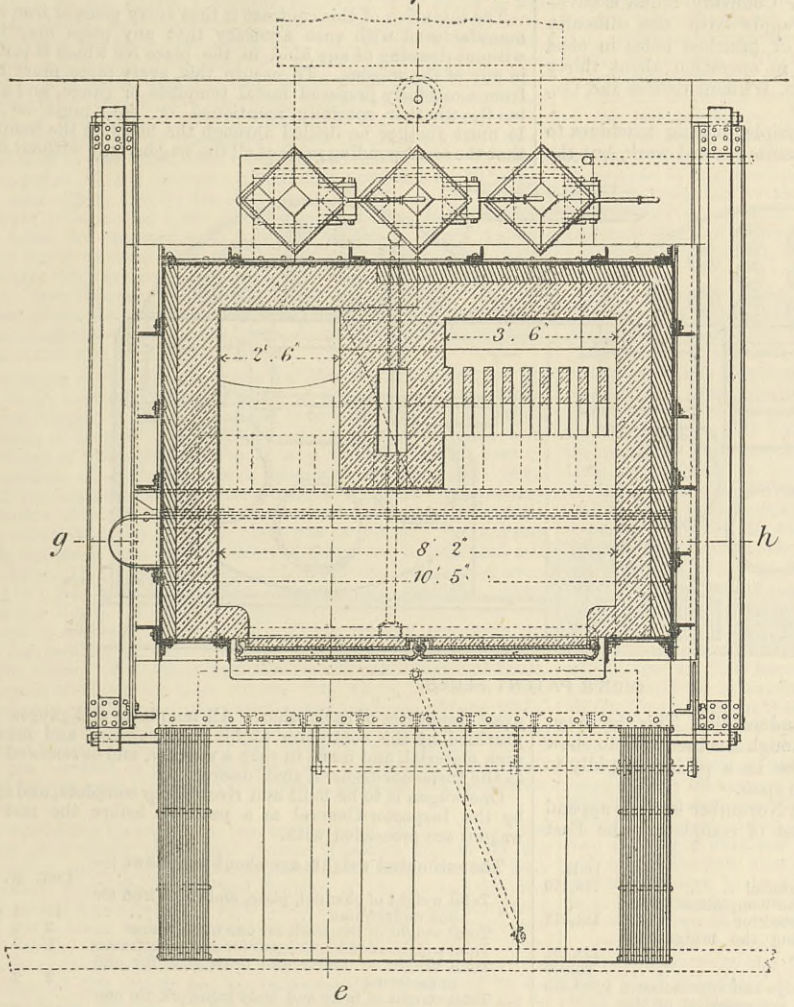


Vertical Section e f

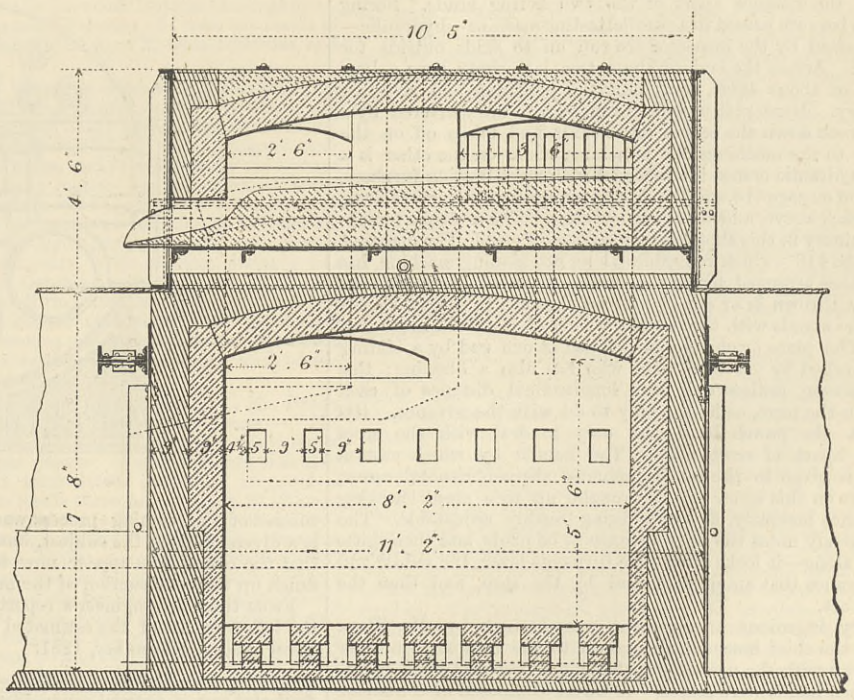
Scale ¼" = 1 Foot.



f Horizontal Section i. k.



General Plan & Section a. b.



Vertical Section g. h

EDGE MOOR IRONWORKS.

THE Edge Moor Iron Company, of which Mr. William Sellers is president, Mr. Geo. Sellers, general superintendent, and Mr. Eli Garrett, secretary and treasurer, has its works situated on the banks of the river Delaware, near Wilmington, State of Delaware, and it owes its inception to the enterprise of the well-known mechanical engineer of Philadelphia, Mr. William Sellers, whose high-class machine tools, and the position he has taken in the States in the matter of standard sizes for mechanical details, have earned him the title of the "Whitworth of America."

As a practical carrying-out of many of his far-reaching ideas, the plant at Edge Moor presents a subject of considerable interest. When thoroughly complete the ore and fuel delivered on the wharf, and brought by barge from the upper Delaware, will be reduced, puddled, rolled, forged, and fitted, finally being delivered either to rail or ships as finished parts of bridge or roof work.

Parallel to the wharf, and about 400ft. in length, runs the puddling house, in the centre of which stand the blast furnaces for reduction of the ore, delivering on either side to the puddling furnaces, eight on each side, which are built on the regenerative principle of Ponsard, with modifications, and an ingenious arrangement of mechanically rotating puddling hearth. This hearth is lined with wrought iron tubes through which water is pumped, and which are covered with the fire-brick lining. The mouth is run against the mouth of the furnace, of which the gas and air inlets are just opened by swinging back the door, the mixed gases then playing directly on the molten metal and returning under the bridge at the mouth down towards the outlets, where they do duty in the regenerator, and finally pass through and round a small tubular boiler, which supplies steam for working the details of the furnace. The hearth is rotated by a small pair of engines on the hearth frame, the whole frame turning on a pivot or hinge away from the furnace mouth, when a pair of tongs on a light type of hydraulic crane, by which they are run back and forth by direct pressure, comes into operation.

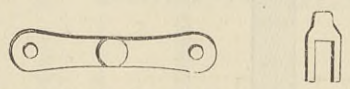
The bloom is operated next in the hydraulic squeezer, which is horizontal, formed of two lower rolls on the floor level, and a large irregularly-shaped corrugated roll above. The bloom is thrown in and out by hydraulic cylinders below, and the position

of the rolls and all gear connected with it are brought under the control of one man.

The heating furnaces stand next in order, being again on the Ponsard principle, and one of which, having a capacity of 40 tons in ten hours, has lately been erected for steel plate rolling. These furnaces have only the heating hearth inside the building, the fuel-feeding arrangements being outside, protected by iron roofs, and all provided with rail tracks of narrow gauge, by which the fuel is brought from the wharf. In the same mill, and stretching across it, stand the plate rolls, while in the parallel mill are the cogging and finishing trains. Between the two rolling mills lies the boiler house flanked by the engine rooms.

The plate train has 30in. by 8ft. rolls operated by hydraulic cylinders, instead of the usual screw levers. There are screws of a small diameter, by turning which with a small hand wheel the position of the roll is regulated, but the strain is taken and the work done by single-acting hydraulic cylinders above in the top of the housing, working with a pressure of 600 lb. per square inch supplied from accumulators in the engine-room. The train is driven by a pair of high-pressure non-condensing oscillating cylinders, by Jas. Moore, of Philadelphia, with hydraulic reversing gear. The cylinders are 36in. by 42in., and work diagonally on to a 14in. crank shaft, both on the same crank without fly-wheel. The boilers are six in number and of the Lancashire type, with the Galloway furnace and tubes of 1876 patent, built by the Edge Moor Company, which have a special shop for the construction of these boilers.

Across the yard is the forging shop, parallel to the machine shop, divided from it by a yard, into which the finished bars are brought. As the production of eye-bars forms one of the largest parts of American bridge building, this may be said to be the most important part of the works, and that one where cheapness in handling and production will be most felt. The long bars are delivered lengthwise into the side of the shop, and their ends run into the mouth of a heating furnace, from which they are carried by a light traveller overhead to the upsetting machine, see page 418, which is illustrated herewith. This machine has a pair of hydraulic rams, which grip the cold part of the bar, and the hot end being in a die, another large ram is advanced with a head fitting closely in the die, squeezing up the end of the bar to the required size of upset. The bar is then passed on to another heating furnace, and when ready the next crane in order passes it to the hydraulic "flattener," which, with a pair of dies, squeezes the upset bar-end to an eye-bar shape, at the same time marking the position of the hole in it by a rounded nipple in the dies. The ram is retired, the bar lifted, and a loose punch placed over the marked place, when the ram being advanced, the hole is punched out. In the further end of this shop are special furnaces and hammers for the making of clevises, right and left-hand nuts, rivets, &c. The clevises are stamped in halves and welded, or by another form of die stamped in one piece with the boss thus, and afterwards bent to shape.



The bars after cooling in the yard are passed endwise into the side of the machine shop and on to the table of double boring machines made by Messrs. Sellers, as, indeed, most of the plant has been. These boring machines deal with a pile of bars at a time, perhaps twelve being packed one on another. The head at one end is fast, at the other end movable, to adjust to different lengths of eye bars; but as bars for the same position on the bridge are often bored at many weeks or months difference of time, the loose head is clamped to a pair of wrought iron bars on the bed, which are accurately graduated to very small fractions of an inch, and which expand and contract with variations of temperature in the same degree as an eye-bar does. The cast iron bed of the machine only bears the weight, but does not preserve the distance apart of the two boring heads. Boring over, the bars are passed to a parallel testing machine—hydraulic—and if passed by the inspector are run on to skids outside for painting. Across the end of these two last shops runs a long building of about 400ft. containing the punching and rivetting machinery. Here plates and channels, &c., are delivered by a double track down the centre on to skids, and taken off on the one side to the machines for punching, while on the other is a row of hydraulic cranes interspersed with rivet-heating furnaces, illustrated on page 418, and Tweddell's hydraulic rivetters are slung from a track above, and are of various sizes. The multiple punching machinery in this shop is in some respects novel. The machine, —see page 418—which resembles a long bed planing machine, has the punches arranged across the head. Each of these may be instantly thrown in or out of gear by the man in charge of the head, who stands with the detail drawing of the work in front of him. The plate or channel is gripped at one end by a sliding saddle worked by another man, who has also a drawing; this one, however, notices only the longitudinal distance of each hole from the next, as he has only to do with the advance. His mate at the punch head has only to deal with the cross distance apart of rivet holes. The handle by which motion forward is given to the saddle actuates also a horizontal screw, and a nut on this screw can be brought up to a stop, checking the advance instantly, this stop being readily adjustable. The feeder merely notes the next advance to be made, and then shifts his stop along—it locks itself; he turns his lever, the saddle and plate advance that amount allowed by the stop, and then the punches act.

A very ingenious arrangement was devised by Mr. Thos. Winans, the chief mechanical engineer to the company, in order to do away with the necessity for having a first-rate hand at this work when hands were scarce. A barrel composed of a number of wheels with a groove in each is arranged on the saddle, and by the position of the groove in one wheel the next advance is regulated; so that the barrel being "set," the man has only to turn the handle without any more attention, and thus a common labourer can be employed. This is only economically used when there is much work of one description, as the "setting" has to be done by a leading hand. At the end of this shop are situated the reaming machines which have been erected for the work of the East River Bridge, which is of steel. The punched plates, &c., are delivered on roller skids, and the reaming machines are swung aloft on a small track. They consist of a long spindle with a keyway in it balanced by a counterweight sliding on two side rods, which also guide the spindle, which latter is driven by a sleeve with universal motion on the carriage, through which the spindle passes.

The reamer used is a square bit of steel, tapered off towards the point, and just touched at the front end edges with a screw thread. The reamer drops through into the oil-pan below when the hole is finished. Two contiguous plates are clamped together and the holes reamed out, so that very perfect rivetted work is the result. In addition, these works possess large smithy, boiler shops, and joiners' shops. The Edge Moor Co. has taken a high rank among bridge builders in the States, and has numerous instances of successful bridges to point to as results. It has now in hand the major portion of the steel work for the East River Bridge at New York.

This great high level suspension bridge is now being rapidly finished, and will be a most remarkable specimen of bridge construction. The following table was prepared in November last, and shows the values of materials under contract, and delivered up to November 1st, 1881.

Name of contractor, &c.	Amount of contract.	Value of material delivered under contract.	Value of material to be delivered under contract.	Percentage retained.
	Dols. c.	Dols. c.	Dols. c.	Dols. c.
Collins Granite Co., granite for approaches	188,498 33	186,788 33	1,710 00	3,040 91
Abbot Pavement Co., asphalting approaches	19,320 00	5,761 85	13,558 15	576 18
Edgemoor Iron Co., steel and iron for suspended superstructure; weight increased to 5500 tons and price from 4·35c. per lb. to 4·71c. per lb.	518,100 00			
2,400,000 lb. of steel additional at 8½c. per lb.	204,000 00			
Total of Edgemoor Co.'s contract	722,100 00	288,493 00	433,607 00	28,849 30
John A. Roebling's Sons' Co., stay ropes	83,412 30	72,974 37	10,437 93	7,297 43
Cofrode and Saylor, Brooklyn street bridges	60,102 49	42,980 10	17,122 39	4,298 01
Otto Lachemeyer, white oak flooring	8,122 33	1,001 67	7,120 66	100 16
Booth Bros., granite paving blocks	19,750 00	15,364 85	4,385 15	1,536 48
Eppinger and Russell, yellow pine flooring	27,051 19	15,961 83	11,089 36	1,596 18
Edward R. Andrews, creosoting yellow pine	14,869 92	6,645 50	8,224 42	664 55
Eppinger and Russell, planing yellow pine	698 66		698 66	
Eppinger and Russell, railway stringers	1,590 80		1,590 80	
Edgemoor Iron Co., suspender rods, &c.	27,107 20	21,578 29	5,528 91	
Edgemoor Iron Co., stay bars	3,750 00		3,750 00	
Isaac G. Johnson and Co., suspender attachments	1,726 08	688 01	1,038 07	
McDougal and Porter, stay rope sockets	2,700 00	698 70	2,001 30	
McDougal and Porter, eye bars for stays	3,582 00		3,582 00	
Keystone Bridge Co., Franklin-square bridge	106,689 60		106,689 60	
D. Y., Saxtan, cast iron for Brooklyn approach	18,166 32		18,166 32	
A. H. Ivins, oak railroad ties	3,008 75	1,358 97	1,650 68	
Dale Tile Manufacturing Co., skylights, Brooklyn approach	660 00		660 00	
W. Wharton, jun., street rails	15,840 00		15,840 00	
Totals	1,328,745 97	660,294 57	668,451 40	47,959 20

An examination of these figures will show the Edgemoor Iron Company to be by a good deal the largest holders of contracts.

The change of material at one time from iron to steel has been a great delay, as the Edgemoor Company found it advisable to put down fresh tools to grapple with the difficulty arising from the weakening effect of punched holes in steel plates. It has now, as we have said, in operation about thirty reaming machines, designed by Messrs. William Sellers and Co., of Philadelphia.

An effort was made by using multiple drilling machines to compete with the punched and afterwards reamed work, but the success of the reaming process was undeniable. This, however, is a diversion from the subject, but enough has been said to show that the contractors appear now to be in a position rapidly to finish up the construction of the main span.

From the chief-engineer's report in November last we append the following list of the estimated cost of completing the East River Bridge, November, 1881.

	Dols.
Liabilities on outstanding contracts for material	716,410
Estimated cost of material required for the completion of the bridge and approaches, not yet contracted for	184,513
Estimated cost of labour for completing the bridge and approaches	122,431
Salaries of officers and engineers	36,000
Total estimated cost of completing the bridge and approaches	1,059,335
The elevated tracks and platforms which are essential at the termini of the bridge approaches, but not considered in the above estimate, will cost for each terminus about 80,000 dols. and for the two	160,000
For the equipment of the railway there will be required forty cars, costing about 2500 dols. each, or in all	100,000
Total estimated cost of terminal arrangements and equipment of railway	260,000

W. A. Roebling, Chief Engineer.

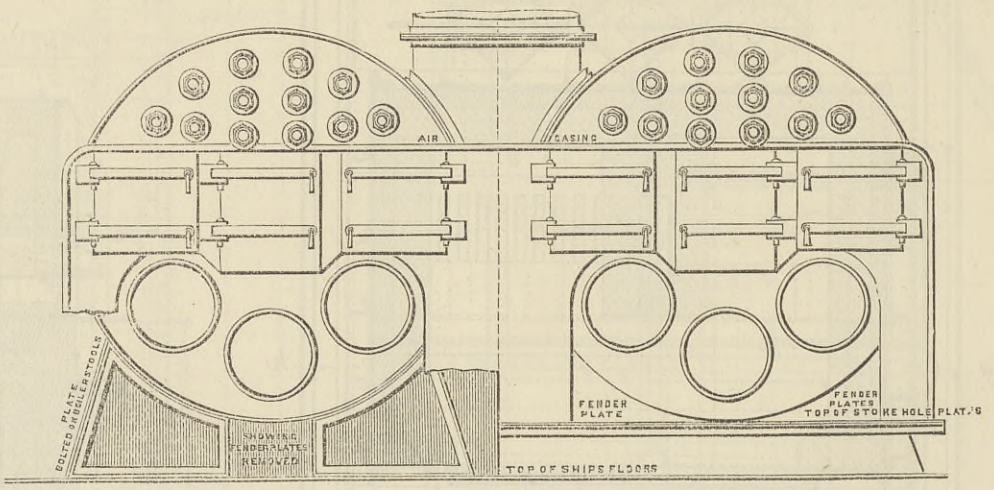
If no further item should "turn up," in the way so familiar to New Yorkers in past years, this will give us the total cost of material for the bridge and approaches, but not of the towers and their foundations, 1,671,690 dols.

The tower and foundation on the Brooklyn side, masonry, and concrete = 43,900 cubic yards.	
Ditto New York side = 55,000 cubic yards.	
The anchorages contain 26,000 cubic yards masonry, each being 119ft. by 132ft. on plan at base, and about 89ft. high.	
Towers above high water	271½ft.
Towers above roadway	159ft.
Main span	1595½ft.
Two side spans	930ft.
New York approach	(long) 1562½ft.
Brooklyn approach	(long) 971ft.
Main span above water	135½ft.

The various members of the floor-beams were calculated for a maximum strain of 15,000 lb. per square inch.

GIBB'S PATENT FLUE ARRANGEMENT.

We referred in our notice of the Naval and Submarine Exhibition to an arrangement of flues for marine boilers shown by Messrs. Rait and Gardiner, and patented by Mr. Andrew Gibb. We now illustrate this invention. It is claimed that this arrangement or form of flue, as it may be called, materially, if not effectually, prevents cold water from lying at the bottom of a boiler, and so gets over the difficulty of variable expansion and contraction during the time steam is being got up, while it utilises the heat of the gases that the old smoke-box allows to pass up the funnel. The smoke, instead of going direct up the funnel, is brought underneath with one, two, or more legs, as in the engraving, carried underneath the bottom, round baffle plates, and thence up between the boilers. A boiler on the principle mentioned has, we understand, been at work for some time, and has given the greatest possible satisfaction, never having had a caulking tool used upon it since it was made. In the case of cable ships and other vessels, which are called upon frequently to stop suddenly when going full speed, a large quantity of cold water is usually pumped in to keep the pressure from rising. This water at once finds its way to the bottom of the boiler and causes contraction; such a result will be almost wholly prevented by the adoption of Mr. Gibb's system, to which it is not easy to discover any practical objection, while the obvious advantages which it possesses are numerous. A boiler set on this principle may be seen at work at Messrs. Rait and Gardiner's, Millwall Docks.



GIBB'S PATENT FLUES.

CONTRACTS OPEN.

IRON COVERED GOODS WAGONS, RANGOON AND SITTANG VALLEY RAILWAY.

The work required under this specification comprises the construction, supply, and delivery in England, at one or more of the ports named in the conditions and tender, of iron underframes and ironwork for underframes and bodies, with all requisite bolts and nuts, washers, rivets, and iron wood-screws complete for putting the work together in India and fixing the bodies to the underframes, for fifty iron covered goods wagons, military type. All fastenings, screws, bolts and nuts, rivets, and washers are to be supplied in quantities sufficient for putting all the work together in India, with an allowance of 20 per cent. extra for waste. The contract does not include wheels and axles, bearing and draw and buffing springs, and axle-boxes. All these parts will form the subjects of separate contracts. No woodwork is required to be sent to India. All the materials are to be of the best quality and no foreign iron is to be used.

The iron must be of such strength and quality that it shall be equal to the undernamed several tensional strains, and shall indicate the several rates of contraction of the tested area at the point of fracture that follow, namely:—

	Tensional strains per square inch. Tons.	Percentage of contraction of fractured area.
Bars and rods	24	20
Plates	21	10
Channel, angle, and T-iron	22	15

The intention of this contract is that every piece of iron shall be manufactured with such accuracy that any piece may be used without dressing of any kind in the place for which it is designed in any of the wagons. To ensure this, every piece must be made from a carefully prepared metal template or gauge, and all holes in it, whether specially mentioned or not, must be drilled. It must further be drilled through the holes in the template, so that the corresponding parts of all the wagons may without doubt be exact duplicates of each other. All templates and gauges must be provided by the contractor at his own expense, and must be of such material, and made in such a manner, and be renewed as often as the Inspector-General shall desire.

One wagon is to be built and rivetted up complete, and approved by the Inspector-General as a pattern, before the rest of the wagons are proceeded with.

The estimated weights are about as follows:—

	Cwt.	qr.	lb.
Total weight of channel, plate, and angle iron for one underframe	18	1	18
Total weight of ironwork for one underframe	2	2	17
Total weight of end brake gear for one underframe	1	0	15
Total weight of buffer and draw gear for one underframe	2	2	16½
Total weight of body and body ironwork for one body	19	2	9
Total weight of bolts and nuts for one underframe and body	0	1	18½
Total weight of rivets for one underframe and body	1	2	6
Estimated total weight of ironwork—exclusive of wood screws—for underframe and body of one iron covered goods wagon, 15ft. 6in. long	46	1	16

	lb.
Total weight of bolts and nuts for one underframe and body	46·33
Total weight of iron rivets for one underframe and body	117·61
Total number of iron wood-screws required for one body	42 doz.

Tenders are to be delivered at the Store Department, in the India-office, Westminster, S.W., on Tuesday, 13th June, 1882, before two p.m., after which hour no tender will be received. They are to be addressed to the Secretary of State for India in Council, with the words "Tender for Ironwork for Iron Goods Wagons" on the left-hand corner of the envelope, and are to be placed in a box provided for that purpose in the Store Department.

RAILWAY MATTERS.

COPPER-COATED iron tubes are being tried in some of the London and North-Western engines.

MR. MACNAY, the manager of the Shildon Works, belonging to the North-Eastern Railway Company, died rather suddenly a few days since. The deceased gentleman was well-known in the Cleveland district, being brother to Mr. Thos. Macnay, secretary of the original Stockton and Darlington Railway.

MESSRS. BEMROSE AND SONS, of Old Bailey and Derby, have now added to their Panoramic Railway Guides, that of the Great Northern Railway. These guides are printed on the same size paper as the railway time tables, and are of great assistance in gaining an acquaintance with the district passed through by the railway.

THE loop line of railway which is to connect Kenilworth with Berkswell, Warwickshire, and thus obviate the necessity of passengers having to proceed by way of Coventry, was commenced last week. The contractors are Messrs. Holmes and King, of Liverpool, who engage to complete the work in one year, for the sum of £39,000. Mr. King has been in the neighbourhood some days making preparations.

THE action brought by the Walsall Wood Colliery Company against the Midland Railway Company for a sum of nearly £6000 and an undefined sum in addition, as compensation for extra expenditure thrown upon the claimants owing to the manner in which the defendants had constructed their line at Walsall, was brought to an end at Walsall this week. The special jury who heard the case under a reference to arbitration found for the claimants for £3500.

ACCORDING to statistics recently worked out, the number of railway travellers killed in France is given by *Nature* as one in each 1,600,000,000 km. run, which is a distance equal to 40,000 times the length of a voyage round the world. The excursion would last during 3044 years travelling day and night at the rate of 60 kilometres per hour. So that, supposing an average lifetime of sixty years for a healthy man, before he could be killed by a railway accident according to the law of probabilities, he would have died fifty times a natural death.

IN districts where water is largely impregnated with lime iron tubes will not answer for locomotives. Lime is quickly deposited on the tubes, and it adheres much more strongly than it would on brass tubes using the same water; in brass tubes a thin scale of $\frac{1}{16}$ to $\frac{1}{8}$in. thick would be formed, whilst the incrustation about the iron tubes would, in a few years, completely block up the water space between the tubes; when this takes place it is impossible to keep the tubes at the fire-box end tight. To prevent the sediment from adhering to the iron paraffine oil is recommended, even where brass tubes are used; about three pints for every 1000 miles run, put into the boiler the evening before washing out on the following day, is mentioned as the quantity. Being free from acid this oil is safe to use.

THE prospect of a railway through the heart of Australia, from Fort Darwin to Adelaide, is already stimulating enterprise and speculation. Five hundred miles of this railway, from Adelaide northwards, the *Colonies and India* says, have already been completed; 100 miles from Port Darwin, in a southerly direction, are likely to be soon authorised by the Government; and the construction of the remainder is but a question of time. Another railway, in Queensland, connecting Brisbane with the Gulf of Carpentaria, and possibly ultimately meeting the line from Port Darwin, is also projected, and must have a remarkable effect in developing the resources of the northern half of the Australian continent. With these railways built, those fertile parts of the continent which have hitherto received but scant notice from the capitalist and the labourer alike will take rank among the richest portions of the British Empire.

IN a recent paper read before the Institution of Civil Engineers of Ireland, by Mr. Martin Atock, the following is given as to the cost, durability, and efficiency of iron tubes, as compared with brass tubes of the same dimensions, viz., 10ft. long × $1\frac{3}{8}$in. outside diameter:—The iron tubes being 13 w.g. thick, and the brass tubes 10 and 12 w.g. thick, one iron tube would weigh about 18 lb., and one brass tube about 22 lb. Assuming 200 tubes to one set, then one set of iron tubes = 3600 lb., at 4d. per lb., £60; interest on £60 at 5 per cent. for 10 years, £30; credit for old tubes, *nil*; total cost of a set of iron tubes, £90. One set of brass tubes = 4400 lb., at $8\frac{1}{2}$d. per lb., £156; interest on £156 at 5 per cent. for 10 years, £78; total, £234; less Cr. for old tubes = 2200 lb., at $4\frac{3}{4}$d. per lb., say, £44; total cost of a set of brass tubes, £190. Both iron and brass tubes are credited with a life of ten years, which is about correct for a running of 20,000 train-miles, average, per annum, and where there are no unfavourable circumstances to affect either metal. Iron tubes are equal in durability and efficiency with brass in cases where the water was not injurious to the iron, and where it was comparatively free from lime. Surface water from bog land seems to suit iron tubes best.

A NUMBER of experiments made by Mr. W. H. Shock, of the U.S. Navy, to find the holding power of brass tubes in tube plates are thus referred to in a recent paper before the Institution of Civil Engineers of Ireland:—Forty-eight experiments were made with brass tubes of 2·5in. diameter by 12 w.g. thick, or 0·9in. area in cross-section, except in the case of tubes with screwed ends; these were 2·6in. diameter, and of a cross section of 1·33in. The average resistances obtained with each method of tube fixing before the tubes were withdrawn from the plate was as follows: No. 1, tubes simply tightened with the expander, 6700 lb.; No. 2, expanded and beaded over, 16,829 lb.; No. 3, expanded, ferruled, and beaded over, 31,751 lb.; No. 4, expanded and ends screwed into $\frac{3}{4}$in. nuts, 25,212 lb.; No. 5, expanded and ends screwed into $\frac{3}{4}$in. nuts, and ferruled in addition, 39,935 lb. In 75 per cent. of the tests the plate representing the tube plate was $\frac{3}{4}$in. thick, and the rest $\frac{5}{8}$in. and $\frac{1}{2}$in. thick. We gather from this very complete series of trials, and report of Chief Engineer Shock, that where the tubes were beaded over and ferruled, the variations of thickness of tube plate, from $\frac{5}{8}$in. to $\frac{3}{4}$in. did not increase the holding power. The holding power of tubes, simply fixed by the expander, and neither beaded over nor ferruled, is generally very much beyond any strain that would be put upon them by the working pressure of a locomotive boiler.

IN concluding his report on the explosion of the fire-box of the engine of a goods train, near South Stockton station on the Darlington section of the North-Eastern Railway, on the 26th December, when the driver and fireman of the goods train and the guard of a mineral train were killed on the spot, and the guard of a goods train and a wagon inspector received fatal injuries, from which they died, Major-General Hutchinson made some curious remarks about fusible plugs. He concluded that the explosion of the copper fire-box was probably occasioned by the crown of the fire-box having become overheated from want of water, and when thus weakened, having been unable to resist the pressure caused by the sudden creation of steam upon water being admitted into the boiler just as the engine was drawing up behind a mineral train at Thornaby Junction. "The failure, he said, of the lead plug—which had been removed from the fire-box by order of the locomotive superintendent soon after the explosion—to melt when the crown of the fire-box became heated, appears to have been owing to the bottom surface of the lead having become covered with a hard incrustation. Some locomotive engineers think these plugs perfectly untrustworthy; others on the contrary use them, but have them very frequently renewed. The plug in the present instance had not been renewed for four or five months, the boiler smith stating that there was no regular time for renewal. There can be no grave objection to the use of these plugs, and if their renewal is made peremptory at short intervals when an engine is in the sheds for overhauling, there would be comparatively little fear of their not being in a state of efficiency in case of need."

NOTES AND MEMORANDA.

IN Switzerland the average distance to a post-office is $1\frac{1}{4}$ mile, in Russia it is 22 miles, and in Bulgaria $12\frac{1}{2}$ miles.

THE vane of the Osler's anemometer at the Greenwich Observatory made in the year 1881 fourteen revolutions in the positive direction N., E., S., W., N.

THE number of hours of bright sunshine recorded by Campbell's sunshine instrument at the Greenwich Observatory during 1881 was 1301, which is more than 100 hours above the average of the four preceding years.

THE rate of indebtedness per head of population in the Australian colonies at the end of 1881 was:—New South Wales, £20 3s. $1\frac{1}{2}$d.; Victoria, £25 13s.; South Australia, £36 17s. $4\frac{3}{4}$d.; Queensland, £53 13s. 7d.; Tasmania, £16 18s. $8\frac{3}{4}$d.; South Australia, £12 8s. $9\frac{1}{2}$d.; New Zealand, £58 19s.; general average, £33 0s. 8d.

AT a recent meeting of the Physical Society, Professor Guthrie read a paper on the repulsion of a suspended horseshoe magnet by a rotating copper disc below it. He gave tables of quantitative results and a plotted curve, showing that the repulsion varied as the square of the rate of rotation. For a surface velocity of the disc of 163 metres per minute the repulsion was ·41 grammes.

THE annual report of the Astronomer Royal, Mr. W. H. M. Christie, gives the mean temperature of the year 1881 as 48·7 deg., being 0·6 deg. lower than the average of the preceding forty years. The highest air temperature was 97·1 deg. on July 15, and the lowest 12·7 deg. on January 17. The mean temperature was below the average, 6·7 deg. in January and 4·8 deg. in October, and above the average 5·9 deg. in November. In other months the temperature in general differed little from the average. On four days in July the temperature rose above 90 deg.

A MACHINE belting made of woven camel hair, or of hair known as camel hair, is being manufactured and used in cotton mills in Manchester by Messrs. F. Reddaway and Co. A test by Mr. Kirkcaldy, of London, of a camel hair belt 6in. wide 0·27in. thick showed a breaking strain of 9181 lb., with an extension at the rate of 2·68 per cent. at 1200 lb., 5 per cent. at 2400 lb., 6·60 per cent. at 3606 lb., and 13·07 per cent. at 4800 lb. We have had no experience of this belting, but it is claimed that it slips less on pulleys, does not deteriorate to anything like the same extent as driving belts of vegetable fibre, and is thoroughly waterproof and not affected by variations in temperature.

AT recent meeting of the Physical Society, Mr. Lecky described a form of battery arranged by Mr. A. R. Bennet, of Glasgow, at a cost of 6d. per cell. The vessel and electro-negative plate consists of an iron meat or milk tin, into which is placed a porous pot containing a zinc plate stuck in a paraffined cork cover, fitting the porous pot. A solution of caustic soda is the liquid. In it iron does not rust, and is electro-negative to zinc. The electromotive force is 1·23 volts where the Daniel is taken as 1 volt and the Leclanché as 1·30 volts. Iron filings round the iron plate facilitate depolarisation by the escape of hydrogen from their points. The cell tested against a Leclanché was found to ring an electric bell even longer than the latter.

AT a meeting of the Paris Academy of Sciences, May 8th, a paper was read on the effects produced in vacuo by the current of Gramme machines, by MM. Jamin and Maneuvrièr. In an electric egg, with carbons—vacuum about 12mm.—a phenomenon like that of Geissler tubes is produced by the two currents, which contribute equally: but it is much more brilliant; the carbons soon get heated to a pale white throughout, and volatilised, giving a blue vapour, which condenses, and makes the egg opaque. This volatilisation was mostly avoided, in another case, by using two groups of carbons—instead of the pair—diverging from the rheophores towards each other, cone-wise. A large number of currents here take the place of one. Still brighter effects, says *Nature*, were had with copper rods so arranged.

THE annual rate of mortality last week in 28 of the largest English towns averaged 19·9 per 1000 of their aggregate population, which is estimated at 8,469,571 persons in the middle of this year. In London, 2176 births and 1304 deaths were registered. Allowing for increase of population, the births were 383 and the deaths 172 below the average numbers in the corresponding week of the last ten years. The annual death-rate from all causes, which had been equal to 19·0 and 19·2 per 1000 in the two preceding weeks, declined last week to 17·5, and was considerably lower than in any previous week of this year. Even this low rate would be lower but for the number of street accidents, which to a great extent are peculiar to the crowded London thoroughfares. Different forms of violence caused 58 deaths; 51 were the result of negligence or accident, among which were 22 from fractures and contusions.

THE mean daily motion of the air at Greenwich Observatory in 1881 was 291 miles, being 12 miles greater than the average. In January and September the mean daily motion was 70 miles and 72 miles below the average respectively; in April, August, and November it was 70 miles, 60 miles, and 71 miles above the average respectively. The greatest daily motion was 999 miles on October 14, the day of the great storm, and the least 59 miles on May 25. A velocity of 61 miles an hour was recorded on October 14, and one of 58 miles an hour on April 29, these being both greater than any recorded in previous years. The greatest pressure was 53 lb. on the square foot on October 14; pressures of 46, 47, 47, and 48 lb. were also registered during the same gale. On April 29 a pressure of $49\frac{1}{2}$ lb. was recorded at a time when the hourly velocity was 50 miles; the pressures corresponding to the maximum velocity of 58 miles an hour were not registered, the cord of the pressure pencil having slipped off the pulley.

IN reply to a letter in the *Times* of the 2nd inst., Mr. Henry Woodall, gas engineer to the Leeds Corporation, writes:—"Mr. Hardy bases his calculations on the supposition that electric lamps will be used for 2000 hours per annum. I am convinced that 1000 hours would be in excess of their actual duration; in proof of which I may mention that in Leeds there are at least 10,000 consumers of gas whose annual payments do not exceed 10s., which would be the return for a single light—*i.e.*, 15 candles—burning 1000 hours. Further, we have 60,000 customers, including many large railway stations and factories, yet our gross sale only averages 20,000ft. per customer—less than 40s. per annum—which, supposing lights were required for 2000 hours, would give an average of only two lights per customer throughout the borough. If Mr. Hardy will accept the data here given, he must declare the cost of incandescent lighting to be almost double what he has calculated it to be." It may be remarked that gas is cheaper in Leeds than in any other town in the world.

AT a recent meeting of the Chemical Society, Mr. Warington read a paper "On the Determination of Nitric Acid in Soils," from which it appears to be important to sample the subsoil as well as the surface, and to take the samples after dry weather. Boussingault, August 9th, 1856, found that after dry weather the surface soil of a kitchen garden contained nitrogen as nitrates = 29·2 per million; a few weeks after—August 29th—rain having fallen, the nitrogen = 1·2 per million; October 10th, after dry weather, the nitrogen was 41·3 per million. It is necessary to dry the sample speedily, else nitrification proceeds; drying at 100 deg. may occasion a loss of nitrates in proportion to the wetness and mass of the soil and its richness in organic matter. Drying at a high temperature also greatly increases the soluble organic matter in a soil. The plan adopted by the author is to break up the soil to small pieces, place these in paper trays, and dry in a stove at 55 deg.—the temperature at which Schloessing and Müntz state that nitrifaction ceases. Soils thoroughly dried in dry air seem to undergo very little change by keeping. The method commonly used to prepare an extract of the soil is to shake 500 or 1000 grms. of soil with its own, or twice its own, weight of water, and take a known portion of the solution for analysis.

MISCELLANEA.

MESSRS. SAMUELSON AND CO., Banbury, have been awarded first prize and gold medal for their new patent "Atlas" grass mowers at the regional Government trials held at Saint Lo, France, on the 7th inst. There were twelve competitors.

THE report of Dr. Frankland on the metropolitan water supply during April is more in accordance than usual with the report of Messrs. Crookes, Odling, and Tidy, which shows it to have been somewhat better than in March, though it was even then satisfactory.

A PAPER, read before the Institution of Civil Engineers of Ireland, on "Single Balk Dams," and of interest to contractors, has been printed for the author by J. Falconer, Dublin, as well as a paper on "The Lowering and Widening of Essex Bridge, of Dublin."

THE London Steamboat Company is about to construct two additional piers for the up-river traffic. A new Nine Elms Pier will be erected in the locality, along Messrs. Bryan and Co.'s wharf in Nine Elms-lane, a very short distance from the site of the old pier closed.

AT a meeting of the Birmingham Town Council on Tuesday, upon the recommendation of the Water Committee, approval was given by 26 votes against 23 to a scheme by which the Corporation will undertake the repair and maintenance of water services at a fixed annual sum by way of insurance. The committee were also authorised to adopt a system of house-to-house inspection of all the properties in the area of the present water supply, and to appoint inspectors to make the survey at an estimated cost of £1500.

IN a letter to the *Times*, Mr. Crookes, F.R.S., has given the result of several months' experience with electric lighting in his own house by means of gas engine and incandescent lamps. Omitting the interest on capital expenditure, which would not obtain to anything like the same amount by lighting from a central station, especially when reduced cost in keeping ceilings and curtains clean and maintaining gilding and book-bindings is taken as against it, he finds the actual cost to him to be £2 19s. per month. Gas lighting to the same extent, he says, would cost £3 6s. 6d. He has in his house altogether about fifty lamps of different powers.

THE Birmingham Corporation have this week approved of the expenditure by the Gas Committee of £4500 for the providing of regenerative furnaces for the retort houses at the Saltley and Windsor-street works. From the experiments of the committee's engineer, and from the reports they have received, it is anticipated that the adoption of these furnaces will augment the productive power of the retort houses by from 50 to 60 per cent., as well as effecting a saving in fuel and labour. Even under the most unfavourable circumstances the capital expenditure will be returned in nineteen months. The plant which the committee are putting down at Windsor-street will, they claim, make these works second to none, either in England or the Continent, for the production of gas.

THE first monthly part of a new journal, entitled "The Field Naturalist and Scientific Student: a medium of inter-communication," has reached us from the publishers, Messrs. Heywood and Son, Manchester, and Simpkin, Marshall, and Co., London. It consists of 32 pages of double column, small quarto, and is well printed, but very sparsely illustrated. As a medium of communication on a special subject it may hold a place, but at 4d. one cannot but look upon it as having a high price as compared with some of the modern illustrated scientific and popular journals, especially as it might be made a highly popular journal without in the least detracting from its scientific value, and from this first part it is clear that anecdotic natural history, a very popular subject, will form a considerable part of the contents.

THE bronze coinage executed at the Mint during last year was not large, having only amounted to £17,400. Tenders were issued for the supply of fifty tons of pence, halfpence, and farthings by a private firm, and the tender of Messrs. Ralph Heaton and Sons, of Birmingham, accepted, was for a coinage in the following proportions:—Pence, 35 tons, £15,086; halfpence, 10 tons, £3733, 6s. 8d.; farthings, 5 tons, £1,866 13s. 4d.; total, £21,280. The amount of bronze coin issued during the year was £23,405, bringing the total amount issued, since the first introduction of the bronze coinage in 1860, to £1,498,013. The amount issued in 1877 was £48,800; in 1873, £43,745; in 1874, £62,110; in 1875, £70,595; and it has decreased each year since then. The issue in 1881 consisted of £15,405 in pence, £5200 in halfpence, and £2800 in farthings, as against £19,640 in pence, £6058 in halfpence, and £2772 in farthings in 1880. The demand, therefore, continues to diminish.

THE use of the electric telegraph in China is making rapid way, and the Shanghai-Tientsin line, which has been working now for a few months, is being supplemented by a line in course of construction in the south, between Canton and Hong Kong—a distance of about 100 miles. It will be a land line, as being more economical, and offering less interference with the junk traffic and fishing operations in the estuary of the Canton River. It is purely a private undertaking of a company of Chinese merchants in Canton. It is stated in the Hong Kong journals that opposition is made by the British authorities to the further construction of the line, and especially to the cable across the harbour necessary to connect Kowloon with Hong Kong, unless it is constructed by a British company; a demand which seems as illogical as unfair, and already one of the telegraphic cables between Hong Kong and the outer world belongs to a foreign company, the Danish Great Northern Telegraph Company.

M. COCHERY, the Minister of Postal Telegraphy in France, has printed a circular extending the use of telephones in provincial cities. The charge for telephonic communications in the cities where the Government will establish central halls, is £10, and in the cities where the number of subscribers will exceed 300, the subscription will be reduced to £8 a year. The subscribers will have the right of supplying their own telephones from among those approved by the Government. Special rooms will be fitted up in Paris, as well as in the provinces for telephonic conversations. The charge will be 5d. from each interlocutor for each five minutes. The time allowed will not exceed ten minutes if there are other would-be interlocutors waiting. The telegrams received for the subscribers to the telegraphic offices will be telephoned to them if desired. The subscribers will enjoy the privilege of telephoning their letters to the post-office for immediate despatch, on paying a charge of 5d. for each 100 words; this privilege is limited to 200 words, the postage must be paid besides. Telegrams will be received in the same manner and on the same scale.

THIS is the jubilee year of the Royal Cornwall Polytechnic Society, and in commemoration an exhibition is to be opened at Falmouth on the 5th September. The exhibition will be on an extensive scale, and the committee have determined to make the exhibition representative of the progress of the past half-century in science and art, mining enterprise, naval architecture and fishing, meteorology, photography, natural history, and statistics, as well as the fine arts pure and applied, more especially in connection with the county of Cornwall. The exhibition will be attended by eminent scientific men, who will visit Falmouth after the British Association meeting at Southampton, and several of them will deliver lectures at the jubilee. Electricity and the electric light will be a special feature of the exhibition. The exhibition will occupy the Polytechnic Hall and the Volunteer Drill Hall, and will be open for double the ordinary period. Excursions will be organised on a large scale for exploring the sea coast, the scientific archæological interests, and the natural beauties of the neighbourhood. In order to ensure success, the committee with confidence solicit the aid of all Cornishmen. They estimate that £600 will be required to carry out the object in view. Special donations amounting to £280 have already been promised, including £25 from the Queen.

BRIDGE MAKING PLANT, EDGE MOOR IRONWORKS, U.S.

(*For description see page 415.*)

ALTERNATING PUNCH HOLDERS FOR MULTIPLE PUNCH

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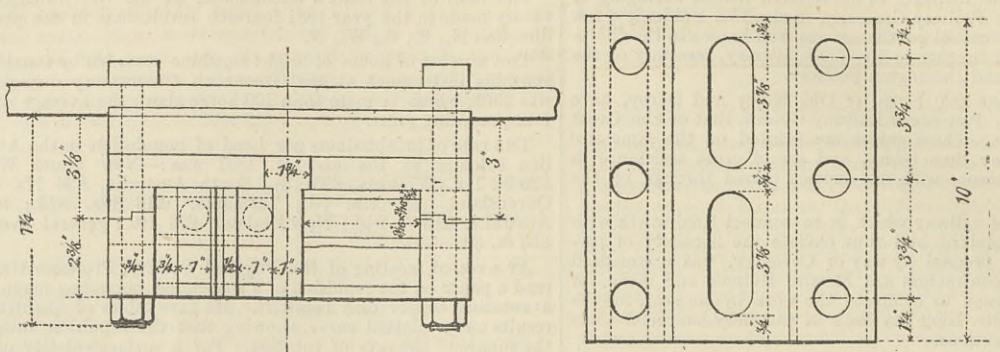
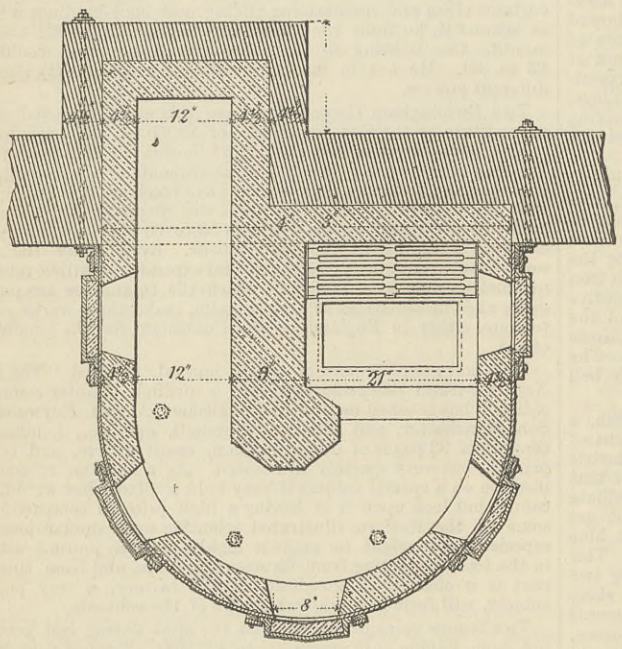
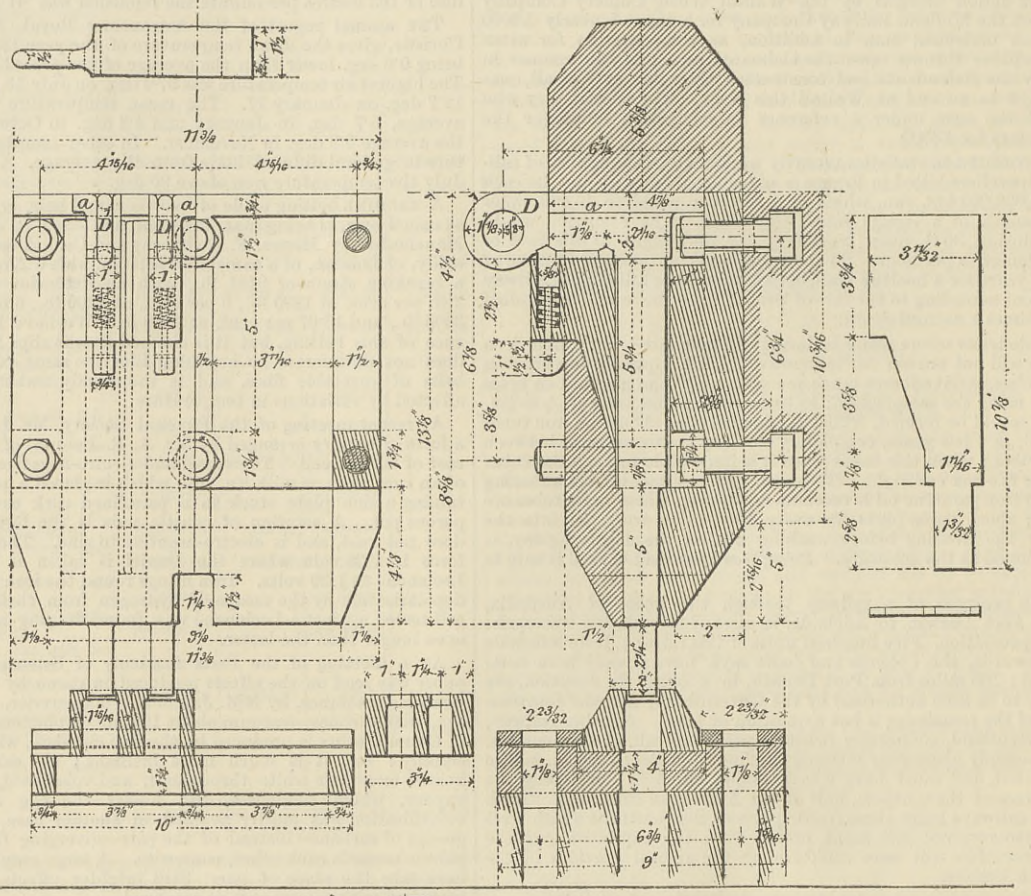


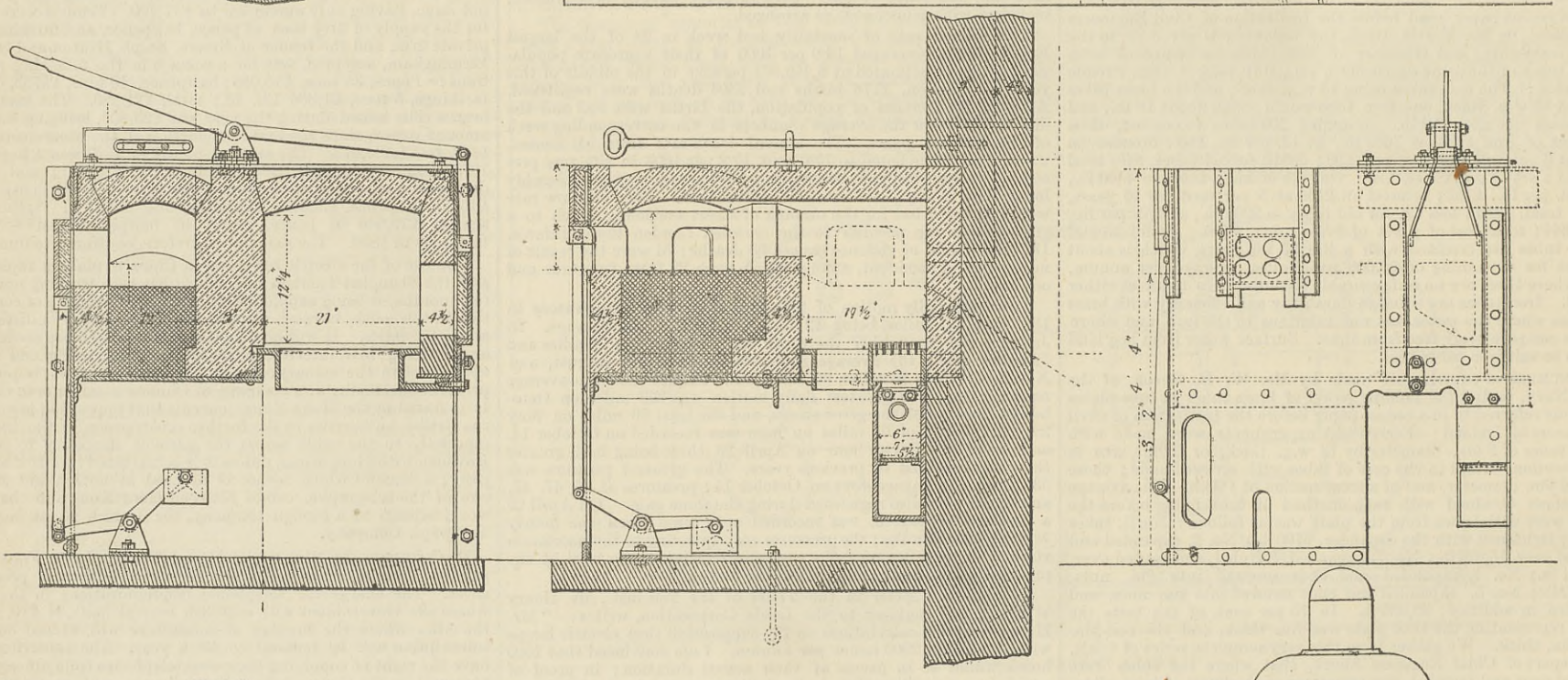
RIVET HEATING FURNACE

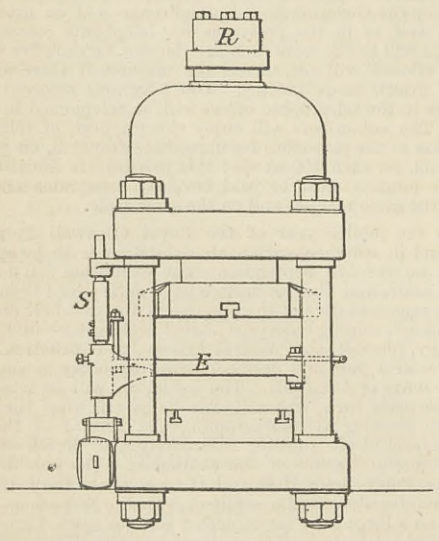
with

Mechanical Fire Feeder

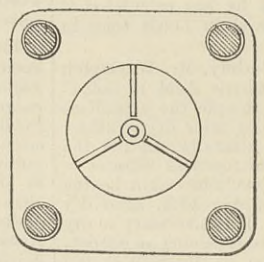




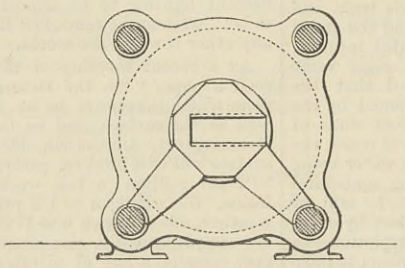




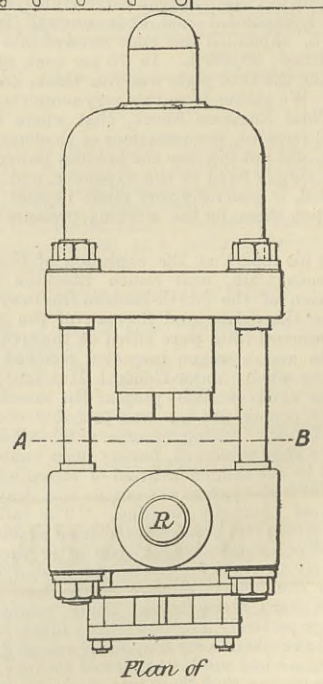
Hydraulic Flatter.



Plan of Base Hydraulic Flatter.



Section on line A.B. Hydraulic Upsetter



Plan of Hydraulic Upsetter.

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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.*

JUNIOR DRAUGHTSMAN.—*The parallelogram of forces gives the thrust.*

J. P. S.—*Read Richard's "On the Indicator," published by Messrs. Elliot, West Strand, London.*

J. H.—*J. H. Carter*, 82, *Mark-lane; A. B. Childs and Son*, 70, *Fenchurch-street; Dell, W. R., and Son*, 26, *Mark-lane; E. R. and F. Turner, Ipswich.*

A SUBSCRIBER.—*We do not know what you mean by the "force of a blow;" please explain. The words are in common use, but they do not admit of being dealt with mathematically until definite ideas are attached to them.*

H. J. M. (Poplar).—"*Principles of Machine Construction,*" *by Edward Tomkins, in two vols., text and plates, is apparently the book you want. It is published by Collins, Son, and Co., but you can get it through any bookseller. Price* 5*s.*

W. S.—*It is not unusual to put the injection into the exhaust pipe. In one case within our own knowledge the condenser is simply the exhaust pipe, about* 14*in. in diameter and* 10*ft. long, set on an incline of about* 3*in. to the foot from the cylinder to the air pump. The injection is taken in near the air pump and directed up the pipe in a jet, spread by a rose. The cold water then moves in one direction while the steam moves in the other. The vacuum is about* 24*in. to* 25*in.*

SUBSCRIBER.—*The girder of which you send sketch is badly designed, because the wood beam, as part of trussed beam, will safely carry a load, which, however, will deflect it sufficiently to bring an equal load on the iron truss bar, and this load would treat the iron as though a mere wire, which, in comparison with your wood beam, it really is. Your wood beam will of itself safely carry* 10 *tons, and to make it carry any more your iron truss bars must be double—that is, there should be a pair—and should be larger in diameter. In that case the breaking load might be very greatly increased.*

LUBRICATING PLUMBAGO OR METALINE.

(*To the Editor of The Engineer.*)

SIR,—Will any of your readers kindly inform me where I can obtain lubricating plumbago or metaline for brass steps, instead of oil?

Manchester, June 7th. J. C.

STATISTICS OF CONSUMPTION OF MINING EXPLOSIVES.

(*To the Editor of The Engineer.*)

SIR,—Could any of your readers kindly give me the following information? I wish to know the average yearly amount of blasting powder, dynamite, and other explosives employed in mining operations, manufactured in England for home consumption. Also the amount of the above material of English make exported. S. C.

London, June 5th.

ELECTRO-MAGNETS.

(*To the Editor of The Engineer.*)

SIR,—I shall be obliged to any reader who will tell me how to make an electro-magnet of maximum power and minimum resistance for that power. In other words, how can I best saturate a bar of very soft iron with magnetism without unduly heating the wire? I believe the best results are obtained when the resistance of the magnet coils is equal to one-half the sum of all the other resistances in the circuit. I can find no precise information on the subject in books. FARAD.

London, Juue 7th.

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*** *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.*

MEETING NEXT WEEK.

CHEMICAL SOCIETY.—Thursday, June 15th, at 8 p.m.: (1) Ballot for the election of Fellows. (2) "Note on the Preparation of Amido-β-Naphthol and β Naphthaquinone," by Mr. C. E. Groves. (3) "On Some New Compounds of Brazilien and Haematein," by Mr. J. J. Hummel and Mr. A. G. Perkin. (4) "On the Determination of Nitric Acid as Nitrioxide by Means of its Reaction with Ferrous Salts," Part II., by Mr. R. Warington.

THE ENGINEER.

JUNE 9, 1882.

CONTINUOUS BRAKES ON METROPOLITAN RAILWAYS.

THE Duke of Westminster has written to the *Times* to complain that the use of continuous brakes on the Metropolitan Railway is doing serious injury to his house property. His estate surveyor tells him that the "evil is a very serious one. Some grave disaster is likely to occur involving loss of life, unless steps are taken to remedy it." The Duke adds that when Parliament sanctioned metropolitan railways continuous brakes were not in use, otherwise precautions would have been taken to prevent them being injudiciously applied. Railway companies are apparently hardly dealt with. On the one hand the Board of Trade and Parliament itself insist that continuous brakes shall be fitted to all passenger trains; while on the other the Duke of Westminster and his surveyor consider them, as regards the Metropolitan District Railway at all events, a dangerous nuisance. The case as it stands is very simple. The Duke of Westminster owns house property standing over and near the District Railway, and he holds that the vibration caused by the use of continuous brakes is shaking his houses down. Concerning the right at law of the Duke of Westminster to compel the railway company to "abate the nuisance" we are not called upon to pronounce any opinion whatever; but we may point out that without continuous brakes the present traffic could not be worked on the Metropolitan Railway. If the Duke is successful, then the accommodation afforded by the District Railway to the general public will be reduced in amount, and dividends, already very small, will entirely disappear. In a word, the Duke of Westminster, while he is about it, may as well obtain an Act to close the line entirely. Possibly his Grace would see in this course the simplest possible way out of the difficulty.

It is a fortunate circumstance that in this case the two rival brakes, the Westinghouse and the vacuum, are both concerned. The vacuum brake is used on the Metropolitan Railway, while the original Westinghouse non-automatic air brake is used by the District Company. The trains of both companies run over the District Company's roads; so do the trains of the London and North-Western, working Clarke and Webb's chain brake. It has not been said that the annoyance complained about is produced by any special form of brake. The Duke of Westminster's surveyor, indeed, to do him justice, does not attempt to single out any special or particular culprit. He objects to continuous brakes in general, as distinguished from the old hand brake. Inventors have consequently no chance of throwing the opinion of the Duke of Westminster's surveyor in each other's teeth. They may, therefore, make common cause so far, and proceed amicably to show that the Duke and his surveyor are both mistaken. In this there ought to be no real difficulty. We cannot tell how the idea first found its way into the brain of the Duke of Westminster's surveyor that continuous brakes caused additional vibration, and so far as we can see there is no foundation whatever for it. The brakes are carefully used by very skilful men, and it seems incredible that the passengers should not complain of excessive vibration if any was produced. As a matter of fact, millions of passengers use the trains yearly, and never express or feel the least dissatisfaction; they know nothing about the application of the brake; now and then someone complains to a fellow-passenger that the train "gave a jerk" at the moment it stopped; but this has nothing to do with vibration. Again, so far as we can gather, the Duke of Westminster and his surveyor seem to think that the vibratory influence of a continuous brake can extend over a very wide range, or else they hold that the trains are run as a rule with the brakes on instead of off. It is pretty well known that the brakes are really only put on close to the stations—that is to say, in localities where dwelling houses are farthest from the railway. But the Duke of Westminster does not seem to draw any distinction. We are driven to the conclusion that the brakes have really nothing to do with the matter—that they are innocent as far as vibration is concerned; but we think it is quite possible that they may offend in another way. Thanks to them, speeds can be maintained now which could not be maintained before, and more trains can be run per hour, because the time spent by a train between any two block signals is less than it would be if brakes slower in their action were still in use. There can be no doubt that the traffic on the District Railway has greatly increased since the line was opened, and it may be assumed that vibration has increased in proportion; but nothing short of very strong proof would persuade us that the use of continuous brakes contributes directly to the deterioration of the Duke of Westminster's house property.

Let us assume, however, for the sake of argument, that it is quite true that continuous brakes do produce augmented vibrations. What then? How is the nuisance to be abated? The object of a continuous brake is to stop a train quickly. It is absolutely essential, the Duke of Westminster to the contrary notwithstanding, that metropolitan trains shall be "jerked at high speeds from one station to another"—this is his Grace's way of putting it. If this can be shown, then, it seems that there is really no help for it. We do not suppose that the public, for whose benefit the railway is worked, would consent to have its utility impaired whether house property was or was not reduced in value; and it will devolve on the Duke to prove that the brakes are not the best that can be used, or that they are used improperly. To do this would be no inconsiderable undertaking even for a very wealthy nobleman, and if success attended his efforts he would deserve a reward not only from railway companies but from the public generally. But meanwhile there seems to be no reason to think otherwise than that the Metropolitan Railway Company and the District Railway Company are using the best brakes that science has yet produced. So far as relates to the question raised by the Duke, we are not aware of the existence of any brake that can be more gently applied than the Westinghouse air brake and the vacuum brake. We cannot say so much for the Clarke and Webb brake used on the London and North-Western Company's trains. It is rough and jerking in its action, as the passengers very well know, and we would advise the Duke of Westminster's surveyor to carry out a few experiments to ascertain at what periods of the day the vibration was most sensible. If a correspondence was found to exist between violent vibration and the passage of London and North-Western trains, the fact might lead to the suppression of a brake which has nothing to recommend it. Inasmuch, however, as we understand that this brake will soon be removed from all London and North-Western trains, it is possible that no further trouble need be taken concerning it.

Our own view of the whole matter is that increased traffic conducted at a higher speed than obtained in the early days of metropolitan railways has augmented vibration. We do not dispute that the Duke of Westminster has more to complain of on this account now than he had at one time. He seems to be mistaken as to the cause of his troubles. Before he can get Parliament to interfere he will have to produce very precise evidence in proof of his propositions. The assertions which carry weight with the public at large in the columns of a daily newspaper often vanish into thin air when they come to be thoroughly sifted. It will be no easy task for a skilled engineer to ascertain how much of a given vibration is due to the train alone and how much to brakes. Yet this will have to be done before his Grace can be in a position even to obtain a hearing. Whether any further steps will, or will not, be taken in the matter we cannot, of course, say; but it is at least certain that no change will be tolerated in the working of the enormous traffic of our metropolitan railways which will diminish the safety of passengers or reduce the accommodation now afforded to the public. The Metropolitan and District Railway companies had hitherto unheard-of privileges conferred on them by Parliament, on the understanding that they were to give an adequate return. It is not likely that the depreciation of some house property in Pimlico will be permitted to interfere with the carrying out of the bargain, or afford an excuse to the railway companies for backing out of it to the smallest extent.

FREE TRADE IN AGRICULTURAL MACHINERY.

WE have within the last few days received a very remarkable circular. It is issued by the Association of Agricultural and Machine Agents, and is marked "private and confidential." As an additional precaution against its being made public, we are informed by a paragraph at the top of the page that "this circular is issued and must be received and regarded as one of a strictly private and confidential nature; not to be lent, used, or exhibited, or any portion of its contents made known to any person except the member to whom it is directed." Now, it is pretty generally understood that whether a printed circular is treated as confidential or not is a matter for the recipient to settle for himself, and that, inasmuch as he is no party to the bargain, he can do just as he pleases. As a matter of fact there is, we believe, no difficulty whatever in obtaining copies of this circular, and with its contents numbers of our readers are no doubt familiar. For the benefit of others we reproduce it *verbatim*, only suppressing the names of firms mentioned therein. The circular runs:—"From information we have received it appears that some of the Co-operative Societies are making special efforts to get agricultural implements either direct from the manufacturers or through some other medium. It is very satisfactory to hear of the direct refusal by many makers to supply at any price. Two cases have come to our notice in which two London firms have been acting as buyers for some of these societies, and we beg to call your special attention to these so that you may know how to act in case of an application. Six ploughs were ordered of one of our large firms by Messrs. ————, to be delivered in Yorkshire; these were proved by one of our Yorkshire friends to be for a Co-operative Society. A set of iron harrows were ordered by Messrs. ———— of one of our principal firms, to be delivered at a station in Ireland; this was also clearly proved by one of our members to be for the Agricultural and Horticultural Association. The ———— Company, Limited, are applying for trade terms on the ground that they intend to add to their business the repairing of implements of all sorts. Hitherto we believe Messrs. ———— have treated them strictly as retail customers, and we hope these terms will be continued by them and quoted by others. We have heard that the ———— Company have been receiving trade terms—we can hardly credit this—as they are consumers pure and simple, and not traders, and this seems to us to constitute the legitimate difference. The ———— Association have advertised to give 10 per cent. off makers' prices for agricultural implements. We shall be glad if you will let us know if you have any application from them. Our attention has also been called to one or two advertisements in local papers, in which 10 per cent. is openly quoted off agricultural implements, and we should be glad if you would remonstrate when these cases come to your notice. The cases now before us are: ———— and Co., in the *Dorset and County Chronicle and Somersetshire Gazette;* and J. A————, in the *Leek Times.*"

The meaning of this circular is not at first quite clear. It is, however, easily explained. In the agricultural implement trade agents are extensively employed to effect sales, and, strange as it may appear, it sometimes costs more to sell a portable engine than it does to make it. In a general way, however, it may be stated that all the leading firms work to a price list which is common to them all, and the prices named are subject to a discount or margin of 10 to 15 per cent. This margin is specially intended to permit the foreign agents to sell at the catalogue price, plus the cost of freight and duty; and it is practically impossible to do a foreign trade under other conditions. The discount from the list price goes to cover two risks, and may be divided into two equal portions. The first belongs to the agent, who takes the risk of stocking machinery against a very fickle demand. The people who buy this machinery wait until they see that they are going to have a good harvest before they will buy, and they require instantaneous delivery. A man who wishes to thrash his wheat next week in Russia or Hungary cannot wait for a thrashing machine to be sent out to him from England. It must be lying this week in Bucharest or Buda-Pesth. It is hardly necessary to point out that so long as the

system of stocking machinery abroad exists, the manufacturer, or his agent, or the middleman, must be covered for the risk run, which is by no means trifling. In other words, this risk means money, and must be paid for by the consumer. Precisely the same state of affairs exists in England. Manufacturers or middlemen have to stock their machinery and to incur risks for which they must be paid; but in England, as a rule, it is the manufacturer who runs all the risk, the English agent incurring none whatever. The second moiety belongs of right to either the buyer or the seller, according to circumstances. Thus if the buyer comes with cash in hand, he has a right to a discount on principles too well understood to require a word of explanation. If, on the other hand, he requires credit, then, for equally well understood reasons, he is not entitled to discount.

Now, it will be seen that the circular we have quoted is issued by agents with the deliberate intention of preventing the purchaser and the manufacturer from coming together. It is intended to render the middleman still essential. If "A" wants an engine, he must not go to "C," the maker, but to "B" the agent. The list price of the engine is £280, we will say; the agent sells at this price, and pays the manufacturer £252, and this without incurring any expense for storing machinery, or suffering any loss by money locked up in stock. We have explained that there are conditions under which it is quite legitimate that the agent or middleman should be paid, and well paid too, by the customer; but these conditions do not always exist, and in fact the agricultural engineering firms do not believe that they need obtain at all in the home trade. The Association of Agents is determined, it would seem, to interfere with free trade in this matter, and to compel the engineers to deal only through them with the public at large. We are very much mistaken if the agricultural engineers will submit to any dictation of the kind. If a co-operative society goes to the manufacturer, cash in hand, it is entitled to get its discount, whether the purpose of the society is to sell again to its members or not. So long as the manufacturer gets a fair profit, it is really nothing to him whether his goods are or are not resold. They cannot be resold at a less price than he has obtained, so that the system of selling direct for cash to any purchaser cannot tell against the trade of the producer. The buyer, on the other hand, gets the advantage which the possession of ready money wherewith to pay for what he wants ought to confer on him. Both parties are desirous to have free trade, and the only opponent to the system is the agent or middleman. His objections to the direct system are, from his point of view, well founded, but from every other point of view they have simply no foundation at all. When it can be shown that the middleman incurs risk or expends capital, then he is entitled to get his discount—not otherwise.

If the facts are examined it will be seen that the very persons concerning whom complaint is made in the circular, are, in a sense, acting the part of middlemen themselves. They go to the manufacturer, buy for cash, get their discount, and sell again. This is precisely what the agent ought to do to entitle him to profit; but, as a rule, this is what he does not do. He takes credit and gives it, but the manufacturer has to give him credit and allow discount as well. The amount of discount is slightly altered, that is all. Here it may, perhaps, be well to warn our readers not to confound agents with travellers. They are distinct classes working under different conditions. Agents are very often wealthy and responsible men, and they have no doubt much power in their hands. We believe, however, that they are encouraging a vain delusion if they fancy that it is possible by the issue of circulars to Boycott certain firms or any firms which think proper to dispense with their services. The man with ready money in his pocket can always find the way to buy in the cheapest market if he pleases. The Association of Agricultural and Machine Agents will do well to confine their exertions to legitimate spheres of action. They might as well try to stop the tide with a pitchfork as control the manufacturers. We have pointed out that there are certain conditions under which they are fully entitled to payment. To ask for it under all circumstances, and to threaten to Boycott the manufacturer who deals otherwise than through their offices is a blunder; and the leading agricultural engineering firms have but to make the fact known that when they please they will deal with the consumer or even the retailer direct, in order to dissipate at once the extravagant claims embodied in the circular we have reproduced. The agents are beyond question a powerful body. They can if they think proper make themselves very disagreeable to the manufacturer; but the public have only to learn that the agent stands between it and the producer to turn the tables completely. The issue of the circular was a mistake, and we venture to hope that it will be withdrawn at once. It may be urged that the members of the Association of Agricultural Implement and Machine Agents do run a very considerable risk by stocking machinery. As we have said, if this is the case they are entitled to discount, and will get it. But it seems that the qualification for membership demands nothing more rigourous than that "either as individuals or as firms each member do at the present time and shall undertake in future to keep in stock agricultural implements, machinery, and fittings to the value of £300, or £1000 worth of ironmongery, together with agricultural implements and fittings to the value of £150." Thus, then, great firms like those at Lincoln are to be put at the mercy of small shopkeepers in country towns. The whole effort reminds us vividly of the attempt made some time ago by retail shopkeepers to suppress "stores." The attempt entirely failed, but it does not appear that retail shop-keeping has been wholly ruined. The fact is that so long as the majority of buyers in this world have not got ready money, so long will the middleman find plenty to do; but whether he does or does not, no attempt on his part to interfere with the free course of trade and to keep the consumer away from the producer can be tolerated. The English ironmonger appears to confound himself with the foreign agent. The more quickly he learns that the work done by each is essentially different from that done by the other the better for all parties.

MACHINE RIVETTING IN NORTHERN SHIPYARDS.

In the shipbuilding yards of the North of England there has been of late considerable attention given to the question of machine rivetting as a substitute for that of manual work. The question has been forced on the attention of the shipbuilders by the irregular habits of some of the rivetters, who now earn wages probably as high as any known in the history of the trade, and who unfortunately lose a considerable amount of working time, owing to their own fault or that of their comrades. In a few of the yards in the North machine rivetters have been in use for some time. In one case all the beams and frames of ships have been rivetted for several years with a fixed machine; and in others general work has been for a considerable time done with movable machines—Arroll's, for example. The general belief is that these machines effect their purpose thoroughly, and that the actual cost of rivetting with them is much less than that of the manual labour that they supplant, but the interest on the cost of the plant, and the cost of the removal of machines, or of the work to be rivetted, minimises the saving that would otherwise be effected. The delay caused by the irregularity of the work of sections of the workmen is turning the thoughts of the shipbuilders and of their managers to the possibility of the greater use of machinery, and it is probable that at some of the chief of the yards between Middlesbrough and the Tyne there will be a considerable addition to the rivetting plant. At the same time the loss of time has not been so keenly felt as it appears to have been on the Clyde, nor is the class of work in the North of England so much of a character as to allow of the full employment of rivetting machines that is known in Scotland —where it is said that in some of the shipbuilding yards nine-tenths of the whole of the rivetting is effected by machine. At the same time the North-country yards which adopt the plan will be able increasingly to use their machines, for there will be gradually an adaptation to the work, and there will be, as the value of the machine rivetter is proved, a greater dependence upon it, whilst after the first cost, the saving on the price of rivetting will be greater. The question is one that is not so likely to be taken up in dull times, but with the pressure that most of the shipyards now feel, it seems probable that there will be an attempt to increase the dependence upon machinery which is not subject to the influences that have restricted the labour of men very seriously at times.

MECHANICAL POWER ON PARIS TRAMWAYS.

Those who have had most experience in the use of steam on the Paris tramways are perhaps least surprised that after about five years' trial the system has been abandoned, and a return to horse-power has been decided upon. It is not too much to say that the design of a tramway locomotive for working in the streets of a city presents more difficult points than the design of any other class of engine, and hence the really satisfactory tramway engine has yet to be made. The objections that are now made to the engines about to be entirely superseded by horses are numerous, and some are equally to be applied to tramcars hauled in any way, but the real objection to these engines has been the cost of maintenance and working, and the comparative frequency of stoppage by reason of breakdowns, of small or great importance. The Paris company has tried twenty-one different engines, and the results are that horse traction is on the whole more satisfactory to the company. This will probably be felt as a blow to mechanical propulsion, and no doubt it will have a retarding effect, but the various causes of failure and the experience gained will form the basis upon which engineers must start anew to make an engine that will stand the abnormal wear due to bad permanent way, dust, mud, frequent stoppages, and very short curves, and that can be run without danger by one man. We have several times given some ideas on the construction of tramway locomotives, and until engines are made with parts and fittings that will be indifferent to dirt and mud, very bad permanent way and short curves, no success will be achieved.

THE SWIFTSURE ACCIDENT.

An accident with a 25-pounder gun on board H.M.S. Swiftsure, which at first created some alarm, has little significance in a manufacturing way. Having occurred in saluting, and the breech-piece having broken from its carrier, it is believed that the bore had not been sponged out, and that some residue of the cartridge remained ignited, and on the insertion of the next round burnt into the powder and fired the charge before the breech was completely closed. Hitherto it has been found impossible to insure the complete consumption of a blank cartridge of any material, consequently sponging has been strictly ordered in all firing without projectiles. Accidents have from time to time occurred with both muzzle and breech-loading guns from the neglect of this precaution. If this accident occurred in this way, the nature of the gun and its mounting, &c., do not concern us. It would, we think, be well if the authorities would consider the possibility of producing a saluting cartridge envelope which would not leave sparks. This is difficult, because even flannel appears to become impregnated with saltpetre by the explosion, and fragments of it go on smouldering for a considerable time after a gun has been fired. Silk does not appear to be better. Possibly asbestos might be used with success, or even a thin metallic cartridge.

THE MIDLAND SIGNALMEN.

How long should a signalman be in his box? This is the most important question from a general standpoint raised by the petition of the Midland Railway signalmen. They say that twelve hours a day is too long; the public may, perhaps, agree with them. It appears that there are twelve-hour boxes and eight-hour boxes, and the men in a respectfully-worded memorial, plead that there may be fewer of the former and more of the latter. A signalman's occupation is remarkably important. On his accuracy almost everything depends; and if he is worn out by excessive watching, and is either mentally or physically inefficient by reason of the continuous strain, the results cannot fail to be deplorable. Eight hours a day of such labour seem sufficient to exhaust the strength of any man. The signalmen, while also asking for an advance of 3s. per week, further solicit a slight change of uniform, asking for a turn down collar to the coat, and a sleeved waistcoat, on the plea that colds are usually caused by the sudden change of clothes when off duty. It is eight years since any concessions were made to this important class of railway *employés*, and requests which seem reasonable, and are earnestly and respectfully asked, are certain to receive careful consideration from such a company as the Midland.

LITERATURE.

Physics of the Earth's Crust. By the Rev. Osmond Fisher, M.A., F.G.S. London: Macmillan and Co. 1881.

Physics of the earth's crust might be held to include all questions treated as physical geology, but in Mr. Fisher's book it is confined to the *modus operandi* of the formation of the salient features of the earth's crust, or to the mechanism of the production of continents, mountains, including volcanic cones, and ocean basins. These subjects constitute a grand hunting ground for the physical geologist, and at different times have afforded more freedom for a limit-rejecting imagination than any other field. The tendency, however, of the more modern writers on these subjects has been to test the bases upon which they would build enormous hypothetical structures by submitting them to mechanical, mathematical, and thermodynamic investigation. The structures have consequently been smaller, or have had much more of reality in them. As a contribution to its subject Mr. Fisher's book may be accepted as of great value, because it brings together a great deal of modern thought and experimental knowledge on questions most intimately connected with the physics of the earth's crust. It cannot, however, be admitted that it adds anything to our previously existing knowledge of the subject. He takes the quantitative information obtained by others, examines their theories by mathematical application of this information, rejects the theories, and subsequently builds his own. He has for several years contributed articles and papers on the subjects treated in his book, and in his preface to the latter he says, "For many years past I have been convinced that various questions of physical geology might be answered negatively, if not positively, by applying to them simple mathematical reasoning and quantitative treatment. My own views have in some respects been greatly altered by the application of this method." The first part of this quotation invites the remark that the application of quantitative treatment is not in any sense original with Mr. Fisher. It was first comprehensively done by Mallet, who by extensive observation and experimental investigation on a very large scale obtained the most considerable part of the whole of the data employed in Mr. Fisher's book, while to the second part of the quotation we cannot help remarking that the author will again have his views greatly altered if to his mathematical reasoning he adds more experimental physics and chemistry.

In the first part of his book the author examines the figures which have been obtained at different parts of the globe, showing the rise of temperature which accompanies descent into the earth. This rise, it is very well known, varies enormously at different places; and though the rise is generally less rapid under mountains than under plains and valleys, no general law can be deduced which will permit the predication of the rise under any given untried spot. In spite of the wide difference, however, in thermal rise in descending different parts of the crust, Mr. Fisher strikes a general average of these, and subsequently proceeds to apply it to phenomena which specially require differential treatment. He then repeats the calculations which were made by Mallet and others, to ascertain the intensity of the orthogonal pressures due to contraction through secular cooling, pressures first pointed out as having this origin by M. Elie de Beaumont, and first applied thermodynamically by Mallet in his celebrated papers on volcanic energy. The formula used for this purpose, but divested of all its ornamental excrescences, is simply that by which the crushing strain of a boiler flue is obtained, external pressure in the case of the boiler flue being substituted by the weight of a stratum or ring of crust of rectangular section taken on a great circle of the globe. Mr. Fisher next estimates the heights of the elevations and depth of the depressions on the earth's surface, taking as a datum a diameter which would have obtained if the materials of the earth had been perfectly homogeneous and isotropic, so that uniform contraction would have been attended with uniform reduction from the diameter which pertained to the primordial world with its presumably smooth surface. In one estimate—the elevations—the author takes the above-mentioned average rise in temperature in the earth's crust, Sir W. Thompson's estimate of the temperature of solidification of the materials of the crust, and Mallet's ascertained temperature of fusion and coefficient of contraction of slags; and assuming that the earth lost heat uniformly, and that solidification and contraction also took place uniformly, he comes to the conclusion that all the elevations which would be produced by compression resulting from radial contraction of the earth having a radius of 20,902,520ft. in cooling from 7000 deg. to the present differential temperature would equal a coating of 800ft. in thickness over the whole globe—that is, over a globe having a diameter as found for the above datum. All his calculations on this subject lead him to the conclusion that the contraction of the earth as a solid cooled from 7000 deg. would not give the actual existing elevations, which are estimated to have a mean elevation of 900ft. The depth of the ocean is taken at three miles, and the continent and sea areas respectively as 51 and 146 millions of square miles. The value of Mr. Fisher's conclusions, it need hardly be pointed out, depends on the correctness of the assumption upon which he bases his calculations, and these assumptions require revision.

It is difficult, for instance, to reconcile the statement that the average height of the earth's elevations above a datum approximately coinciding with the profound depths of the ocean is more than ten times as great as that due to compression resulting from contraction from a temperature of solidification of 7000 deg. Fah., and about fifty times as great as the estimate due to solidification at 4000 deg., when we find that the author's own calculations give the average height as 9504ft. or about 9500ft., and elsewhere the radial contraction of the earth from a temperature of 4000 deg. as 3479ft. The usually estimated area of the land surface of the globe is 51 millions of square miles, and of the oceans 146 millions, or as 1 to 2·88. If we put r = radial contraction we should then

have, even upon this calculation of the quantity of material at disposal for elevations above datum or deep sea bottoms, an average height of elevation of $r + (2{\cdot}88\ r) = 13{,}498$ft., which is considerably above 9504ft. This latter height is moreover obtained by placing the datum line considerably below the mean depth of the oceans. No one but the author can gain any idea of how the above-mentioned "fifty times" is obtained. From the part of the book here referred to, which contains a great many generalisations in order to arrive at the conclusions, the author leads to a theory of his own which is put forward to account for mountain and continent formation and for volcanic action; but in the intervening pages there are some speculations which will be effectually disposed of by reference to Dr. Ball's "Glimpses through the Corridors of Time." By reasoning, not worth reproducing, the author also comes to the conclusion that "the waters of the ocean cannot supply the steam emitted from volcanic rents," and this notwithstanding the enormous array of facts against such a conclusion. The author, however, has to bring out his new theory, and this it seems was suggested to him by one of the last papers written by Mallet, namely, that "On the Temperature of the Primordial Ocean," though it may be safely said that Mallet would have been surprised at the offshoot of one of his last productions. Without going further into this paper, it may be said that it showed a method of arriving at the probable temperature at which all the water of the globe then existing as a vapour began to condense on the cooling surface of the world, cooling from fusion; and incidentally it mentions the great solvent and subsequent surface splitting-up action of the water on the incipient crust. This idea Mr. Fisher has seized upon to provide him with "an elastic highly heated layer of rocky matter combined with water substance kept in a state of compression by the superincumbent pressure of the crust, but ready to burst forth with the evolution of steam and gas wherever and whenever a vent is opened for its escape;" and, in referring to Mallet's paper, he asks: "Is it necessary to suppose that the rocky materials had already formed a solid globe upon which this water substance was supernatant? Might not rather such substances as were soluble have been in solution with it, even to that depth at which the magma was succeeded by denser materials insoluble in superheated water? If that were so, then as cooling proceeded a crust of rock would have been formed by crystallisation at a certain level, and would have gradually extended downwards. But there may be even still remaining an intensely hot layer of original water-dissolved silicates underlying the solid crust, ever in readiness to furnish the steam, gases, and ejectamenta of the volcano, and by the extravasation especially of the former of these, to contribute to the contraction of volume of the globe." Upon this the author builds a very large structure, for this hypothesis, it will be seen, frees him "from the trammels imposed by (Sir W. Thompson's) hypothesis of a solid globe," from Mallet's theory of volcanic energy, from all trouble as to the, as he calculates, insufficiency of the contraction of the globe to account for the formation of continents, and from other approximately measureable but differential quantities, causes, and effects. This hypothesis makes it desirable that the crust of the earth, formed, as he thinks, of crystallised "water substance," should not be flexible; that contraction should be accommodated by crushing together and thickening of the crust, and not by bending and folding, and he sets to work to prove these things are so, his assumptions requiring that cooling and contraction should have taken place uniformly over the whole globe, and that the "ocean basins are not caused by depressions in the upper surface of a crust of the same density as that beneath the continents, but that they are due to a greater density and general depression of the sub-oceanic crust." Why the crust should be of so much or any greater density under the ocean than at the same depth under continents is not shown; but it is assumed that it is so, otherwise the waters of the ocean, it is argued, would be so attracted by the northern continents as to make the mean level of the sea greater there than at the south. We have never seen it proved that this is not the case, nor has it been shown that the Colorado river is much higher at its edges than in the middle where it runs through canons several thousands of feet in depth. This theory or hypothesis which is to take the place of those of men who based theirs on exhaustive experiments, is launched into the world without one word of evidence based on experimental data. In the whole book there is not a line descriptive of any original experiment or research which makes a single addition to the knowledge already possessed on the action of hot water or steam under pressure upon silicates or other materials constituting the earth's crust; while, on the other hand, it is known that under available pressures and temperatures, water and steam have practically no solvent action on silica, and less on other materials, as alumina, which also formed constituents of the primordial crust. If all had been alkaline silicates Mr. Fisher might have got his silica porridge; but unless he shows where the caustic soda or other solvent is to come from, it does not seem too much to pronounce his theory of an earth's crust of, say, twenty-five miles in thickness of crystallised silica, and an underlying reservoir of "water substance," as the most absurd inflicted upon the geological world during the past half century.

Mr. Fisher gets into some trouble about faulting, and although he is aware of the monster faults in the Utah Plateaus and elsewhere, and mentions the great fault in the Appalachian Chain, where on opposite sides of a crack, over which one can step, beds once together are separated vertically by 20,000ft., he proposes to "explain the phenomena of faulting by the occurrence of fissures commencing at the surface and running downwards; and among the causes which may have given the first impetus to their formation, may possibly have been the drying of a surface from which either the sea or inland lakes had been drained off, or even where the climate had changed and become arid." To such origins would Mr. Fisher ascribe the great upthrow faults whereat miners lose a seam for perhaps a quarter of a mile in an immense raised voussoir with faces having roughly radial directions. The author's fluid water substance substratum requires, it will be seen, that when areas are loaded they must sink, and when relieved, as by degradation, they must rise. Greenland, or a good part of it, is sinking at the rate of about from 6ft. to 8ft. per century; so Mr. Fisher suggests "this may possibly be accounted for by the snowfall being at present greater than is carried off by the glaciers and by evaporation," and in a foot-note he quotes Sir Wyville Thomson's statement that the glaciers stand 200ft. above water, and he then calculates, taking the specific gravity of ice as 0·90, that this gives a total height of glacier of 2500ft., so as to show the great weight of ice existing round Greenland, which, considering the proportion of this ice which comes away as icebergs, is very much the same as trying to prove that the weight of the Thames is greater when there are ironclads in it than when they are in the Mediterranean. Of figures respecting this snow we have none. Mr. Fisher's theorising is certainly not very edifying. We had intended to say something of his remarks on Mallet's theory of volcanoes, but our space is limited; and after what we have said, it is perhaps, unnecessary to do more than mention that he does not agree with Mallet. Mr. Fisher cannot yet see that rock might be crushed under such circumstances and at such velocities that it, or any part of it, would be melted, any more than would be a piece of rock crushed in a gravity testing machine. He does not see the difference of effect when a given quantity of work is done upon an object in a very short or in a very long time, and according to his ideas the sparks which fly from a rapidly revolving grindstone when iron or steel is being ground, and which consist of molten particles of metal and silicon, ought never to appear, and those made by a horse's hoof on granite pavement or the sparks resulting from the clashing of lumps of rock are also instances of fusion by crushing which ought not to be. In conclusion, it must be remarked that Mr. Fisher is prone to calculate too much upon averages, on subjects treating of phenomena which have their origin in maxima and minima. His geology and physics are too much of the library and not enough of the field and the laboratory or workshop. His book is built almost entirely on the facts and figures gained by others, and those upon which Mallet spent time and fortune, guided by rare originality, form some of the most valuable in the book. W. W. B.

IMPROVED PALLISER PROJECTILES.

ONE of the last designs of the late Sir W. Palliser was an improved shot for penetrating armour, which, in its latest form, we illustrate herewith. The history of this shot, which has just been tried, is as follows:—The original Palliser chilled shot depended for success on the softness of the armour it penetrated. Wrought iron had been introduced universally in some form. The Palliser shot first proposed had two advantages over the projectile previously employed: First, it was of hard, rigid, though brittle, material; secondly, its point was sharp, being, in fact, a considerably sharper ogival than those finally adopted in the service, which were in this respect altered by the Committee for the worse. The hardness enabled the projectile to stand up to its work; the sharp point told in two ways. For one, it enabled it to penetrate far enough to get considerable support from the surrounding armour before the full shock of resistance fell on it. We are discussing this question critically, because we know of no place where it is dealt with. Fairbairn, who was one of the members of the original Committee on Iron Plates, showed by experiment that a certain flat-headed shot required 55·32 tons pressure per square inch to crush it, while a hemispherical one yielded under 26·86 tons. This is due to the same mechanical action that causes an arch to yield laterally. A pointed shot resisted by a hard surface which acts on it while the point only is in contact, then, may yield outwards when the same projectile entering soft material would only encounter the full resistance when its head had entered the armour, and when it experienced no more outward thrust than a flat-headed projectile. The second advantage of a sharp point is due to the fact that armour yields by tearing open at the back. In this a sharp point has a great advantage, because it gets close to the tearing spot, and so acts immediately and locally. From the above it may be seen how admirably a rigid shot with a sharp point acts on soft armour; while, on the other hand, the introduction of steel plates calls for tenacity to resist yielding outwards which chilled iron does not possess. Hence the failure of chilled shot against steel, although it compared well even in recent competitive trials compared with the best steel shot against soft iron. The Surveyor-General of Ordnance in 1880 invited Sir William Palliser to design a special form of chilled projectile for hard armour. Sir William then made a shot—Fig. A—with two peculiarities: (1) It had longitudinal ribs on its head, which he hoped might assist in breaking up the steel face of the plate, experience having shown what a great matter it is to injure the continuity of any resisting steel surface and so attack it, as it were, locally and unevenly. (2) It was supported by a band of wrought iron or steel round the body B, so as to hold together on the shock of impact. The shot in Fig. 1 embodies one or two further improvements, due either to Sir William or his brother, Captain Edward Palliser, we presume.

It may be seen that there are two steel jackets; the inner one simply holds on to the body of the projectile, which is of decreased size, but below the curve is of cylindrical form. The outer jacket holds on to the inner one, of which the exterior is conical. The head between the ribs is of decreased diameter, corresponding to that of the inner jacket. Consequently it is hoped that the shot may enter the target in a hole of the decreased size, experiencing a corresponding smaller amount of resistance, the exterior jacket stripping off and being left behind. This last advantage might exist in the case of steel-fronted armour, but hardly in the case of hard steel, which breaks up and cracks, and is not punched in a clean hole. It will be seen that the fact of an armour-piercing shot having decreased diameter in this way does not affect the diameter of other projectiles fired from the same gun, such as common shell, whose internal capacity is a matter of importance.

The idea of this shell we think very good. Chilled iron shot would of course benefit by a jacket of this kind much more than those of softer metal. A steel shot often yields at the shoulders, as shown in Fig. 2, while a chilled shot shivers without setting up. Such action, as is seen in Fig. 2, would tear a steel jacket from the front edge instead of acting on it evenly all over.

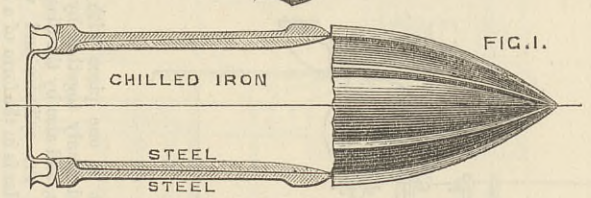
We believe that Captain Palliser has also proposed to employ steel riband as an alternative arrangement for the jackets shown in Fig. 1. It may possess three advantages:—(1) It has the tangential strength of a continuous spiral; (2) the actual tensile strength of a steel riband is greater than of steel of large cross section, apart from the question of the spiral being unbroken by a cross seam; (3) it can be applied by being wound on at the desired tension without heat, which may interfere with the temper of the metal.

The design of the shot in Fig. 1 is to retain the interior jacket and hold together in penetration. If this enabled a shell to perforate armour before bursting, of course an enormous advantage would be secured. In fact, this is the object aimed at in the best forged steel shell, but which has been only very occasionally achieved. It must still be regarded as a possible achievement, but not one that can at all be secured as yet. Sir Joseph Whitworth's recent refusal to supply any more forged steel shell comes at an unfortunate time for the solution of this problem.

With regard to the decreased area of resistance, or decreased diameter of the shot, on which Captain Edward Palliser lays official stress, we would call attention to Fig. 4, the front view of the head, in which it may be seen that the annular space between the circles A and B is considerable. This represents the decreased space except that of the cuts made by the ribs, and these cuts are only continuations of cutting lines begun from the entrance of the projectile's point, and, as experience shows, easily made.

FIG.2.

FIG.1.



RIBBED & JACKETED PALLISER SHOT WITH FIXED UNDER JACKET & MOVEABLE UPPER JACKET

FIG A

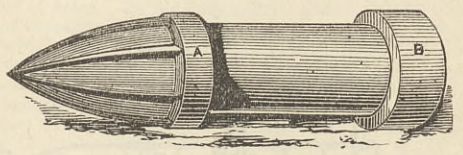


FIG.3

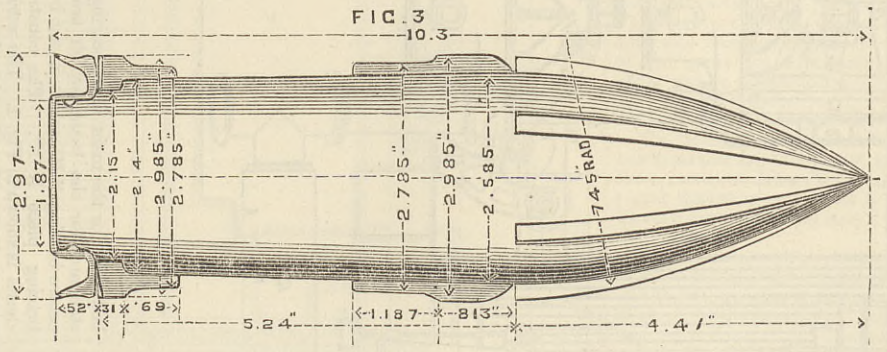
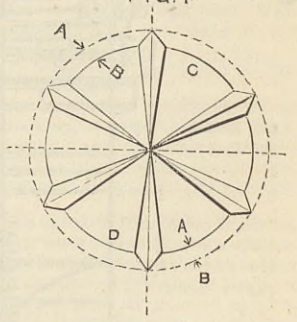


FIG.4



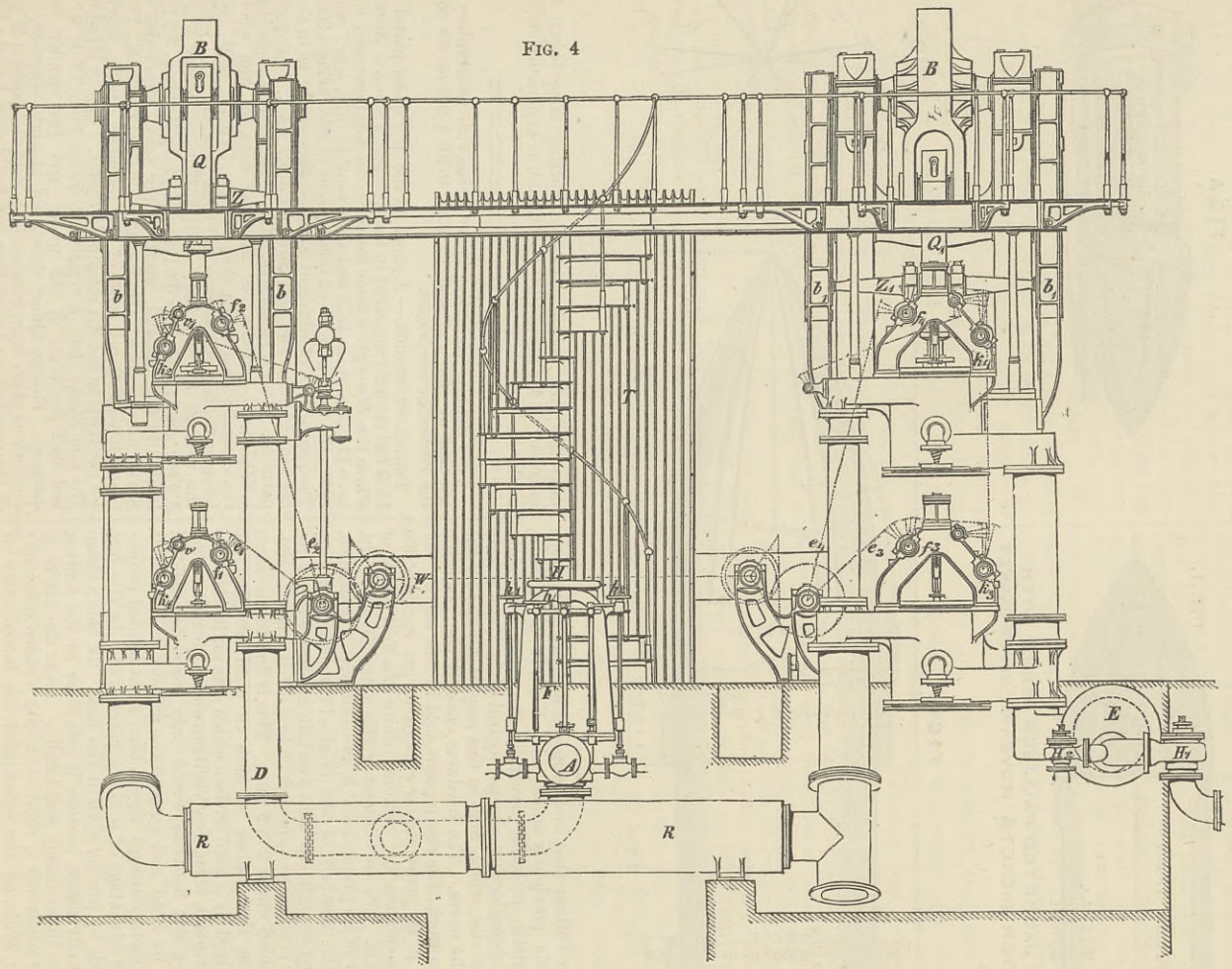
TIME signals, originating in the Greenwich Observatory, are distributed at 10h. a.m. and 1h. p.m. to all parts of the country by the Post-office telegraphs.

POSTAL STATISTICS.—A paper on the European postal traffic in 1880 has recently appeared in the *Deutsche Industrie Zeitung*, from which the *Times* gives some items:—The total increase, which had been 11 per cent. in 1878 and 4 per cent. in 1879, was 7 per cent. in 1880; the total number of articles sent in 1880 being 6,206,577,592. The proportions of different articles were nearly as in the preceding year—Letters and post-cards, 61·3 per cent.; book packets and patterns, 15·8; newspapers, 22·9. England stands first with 1,690,724,491 articles, or 27·2 per cent. of the whole; next Germany, 23·3 per cent.; then France, 19·6 per cent. (showing a large percentage in patterns and book packets, 27·6, while 15·8 is the average for Europe); Austria-Hungary ranks fourth with 8·6 per cent.; Italy has 5·6; Russia, 3·3; Belgium, 3·2; Switzerland, 2·4; and Holland—ninth—2 per cent., closes the series of States whose entire traffic is over a hundred millions. These nine States have 95·2 per cent. of the European traffic, leaving only 4·8 per cent. to the ten remaining States. Turkey is not included. The nine States show a relative decrease from 1879—when they had 96·4 per cent. of the whole—and the smaller States an increase. Greece alone shows an absolute decrease. Nearly everywhere there is an increase of letters and post-cards per head of the population; Luxemburg and Spain show a slight falling off; Russia, a decrease of 10 per cent.; and Bulgaria—where the postal service had grown extraordinarily the previous year—one of 85 per cent.

COMPOUND BEAM ENGINE.

HERR A. BORSIG, MOABIT, BERLIN, ENGINEER.

FIG. 4



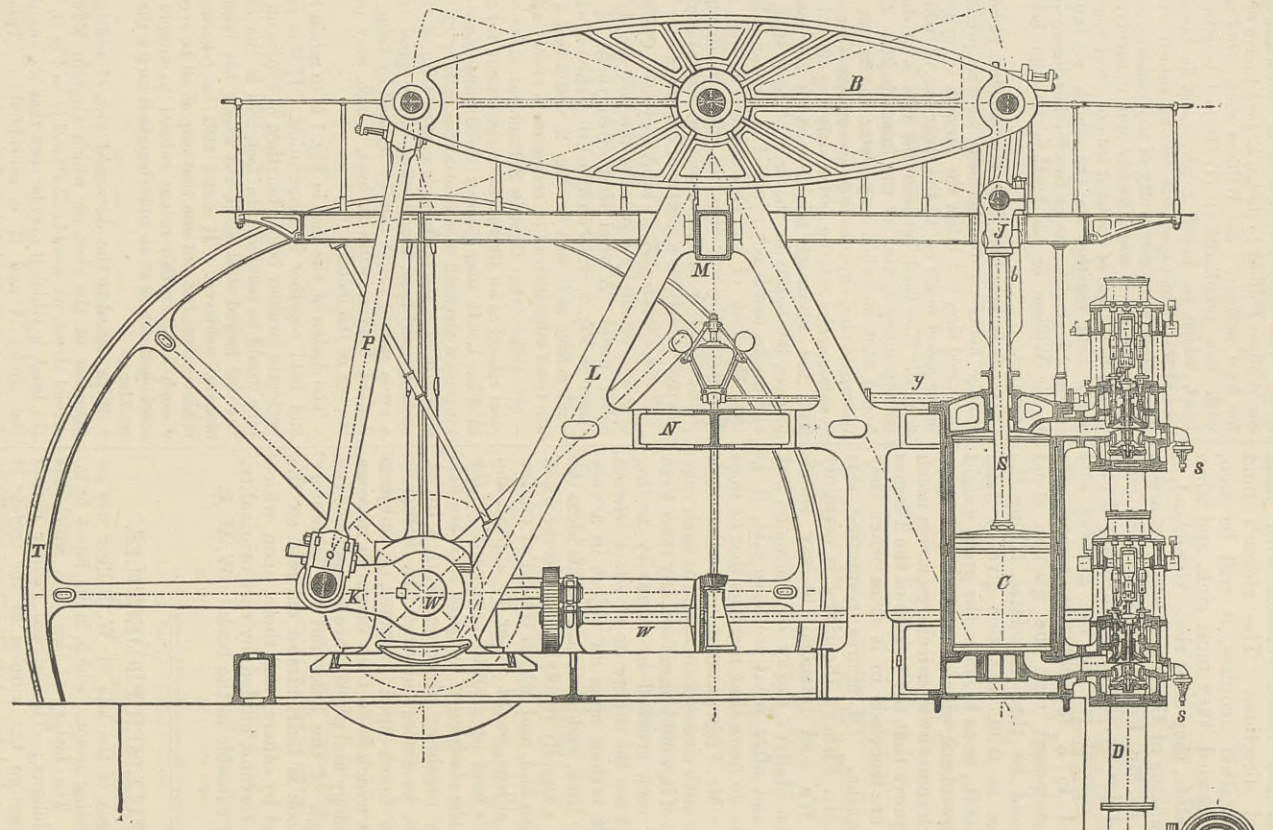


FIG. 1

THE engine represented in Figs. 1 to 4 herewith and on page 423 is intended for a mill, and is of 530 to 800 indicated horse-power, the pressure being seven atmospheres and the number of revolutions forty-five per minute. As will be seen by the drawing each cylinder is placed in a separate foundation plate, the two connecting rods acting upon cranks keyed at right angles upon the shaft W, which carries the drum T. The high-pressure cylinder C is 760mm. diameter, the low-pressure cylinder being 1220mm. diameter, and the piston speed 2·28m. The drum, which also fulfils the purpose of a fly-wheel, is provided with twenty-eight grooves for ropes of 50mm. diameter. With the exception of the cylinders, pistons, valves, and valve chests, the engines are of the same size, corresponding to the equal maximum pressures which come into action in each cylinder, and in this respect alone the engine differs in principle from an ordinary twin machine.

The steam passes from the stop valve A, Fig. 4, through the steam pipe D to the high-pressure cylinder C, and having done its work, goes into the receiver R, where it is heated. From the receiver it is led into the low-pressure cylinder C¹, and thence into the condenser. Provision is made for working both engines independently with direct steam when desired, suitable gear being provided for supplying steam of the proper pressure to the condensing engine, so that each engine shall perform exactly the same amount of work.

The starting gear consists of a hand-wheel H, which controls the stop valve A, and of another h, which opens the valves for the jackets of the cylinders and receiver. The hand-wheel h^1 and h_2 govern the valves, which turn the steam direct into the two cylinders. There are also lever g, which opens the principal injection cock H^1, and the auxiliary injection cock H^2, the function of which is to assist in forming a speedy vacuum, when the engine has been standing for some time.

The drum is 6·08m. diameter, the breadth being 2·04m., with a total weight of 33,000 kilos. The beams are of cast iron with balance weights cast on. The connecting rods and cross beams are of wrought iron, and the cranks, crank shaft, piston rods, valve rods, &c., of steel. The bed-plate for the main shaft bearings are cast in one piece with the standards for the beam, which are connected firmly together by the centre bearing M M¹, which is cast in one piece, and also by the diagonal bracing piece N N¹. The construction of the cylinder and valve chests is shown in Fig. 1. The working cylinder is in the form of a liner to the cylinder, thus forming the steam jacket, with a view to future renewal. This lining has a flange at the lower part for bolting it down, being made steam-tight by the intervention of a copper packing ring. There is a similar ring at the upper part which is pressed down by the cylinder cover. The latter is cast hollow and strengthened by ribs. The pistons are provided with cast iron double self-expanding packing rings. For preventing accidents by condensed water, spring safety valves s s and s^1 s^1, are connected to the valve chests. The valve gear, which is arranged in the same manner for both cylinders, is actuated by shafts w and w^1, rotated by toothed wheels as shown. Motion is communicated from the way-shafts w and w^1 by the excentrics, and the excentric rods e^1 e^2 e^3 e^4, and the levers and rods belonging thereto, to the short steam valve rocking shafts levers f^1 f^2 f^3 f^4, and the exhaust valve rocking shafts k^1 k^2 k^3 k^4, the bearings of which are carried on brackets above the valve chests, which, being furnished with tappet levers, raise and lower the valves.

The valves are conical, double-seated, and of cast iron, and the inlet and outlet valves are placed the one above the other, the seats being also conically ground and inserted through the cover of the valve chest. Both inlet and outlet valves are actuated from above, and are removable upwards, an arrangement which admits of the valves being more easily examined than when the two are actuated from different sides of the valve chest. To carry out this idea the inlet valves are furnished with two guides, which, passing upwards through the stuffing-box, are attached to a hard steel cross piece, which receives the action of a bent catch turning on a pin attached to the levers t_1, t_2, t_3, t_4. This catch is kept up to its work by means of a spring. The exhaust valves, on the contrary, have only one guide each, which passes upwards through the seat of the admission valve, through the valve itself by means of a collar, and through the stuffing-box. It is furnished with hard steel armatures, through which the levers z_1 z_2, Fig. 3 act upon the exhaust valves.

The governor effects the acceleration or retardation of the loosening of the catch actuating the steam valve by means of hard steel projections on the shaft v_1, the position of which, by means of levers, is regulated by the governor, which in its highest position does not allow the lifting of the inlet valve at all. The regulation of the expansion by the governor from 0 to 0·45 takes place generally only in the case of the high-pressure cylinder, while the low-pressure cylinder has a fixed rate of expansion. Only when the low-pressure cylinder is required to work with steam direct from the boiler is the governor applied to regulate the expansion in it. An exact action in the valve guides and a regular descent is secured by furnishing them with small dash pot pistons working in cylinders. Into them the air is readily admitted by a small india-rubber valve, but the passage out again is controlled at pleasure.

SOCIETY OF ENGINEERS.

TUNNELLING IN JAPAN.

AT a meeting of the Society of Engineers, held on Monday evening, the 5th inst., in the Society's hall, Victoria-street, Westminister, Mr. Jabez Church, president, in the chair, a paper was read on "Railway Tunnelling in Japan," by Mr. T. M. Rymer Jones, in which the author described the Osakayama tunnel, situated on the line between Kioto and Otzu, a distance of 11½ miles. The length includes 5½ miles of gradients of 1 in 40, 3 miles of this being continuous. The tunnel is 727 yards in length, width at springing 14ft., and gauge of line 3ft. 6in. No machinery was used, the whole excavation being done by chisel and pick, with occasional hand-drilling for blasting purposes. The inclination of the tunnel is 1 in 40. No shafts were used. The arching of two or four rings of brickwork was turned throughout, except for a short length where six rings were used; the arching was underpinned with side-walls, 1ft. 6in. thick on the entire north side; on the southern side the side walls were 4 lineal feet of 1ft. 6in., and 6 lineal feet of 9in thickness alternately. The whole brickwork was set in Portland cement. Ventilation was kept up during construction by means of fans working at the end of long air-tubes, within doors, placed at stated intervals, the air being passed through the purer drainage water for the sake of coolness. No European labour nor supervision, with the exception of that of the district engineer, was employed.

The headings were commenced 1st October, 1878, and met 10th September, 1879; the brickwork was completed 1st June, 1880; and the line opened by the Mikado 14th July, 1880. The total cost of the tunnel was £34,374 10s. Other tunnels were alluded to, and various rock-boring machines described, special allusion being made to Jordan's hand rock drills. The author also touched upon the use of electricity as a motor, and for lighting purposes.

MIDLAND INSTITUTE OF MINING ENGINEERS.—On Tuesday afternoon a well-attended meeting of the members of this Institute was held at Leeds. A lengthy discussion on a paper read by Mr. W. E. Garfarth, "On the Long Wall Method of Working the Silkstone or Middleton Main Seam of Coal at the West Riding Colliery," was resumed. The discussion bore principally on the question of the depth at which coal can be worked, and whether the most damage is done to buildings on the surface by shallow or deep mines. The general opinion seemed to be that in deep mines the settlement of the strata, being more gradual than in shallow workings, less damage was done to buildings on the surface. Owing, however, to the importance of the subject, the discussion was adjourned. A discussion was placed on the business paper on a communication read by Mr. T. W. Embleton "On Atmospheric Pressure in Relation to Colliery Explosions." The paper not being in the hands of members the discussion was adjourned. An interesting discussion on a paper read by Mr. C. Hodgson "On the Issue of Gas from the Silkstone Seam at the Rockingham Colliery," was next proceeded with. The writer was of opinion that these outbursts for the most part occurred soon after the opening out. Similar opinions were expressed by several other gentlemen, and the discussion then closed. It was agreed that the consideration and discussion of the preliminary report of the Royal Commission on Accidents in Mines should stand over, further information being waited for.

BORSIG'S COMPOUND BEAM ENGINE.

FIG. 2

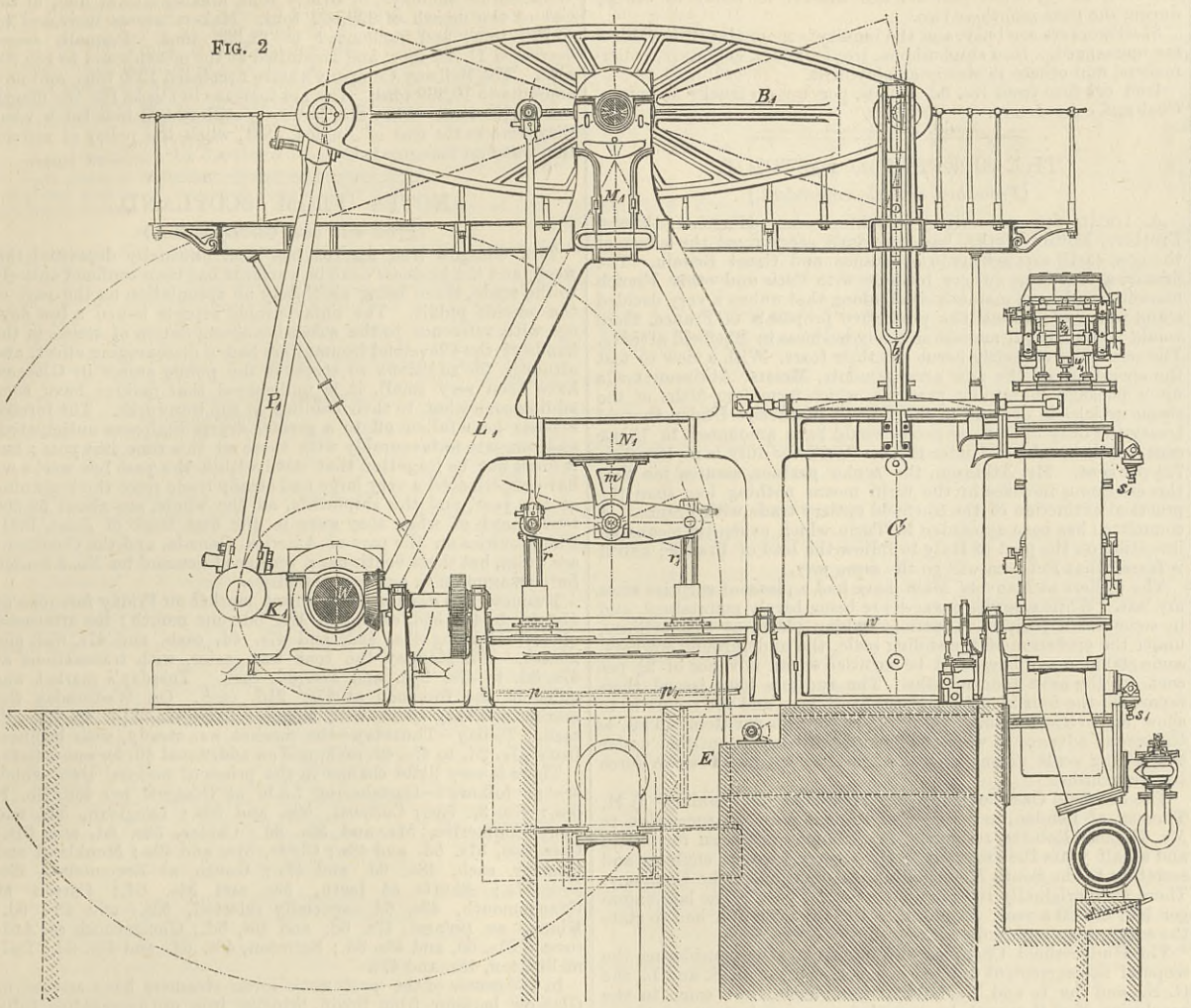
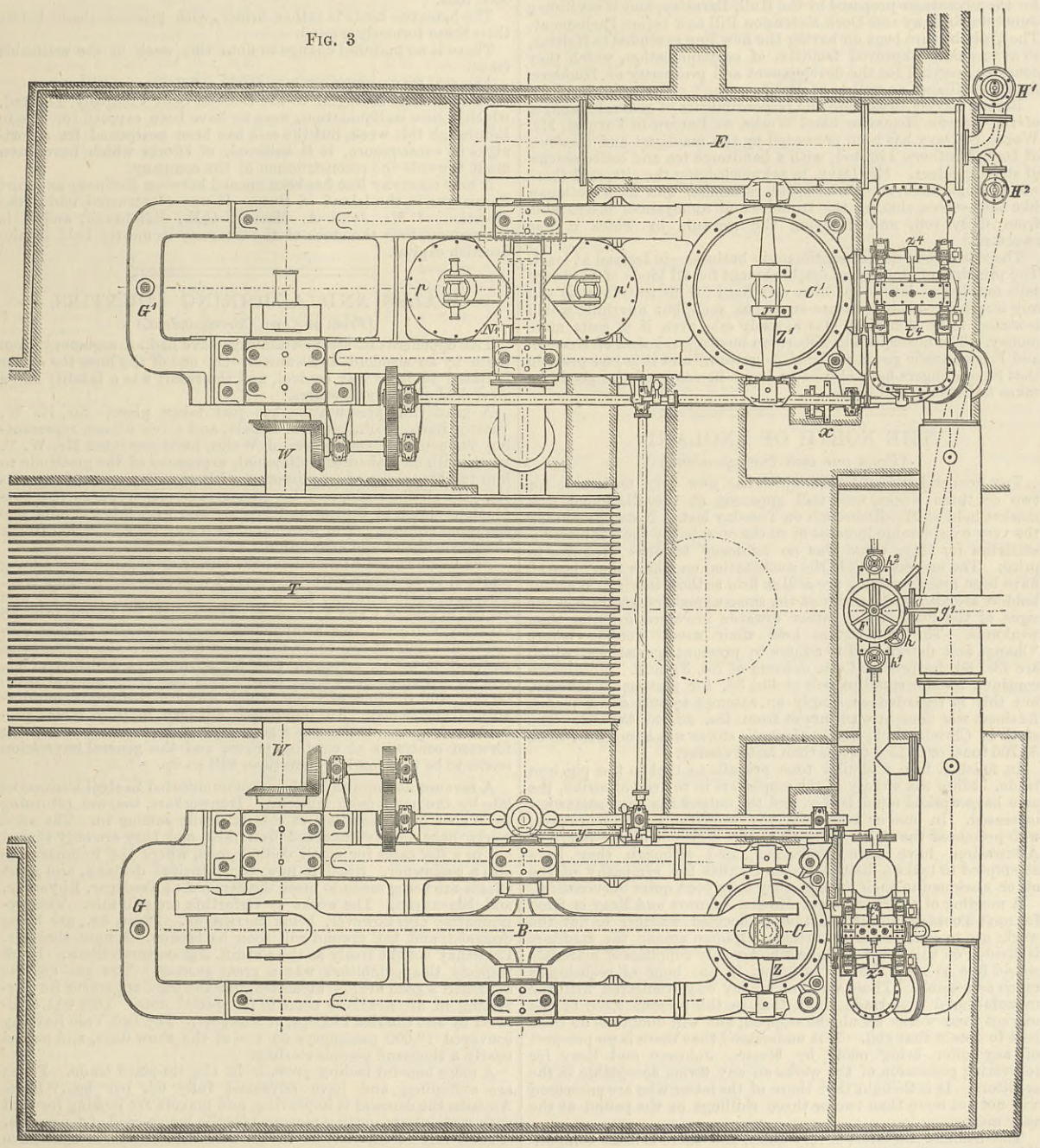


FIG. 3



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

(From our own Correspondent.)

THERE were some sorts of pigs of local make which were higher in Birmingham to-day and in Wolverhampton yesterday by from 1s. 3d. to 2s. 6d. than they were a month and six weeks ago. The recent considerable sales on account of next quarter's requirements have had much to do with this; and there were mill and forge proprietors who yet desired to buy, though they hesitated to give the prices generally asked by vendors.

Best second-class Staffordshire pigs were firm at 57s. 6d., and offers at less were consistently refused. Sparrow's Millfields brand of pigs were at this price. Less valuable brands of part-mines were 55s. and 50s., according to mixture. Cinder pigs were nominally 40s., but 37s. 6d. was about the actual selling price, and some sorts might have been had at slightly less.

Agents of part-mine pigs made at a distance, particularly in Derbyshire, Northampton, and Leicestershire, announced an increasing demand. The price demanded for these three descriptions was 47s. 6d. The special Northampton—Wellingborough—brand, however, was quoted at 52s. 6d., but without sales at the figure.

All-mine pigs of Staffordshire make were 65s. to 67s. 6d. The former figure was that, for instance, of Messrs. Turley's No. 5 grey forge, while the latter figure was their price for No. 3 and No. 4.

Hematite pigs were not weaker than at date of last report. Consumers of Wigan kinds, indeed, reported themselves less able to buy at the figures which they reported a week ago. The Barrow Company again named £3 7s. 6d., and Tredegar was firm at £3 5s. Brymbo (Wrexham) part hematite were quoted £3. Users decline to admit that the pig market must soon be much stronger; and the less valuable sorts were unfavourably influenced by the growth of stocks in makers' hands at Middlesbrough.

Scrap iron from South Wales, composed mainly of sheet shearings, is quoted this week at 62s. 6d. delivered; but there is not much doing.

The probable effect upon this district of the ironworkers' strike in America has been canvassed. A few producers reported inquiries from Liverpool merchants on United States account, which seemed to be resulting from the labour struggle, but such inquiries had not yet formulated into much actual business. The general impression was that the strike would not be of sufficiently long duration to much influence Staffordshire orders or prices.

The marked iron houses continue inadequately supplied with orders in other than exceptional instances. The Earl of Dudley's Round Oak bars are £8 2s. 6d., and those of other firms £7 10s. Medium quality bars are £6 15s. to £6 10s., and common Staffordshire bars £6 5s. Hurdle bars are obtainable at as low as £6.

Hoops are going abroad in large quantities. £6 17s. 6d. was quoted this afternoon, though for export some makers would have accepted £6 15s. On the other hand branded hoops were strong at £7 7s. 6d. per ton.

Plate makers did not report any improvement at £8 10s. to £9 and £9 10s, for boiler sorts, according to brand.

Galvanisers announced the receipt of a number of new good orders on account of South America, Canada, Australia, the Cape, and British India. One firm has 180 tons ordered for Rangoon, the whole to be shipped this month. The home demand also they reported brisk. But prices remain low. Ordinary sheets of 22 to 24 w.g. were obtainable this afternoon at £14 per ton, in bundles delivered Liverpool; with £16 for 26 w.g., and £18 for 28 w.g. For superior brands of 24 w.g. £15 was very firmly demanded; for similar qualities of 26 gauge, £17; and for 28 gauge, £19. Wire netting and similar season requisites are imparting more activity to the business doing at the galvanising pits.

This activity amongst the galvanisers is naturally reflected by the black sheet makers. Some of these are this week asking prices which upon the late minimum mean an advance of from 2s. 6d. to 5s. per ton. Singles were £8, doubles £8 10s. to £9, and lattens £9 10s. to £10 per ton.

In best stamping sheets there is a decided improvement upon home as well as upon export account. There are firms who report the receipt of more new work on home account in the past fortnight than during the previous two months. Messrs. Crowther Bros., of Kidderminster, are amongst the firms well on. Their export work includes orders from Northern Europe, from the United States, and from Canada. This and other firms are receiving promising inquiries this week from Russia and from Spain, but at present the correspondents delay to place their orders.

There was slightly more firmness both in Wolverhampton and Birmingham in the tin-plate department. Charcoals might have been got at 19s. delivered in Liverpool, and here and there 18s. 6d. would be occasionally taken in a good order; while others again demanded 20s. per box. Cokes were 16s. to 17s. in Liverpool. Most makers reported the receipt of orders recently, mostly for high-class qualities for home use.

In such cases steel sheets are used in the place of either charcoal or coke. The demand is improved by the enterprise of the tin-plate users, who are using machinery to secure a high polish upon some of their goods, and they are using it with so much success that the goods are taken by customers instead of the higher-priced nickel-plated ware of the same order. Tea and coffee-pots and tea-kettles are amongst the requisites in whose finish the polishing machinery is used. Sheet steel is likewise in growing request for use in the making of travelling trunks. Such trunks, wood bound, are selling well, and they are going freely to India and the Colonies.

Stamping machinery is in larger request because of the demand which is being expressed in London and the chief provincial centres for wares of brass. By the employment of the stamping machinery sheets of brass are being extensively used up in the manufacture of goods which have heretofore been made sometimes of china, at other times of japanned iron. There is quite a rage for complete toilet sets of brass, with tinned or painted linings.

The bridge for the Mexican Railway, to which I made reference in my last week's report, is being constructed by the Horsley Engineering Company, under the inspection of Mr. G. H. Stanger, C.E., of Wolverhampton. The swing bridge will have a clear swing of 200ft., and the three fixed spans are of 150ft. each. The triangular lattice girder principle is adopted, and the material is almost wholly wrought iron. The swing bridge will revolve on a central turntable supported by forty steel rollers. Of that metal, too, will be the track plates for the roller path, and also the racks. The structure is to be thrown across the Tamesi River, on the San Luio and Tampico Branch of the Mexican Central Railway. Two of the spans are now ready for shipment, and the whole of the order will be completed in about another month.

The cable and chain and nut and bolt firms report themselves well on, and the prospects are pronounced good.

The South Staffordshire Institute of Mining Engineers, whose headquarters are at Dudley, have received a communication from the trustees of Mason's College, Birmingham, expressing extreme regret that they are unable to receive the Institute into the College. The communication has caused considerable disappointment amongst the engineers.

Mr. W. Farnworth, president of the South Staffordshire Institute of Mining Engineers, read a paper this week before that Association on the lime process of getting coal. He showed that the percentage of small coal was very low, whilst compared with wedging the plan was much cheaper. A discussion ensued, and the general opinion was that whilst the operation was safe, it was too slow for modern requirements. The vice-president mentioned the new explosive, dynamogen, as being a promising help in coal mines.

The local governing authorities of Oldbury, near Birmingham, have determined to extend their gasworks at a cost of £3000. The expenditure will be chiefly in the direction of providing additional retorts.

Although the nine colliers who descended Baxterley coal pit, near Atherstone, Warwickshire, shortly before the late explosion, have now been entombed for five weeks, the pit mouth continues hermetically sealed. The fire is believed to be out, but it is not yet thought safe to re-open the pit. The few surviving members of the exploring party are progressing favourably.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—With the trade of this district just emerging from the Whitsuntide holidays, which in the iron and coal industries have caused a stoppage of operations for quite a week, an absence of animation has naturally characterised the market. Notwithstanding, however, the necessarily limited extent of business transactions, a somewhat steadier tone seems to be following the holidays. During the week a very fair number of inquiries, considering the holiday season, have been coming in, and although it can scarcely be said that better prices are actually ruling, there is less disposition to push sales at low prices, and some of the sellers of district brands have withdrawn the low quotations at which they were booking orders last month.

The Manchester market on Tuesday was only moderately attended, and there were not many orders stirring. Lancashire makers of pig iron were still quoting 45s. for No. 4 forge, and

46s. for No. 3 foundry, less 2½ delivered equal to Manchester, and at these figures a few small parcels are booked. Business of any weight, however, cannot be done, although offers to a fair extent have been made at a little under; but local makers, whilst open to some concessions to secure good orders, do not seem disposed to give way to the full extent expected by buyers. Lincolnshire makers of pig iron who have recently been booking pretty freely in this district at prices 6d. to 1s. per ton under local quotations, have this week put up their prices about 1s. per ton, and for delivery equal to Manchester the average quotations are now 45s. to 45s. 6d. for No. 4 forge, and 46s. to 46s. 6d. for No. 3 foundry, less 2½. One or two sales have been made on the basis of these figures, but the advance seems to have checked for the present the placing out of further orders. There have been sellers of Middlesbrough iron at a little less money, but north-country brands, in which at one time a large business was done here, are still completely out of this market.

In the finished iron trade business continues very quiet, the new orders giving out being very limited in extent, and some of the rolling mills are only being kept irregularly employed. Large American orders are, however, reported to be lying at Liverpool ready to be placed on the market at a limit of price very little below that now being asked by makers. For local bars delivered equal to Manchester prices range from £6 5s. to £6 10s. per ton.

The engineering works are only getting into full swing again this week, a complete start not being made in many cases until Tuesday. Operations, however, are gradually being resumed after the holidays with good prospects as to employment for some time forward; and although there is still a keen competition for orders, which stands in the way for the present of any great improvement in prices, the actual condition of the engineering trade may be fairly described as mending steadily.

The question of the safe lighting of coal mines was again before the members of the Manchester Geological Society for discussion at their opening meeting on Tuesday, and improved safety lamps were submitted for consideration. Mr. James Cunliffe, of the Bridgewater Collieries, Walkden, exhibited an improvement on the Davy type, and urged that as it was impossible to construct lamps which were not liable to be broken by ordinary accidents in the mine, it was better to pay attention to increasing their lighting power, which would diminish the risk of accident both to the collier and the lamp. Mr. James Ashworth, of Derby, submitted an improvement of his own on the Museler type by the addition of a light copper or tin shield above the horizontal gauze, which touches the chimney at six equidistant points and prevents any current passing through the horizontal gauze on one side of the chimney and out again on the other, as it may do in the ordinary Museler, and of an appendage which he terms a "chimney-pot," consisting of a cylinder containing three wings which commence a little above the top of the chimney, and extend to a little below the bottom of the cylinder, dividing the pot into three compartments. With these additions it is claimed that a continuous and steady current is maintained in the lamp with no more air entering the lamp then is required to supply the wick flame, whilst the air so entering is highly heated by direct contact with the chimney, and arrives at the lamp flame in the best condition for producing perfect combustion. For the light he adopted mineral oil in preference to vegetable oil, and so far as his own experience went he considered it safer than any other. Whilst admitting that it was useless expecting that Government would make the use of any particular lamp compulsory, he thought they might impress upon them the necessity of the employment of lamps of standard types only, and that all new lamps introduced from time to time should receive the authorisation of the Home Office before they could be used in any mine. After some further discussion, which was eventually adjourned to a special meeting of the society to be held in Wigan at the end of the month, Mr. J. S. Martin, Inspector of Mines, said there could be no doubt that the lamp which was required was one which would go out when it came in contact with an explosive mixture, because so long as the flame continued inside the lamp when in the midst of an explosive mixture something must ultimately give way, and the result in all probability would be an explosion. The chief use of a safety lamp should be considered as an indicator for detecting the presence of gas, and not for working in the midst of gas. That at least was his opinion of the proper functions of a safety lamp.

The official address of Mr. R. Knight, the general secretary of the Steam Boiler Makers' Society, in his last annual report, which has been reprinted and largely circulated amongst employers in this district, is so temperate and sensible a statement of the interests of employer and employed from a workman's point of view, that it has commended itself generally to favourable reception, and a short abstract will be of interest. Mr. Knight, in offering a word of prudent advice to the members, which he hopes will be received in the same friendly spirit that actuated himself, says, "While fully alive to the advantages derived from good wages, it is possible to venture too far in making unreasonable demands upon employers. This I know has been the case in some districts on some occasions that have come under my notice. This I must pronounce a mistake. Under pressure employers will concede our requests until a certain point is reached. That point is where his profits from his business are converted into loss; at this stage self-preservation prompts him to resist. If the members persist in making excessive demands, that are much above other districts, they only harass their employers, and either force them into liquidation or otherwise out of the trade. If we force up the wages in one district higher than other districts are paying, when a depression comes the high-priced district is surely the first to feel the effects, as trade will naturally gravitate to those places where labour is cheapest. Therefore, for any workmen to insist upon excessive demands when trade is prosperous, and by this action handicapping their employers unfairly with other competitors in the trade, is an unwise policy, suicidal, and must re-act upon the authors to their own suffering and loss. It is rather the duty of a trade's union to equalise the cost of labour, so that all employers may purchase it at the same cost." Mr. Knight adds that he is opposed to those periodical violent fluctuations of wages which occurred in some districts, and as a remedy suggests a general system of making agreements for time, wages, and piece prices satisfactory to both parties, signed and ratified for a certain period, such as six or twelve months.

In the coal trade of this district there has been very little business doing during the past week, either in house fire or manufacturing classes of fuel, and many of the pits did not get fully to work again after the holidays until Wednesday. Prices consequently have scarcely been tested, but beyond slight concessions here and there of about 6d. per ton on the better classes of round coal, there has been no further announced reduction in rates beyond that which came into force in the Manchester district with the opening of the month. An easier tone, however, characterises the market and prices are irregular; at the pit mouth they average about as under:—Best coal, 8s. to 8s. 6d.; seconds, 6s. to 7s.; common coal, 4s. 9d. to 5s. 6d.; burgy, 4s. 3d. to 4s. 9d.; and slack, 3s. 3d. to 3s. 9d. per ton.

Barrow.—Last week I noted the tone of the hematite pig iron trade of this district as being of a much more satisfactory character than had been experienced for some time past. This improvement has not only been maintained, but has considerably improved during the last few days. The amount of new business done, however, is only small as compared with the demand; but as makers are well situated for orders, they do not seem disposed to enter into large engagements at present prices. From all quarters there is a marked increase in the demand; but more particularly so as regards continental users. Prices have advanced 1s. per ton all round, 56s. being quoted for No. 1 Bessemer; 55s. for No. 2; and 53s. for No. 3 f.o.b., delivery at West Coast ports. Shipments of iron and steel are not so considerable as might be expected for the time of the year; but it is thought exporters are hanging back till freights are lower. A heavy tonnage of metal is being consigned over local railways, and this, together with the slightly decreased output, is effecting a reduction in stocks. The better feeling in the market is beginning to make itself felt in other directions, and the hope is entertained in some quarters that we may expect a considerable advance in prices. It is too soon, however, to say what position the market is likely to occupy during the next month or two.

Steel workers are busy, and the inquiry is more cheerful. Prices are unchanged. Iron shipbuilders, ironfounders, engineers, boilermakers, and others in steady employment.

Iron ore firm from 13s. 6d. to 15s. per ton on trucks at mines. Coal and coke steady.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

A LOCAL firm of cutlery manufacturers, Messrs. Atkinson Brothers, Milton Works, have promptly ascertained the effect of the new tariff arrangements of France and Great Britain. The firm do a very large cutlery business with Paris and other French markets, and have maintained all along that unless a very decided stand was made against the protective proposals of France, there would be no hope of maintaining any business in Sheffield articles. The result has curiously borne out their fears. With a view to test the operation of the new arrangements, Messrs. Atkinson made up a package containing patterns, which form four-fifths of the staple articles in demand in the French markets. Under the old treaty the duty upon these goods would have amounted to 15 per cent. on their value. Under the new tariff the duty is no less than 72½ per cent. Mr. Atkinson, the senior partner, assures me that this enormous increase in the tariff means nothing less than the practical extinction of the Sheffield cutlery trade with France. A committee has been appointed in Turin which evidently means an intention on the part of Italy to follow the lead of France; and it is feared that Belgium will go the same way.

The colliers at Manvers Main have had a pleasant surprise since my last. While elsewhere wages are being barely maintained, and in some cases positive reductions taking place, at this colliery, under the operation of the sliding scale, the underground workers, some 800 men and boys, will be entitled to an advance of 2½ per cent. for the next four months. The auditors have issued their report for the four months ending April last, and the result is to show an average selling price of 5s. 5·07d. per ton. This is the second advance to which the men have become entitled under the sliding scale arrangement, which has not yet been in force twelve months.

The Sheffield Gas Company has appointed Mr. Hanbury J. H. Thomas, of London, as manager of the company, in succession to Mr. Thomas Roberts, resigned. Mr. Thomas has been for twelve and a-half years the assistant to Mr. George Livesey, engineer and secretary to the South Metropolitan Gas-light and Coke Company. There were originally 106 candidates for the post. The late manager had £1500 a year. Applicants for the situation had to state the salary they required.

The Huddersfield Chamber of Commerce, after considering the scope of the agreement entered into between the M. S. and L., the G. N., and the L. and Y. Railway Companies, have come to the conclusion that it cannot be regarded as a satisfactory substitute for the advantages proposed by the Hull, Barnsley, and West Riding Junction Railway and Dock Extension Bill now before Parliament. The Chamber are bent on having the new line extended to Halifax, so as to secure improved facilities of communication, which they consider essential for the development and prosperity of Huddersfield and Elland, as well as of Halifax.

Before leaving to assume the responsibilities of general manager of the Barrow Hematite Steel Works, at Barrow-in-Furness, Mr. Walter S. Davy has been presented by the managers and *employés* of Davy Brothers, Limited, with a handsome tea and coffee service of sterling silver. Mr. Davy, in acknowledging the gift, said there was amongst them some who could remember him as a workman like themselves, sharing the troubles and annoyances inseparable from daily toil, and enjoying the rewards by which it was sweetened.

There is a good deal of sentiment in business—in Ireland at least. The principal of the largest establishment for all kinds of hardware tells me that of late it has been very hard for his travellers to sell any English goods if they are offered as such, but anything which is stated to be American has a ready sale even if it costs more money. The unsuspecting Hibernian buys a good deal of German and French-made goods as "real American," and it is just possible that Saxon fingers have also had a hand in some of the goods he takes to his shop and home.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

THE firm and cheerful tone which has now been noticeable for two or three weeks was still apparent at the Cleveland iron market held at Middlesbrough on Tuesday last. Notwithstanding the very considerable increase of stocks revealed by the ironmasters' statistics for May, there was no tendency towards weakness in price. The makers outside the combination on whom the "bears" have been mainly relying are still as firm as those inside. Warrant holders are also quoting almost the same as makers, and in fact the signs of the market are rather towards increased firmness than weakness. The ironmasters held their usual meeting before 'Change and determined to adhere to previous quotations, which are 43s. 6d. for prompt f.o.b. delivery of No. 3 g.m.b. Middlemen continue to offer small parcels at 43s. 3d. for postponed delivery, but this is regarded as simply an attempt to pull down prices. Business was done in warrants at from 43s. 3d. to 43s. 6d. The stock of Cleveland pig iron in Connal's stores was announced to be 33,706 tons, or 2413 tons less than last Tuesday.

In finished iron a similar tone prevails to that in the pig iron trade. Since the victory of the employers in the recent strike, the men have worked much better, and the output has been somewhat increased. In one or two cases the workmen's representatives, who promoted the strike contrary to the decisions of the Board of Arbitration, have been discharged, and although they have attempted to make a disturbance and enlist the sympathy of the other workmen in their favour, they have been quite unsuccessful.

A meeting of the creditors of Messrs. Johnson and Reay is fixed for next Tuesday, and it will then be decided whether or not the works are to continue in operation. Opinion among the creditors is divided on this point. Those who are only suppliers of materials would like to keep the works going, in the hope of realising as much as possible. Those who are in any way connected with the manufactured iron trade think that in the present state of the market these works should be stopped, and will doubtless do their best to obtain that end. It is understood that there is no prospect of any offer being made by Messrs. Johnson and Reay for recovering possession of the works on any terms acceptable to the creditors. It is thought that those of the latter who are unsecured will not get more than two or three shillings in the pound at the very most.

The demand for steel is very quiet, and there is brisk competition for any order which may come into the market.

Hematite pig iron is flat, price being now about 55s. f.o.t. Middlesbrough. The shipments of pig iron from the port of Middlesbrough during the month of May were 71,505 tons; in May, 1881, they were 71,729; and in May, 1880, 81,829 tons. Of the shipment last month 15,042 tons were sent to Scotland; 14,295 to Germany; 11,033 to France; 13,488 tons coastwise; 5546 tons to Holland; 4145 tons to Belgium; and to other countries 7956 tons. None at all went to America.

The Cleveland ironmasters' returns for May showed that the blast furnaces in operation were 119, being the same as a year ago. Of these, seventy-nine are making Cleveland iron, and forty hematite, spiegel, and basic iron. The total make of Cleveland iron was 149,486 tons, being an increase of 7775 tons on April. The make of other classes of iron was 81,966 tons, being 1414 tons more than the previous month. The total make of all kinds in the whole district was 231,452 tons. Makers' stocks increased during the month, owing to the struggle with the "bears," the strike, and the Whitsuntide holidays, by 34,626 tons, making a total held at the end of the month of 139,002 tons. Makers' stores increased by 45,766 tons, and amounted to 61,968 tons. Connal's stores decreased 11,782 tons, and amounted at the month's end to 135,769 tons. The Railway Company's store decreased 1250 tons, and now amounts to 10,208 tons. The net increase in stocks for the month was 26,170 tons. They are, however, still 90,000 tons below what they were at the end of August, 1881, when the policy of restriction was first inaugurated.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THE Glasgow iron market has been unusually depressed this week, and the business done in warrants has been confined entirely to the trade, there being absolutely no speculation on the part of the outside public. The unfavourable reports issued a few days ago with reference to the extensive accumulation of stocks in the hands of the Cleveland ironmasters had a discouraging effect, and although the additions to stocks in the public stores in Glasgow have been very small, it is understood that makers have been adding somewhat to their holdings at the ironworks. The foreign exports have fallen off to a greater degree than was anticipated, and compare unfavourably with those at this time last year; but it must not be forgotten that until within the past few weeks we have experienced a very large and steady trade since the beginning of the year, and the shipments, on the whole, are about 36,000 tons ahead of what they were in the first week of June, 1881. The inquiries on the part of America, Canada, and the Continent are quiet, but there continues a very good demand for No. 3 Scotch for consumption in our own foundries.

Business was done in the warrant market on Friday forenoon at 47s. 4d. to 47s. 5½d. cash, and 47s. 6d. one month; the afternoon quotations being 47s. 4½d. and 47s. 4d. cash, and 47s. 6½d. one month. On Monday the tone was easier, with transactions at 47s. 3d. to 47s. 2½d. and 47s. 2d. cash. Tuesday's market was quiet in the forenoon at 47s. 2½d. cash. On Wednesday the market was very quiet, with business from 47s. 3½d. to 47s. 2d. cash. To-day—Thursday—the market was steady, with business from 47s. 2d. to 47s. 4d. cash, and an additional ½d. for one month.

There is very little change in the prices of makers' iron, which are as follows:—Gartsherrie, f.o.b. at Glasgow per ton, No. 1, 58s.; No. 3, 53s.; Coltness, 59s. and 55s.; Langloan, 59s. and 54s.; Summerlee, 57s. and 50s. 6d.; Calder, 56s. 6d. and 51s.; Carnbroe, 51s. 6d. and 48s.; Clyde, 51s. and 49s.; Monkland and Quarter, each, 48s. 6d. and 47s.; Govan at Broomielaw, 49s. and 47s.; Shotts at Leith, 59s. and 54s. 6d.; Carron at Grangemouth, 49s. 6d.—specially selected, 52s.—and 48s. 6d.; Kinneil at Bo'ness, 47s. 6d. and 46s. 6d.; Glengarnock at Ardrossan, 51s. 6d. and 48s. 6d.; Eglinton, 48s. 6d. and 46s. 6d.; Dalmellington, 48s. and 47s.

In the course of the past week seven steamers have arrived in Glasgow harbour from Spain, bringing iron ore aggregating fully 6000 tons.

The hematite trade is rather firmer, with prices a shade better than those formerly quoted.

There is no material change to note this week in the malleable trade.

The coal trade continues in a fairly satisfactory position.

The collieries belonging to the Benhad Coal Company, Limited, which is now in liquidation, were to have been exposed for sale in Edinburgh this week, but the sale has been postponed for a fortnight in consequence, it is believed, of efforts which have been made towards the reconstruction of the company.

A new tramway line has been opened between Rothesay and Port Bannatyne in the Island of Bute. It was constructed under the direction of Mr. John A. Macrae, C.E., Edinburgh, and it is understood that the stock of the company is mostly held in the Scottish capital.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

THE opponents of steam tramways have had an argument given them by an accident at Swansea. On one of the lines the driver is stated to have lost control, and the result was a fatality and a good deal of injury to others.

A gratifying presentation has just taken place. Sir H. W. Vivian, Bart., M.P., Sir Geo. Elliott, and a few others, representing the principal coalowners of Wales, have presented Mr. W. T. Lewis with an elaborate testimonial, expressive of the gratitude to him for his services in connection with the Coalowners' Association, the sliding scale, and his efforts generally towards the harmonious action of capital and labour, and with this a sum of one thousand guineas. The occasion chosen was his re-election to the chairmanship of the association.

The Coalowners' Association have finally arranged a new sliding scale, in co-operation with the representatives of the working men. The new scale arranges for a change of standard from 8s. and 8s. 6d. in groups 1 and 2, to 7s. 8d. and 8s. per ton selling price on all coals, and with this arrangement the coalowners further conceded a bonus of 2s. to be taken as a loan until the selling price justified it as an advance, and an advance in addition of 2½, making a concession of 5 per cent. This has given general satisfaction, and the tone of trade, which was firm before, is considerably strengthened. An immediate advance in price seems probable. At present there is a good deal of hesitation in accepting forward contracts at existing prices, and the general impression seems to be that market quotations will go up.

A favourable impulse has been communicated to steel business of late by the news from America. Ironworkers, too, are returning to Wales, in expectation of a brisk trade setting in. The steel works have nearly discarded iron rails, and they are only turned out in a few cases for small colliery uses, where the ironmaster is also a coalowner. Steel is now the principal demand, and great efforts are being made to meet the demand at Tredegar, Rhymney, and Blaenavon. The works at Cyfarthfa are still idle. The preliminaries are, however, being carried on. Plans, &c., are being designed, and the ground will soon be broken. I note that Mr. Crawshay bought freely at the Cardiff Agricultural Show. In all respects this exhibition was a great success. The gas engines attracted a good deal of attention, but the huge apparatus for harvesting in all weathers came in for special note. This was exhibited by Mr. Charles Phillips, of Newport. The Taff Vale Railway conveyed 19,000 passengers on one of the show days, and netted nearly a thousand pounds sterling.

A more hopeful feeling prevails in the tin-plate trade. Prices are stiffening, and have advanced fully 6d. per box. From America the demand is improving, and makers are looking forward with certainty to getting recouped for the long period of depression. A good deal of this is due to the numerous stoppages that have taken place, and the reduced make thereby. A turn now into good times would be likely to cause a re-start at some of these, but not at all, for a few are hopelessly closed and machinery dispersed.

Treforest furnaces continue to take the lead in output of pig. Doubling the old make of the small ironwork furnaces used to be regarded as extraordinary, but it is now quadrupled.

Llanelly tin-plate prices are 16s. per box, ordinary coke. Bar iron remains at £5 10s.

Over 7000 tons of patent fuel left Swansea last week, principally for Spain and Russia.

The announcement made that a peaceful solution had occurred to the colliery strike in North Wales is, I see, premature. No arrangement has yet been brought about.

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.

30th May, 1882.

2541. ARCHITECTURAL WORK, P. Ross, London.
2542. DRYING GRAIN, Sir H. Scholfield, Nottingham.
2543. LOOMS, W. R. Stitt and J. Lees, Belfast.
2544. COLOURING MATTERS, J. Erskine.—(*C. Kœnig, Germany.*)
2545. MIXING COFFEE BERRIES, E. Humphery, London.
2546. TRACTION ENGINES, J. and H. McLaren, Leeds.
2547. THRASHING MACHINES, J. H. Johnson.—(*M. Epple and Company, Munich.*)
2548. STEAM BOILERS, J. A. MacLellan, Glasgow.
2549. BUILDING, T. Hyatt, London.
2550. SIFTING MACHINE, M. Shearer, son., and M. Shearer, jun., London.
2551. DENTAL INSTRUMENTS, G. Poulson.—(*J. W. Zeuch, Hamburg.*)
2552. STEERING QUADRANTS, J. Cook, Durham, and W. Prosser, Newcastle-upon-Tyne.
2553. HINGES, A. J. Boult.—(*E. Salomon and E. Armant, Montreal.*
2554. VULCANISING INDIA-RUBBER, J. H. Johnson.—(*H. M. F. Jules and A. M. Auguste, Paris.*)
2555. BLOCKING TUNNELS, F. Barnett, London.
2556. WINDOW SCREENS, G. Reynolds, Oakland, U.S.
2557. ILLUMINATING, M. A. Wier, London.
2558. GENERATING ELECTRICITY, J. Williams, London.

31st May, 1882.

2559. TREATING FATTY SUBSTANCES, R. H. Brandon.—(*A. Marix, Paris*)
2560. ELECTRIC LAMPS, S. Hallett, London.
2561. SCOURING LEATHER, F. Lockwood, Boston, U.S.
2562. BRUSHING by ELECTRICITY, R. Heney, London.
2563. LAMPS, W. R. Lake.—(*J. J. Wood, Brooklyn, U.S.*)
2564. BARGES, E. Moxon, Tunbridge Wells.
2565. DYNAMO-ELECTRIC MACHINES, A. Jarman, London.
2566. WEAVING CLOTH, D. A. Guille, London.
2567. HEATING by ELECTRICITY, O. Rose, Manchester.
2568. BARRELS of LOCKS, G. Bolton, Wolverhampton.
2569. ELECTRIC LAMPS, T. E. Gatehouse and H. R. Kempe, London.
2570. LAMPS, W. R. Lake.—(*J. J. Wood, Brooklyn, U.S.*)
2571. INSULATING BODIES, W. A. Phillips, London, and S. E. Phillips, Charlton.
2572. CORSETS, G. Wrencher, London.
2572. DYNAMO-ELECTRIC MACHINE, S. Hallett, London.
2574. GRAIN, J. Wetter.—(*W. Ager, Washington, U.S.*)
2575. REMOVING VEGETABLE MATTER, J. Wetter.—(*A. Snoeck, Belgium.*)
2576. COMPRESSING AIR, W. Darling & R. Sellers, York.
2577. WASHING BOTTLES, E. Lofts, Cherryhinton.
2578. TELEPHONIC INSTRUMENTS, S. Thompson, Bristol.
2579. REVERSIBLE CLOAKS, T. H. Harrison.—(*H. F. Bindseil and L. Weil, New York, U.S.*)
2580. FENCE POSTS, S. Pitt.—(*O. Shepherd, Boston, E. W. Peck, G. H. Morse, W. A. Crombie, E. R. Powell, and T. S. Peck, Burlington, U.S.*)
2581. PREPARING LITTERS, C. W. G. Ernst, London.
2582. MEASURING APPARATUS, F. C. Glaser.—(*Werkzeug und Maschinenfabrik Oerlikon, Switzerland.*)

1st June, 1882.

2583. STARTING ENGINES, W. H. Allen, R. Wright, and W. L. Williams, London.
2584. STARTING SEWING MACHINES, A. Pentz, Glasgow.
2585. SEPARATING SOLUBLE MATTERS, G. T. Beilby, Mid Calder, N.B.
2586. SUGAR-CANE MILLS, E. Hunt.—(*J. Thompson and J. Black, Campos, Brazil.*)
2587. CATCHES, J. F. Davies, Blackburn.
2588. LIFE-SAVING GARMENTS, F. W. Brewster, London.
2589. BUTTONS, F. Wirth.—(*L. E. E. Hunrath, Germany.*)
2590. GLAZING, T. H. P. Dennis, Chelmsford.
2591. WATER-GAUGES, W. Lake.—(*L. Fleet, Boston, U.S.*)
2592. PARALLEL SCREW VICES, P. Lawrence, London.
2593. WRENCHES, P. Lawrence, London.
2594. AMMUNITION BOXES, W. R. Lake.—(*E. G. Parkhurst, Hartford, U.S.*)
2595. ELECTRIC BATTERIES, W. Boggett, London.
2596. ORGAN PEDALS, W. C. Dyer, Weston-super-Mare.
2597. STOPPERING BOTTLES, G. Falconnier, Switzerland.

2nd June, 1882.

2598. LOADING GRAIN, W. Cooper & J. Holdsworth, Hull.
2599. MOULDS, A. Patrick, Glasgow.
2600. DABBING BRUSHES, J. Haigh, W. Dean, and T. W. Mitchell, Bradford.
2601. PURSES, S. Cooke, London.
2602. SECONDARY BATTERIES, Sir C. T. Bright, London.
2603. VALVES, J. Hitch, London.
2604. LAMPS, F. des Vœux.—(*A. Bernstein, Boston, U.S.*)
2605. IMPLEMENTS, G. P. Blake, Exeter.
2606. DRYING HAY, T. Perkins, Hitchin.
2607. FLOORINGS, W. H. Lindsay, London.
2608. SLATES, C. Abel.—(*W. Stuckle, Germany.*)
2609. TOY RIFLES, A. J. Boult.—(*A. Griviau, France.*)
2610. CORSETS, W. H. Taylor, London.
2611. DISTILLATION of COAL, W. J. Cooper, London.
2612. STOVES, C. Lister and T. Wardle, Middlesbrough.

3rd June, 1882.

2613. ELECTRIC LAMPS, W. Ayrton & J. Perry, London.
2614. STOVES, &c., C. E. Green, London.
2615. PRESERVING MILK, E. Scherff, Prussia.
2616. CHURNS, G. Hathaway, Chippenham.
2617. SEWING MACHINERY, A. Greenwood and J. W. Ramsden, Leeds.
2618. ELECTRIC MACHINES, R. E. Crompton, London.
2619. ELECTRIC LIGHTING, R. E. B. Crompton, London.
2620. HAT BRIMS, J. T. Grimshaw, Stockport.
2621. HORSESHOE NAILS, H. P. Fenby, Leeds.
2622. ELECTRICITY, E. L. Missonnier, London.
2623. COUPLING DEVICES, W. R. Lake.—(*J. J. Wood, Brooklyn, U.S.*)

5th June, 1882.

2624. WATER GAUGES, H. Slater, Derby.
2625. CLEANING KNIVES, C. Spong, Lewisham.
2626. FLUID MEASURE, J. N. Holliday, Sunderland.
2627. REGENERATIVE STOVES, B. Ford, Middlesbrough.
2628. TRANSMITTING ELECTRIC FLUID, H. Defty, Middlesbrough.
5629. ELECTRIC LIGHTING, R. Kennedy, Glasgow.
2630. DYNAMO-ELECTRIC MACHINES, A. Jarman, London.
2631. ELASTIC WEDGES, A. E. Séné, Paris.
2632. LAMPS, W. R. Lake.—(*J. J. Wood, Brooklyn, U.S.*)
2633. STEAM BOILERS, A. C. Engert, London.
2634. PLEATING MACHINES, C. G. Hill, Nottingham.
2635. STEAM BOILERS, F. Brown, Luton.
2636. ELECTRIC MACHINES, A. Fyfe & J. Main, London.
2637. HORSESHOES, T. H. Heard, Sheffield.
2638. PAPER-DAMPING MACHINES, J. J. Allen, Halifax.
2639. FOLDING CHAIRS, J. Hayes, London.
2640. SHAPING METAL SHEETS, G. E. Edwards, London.
2641. TELEPHONIC COMMUNICATORS, A. Rose, London.
2642. REGISTERING APPARATUS, W. E. Ayrton and J. Perry, London.

Inventions Protected for Six Months on Deposit of Complete Specifications.

2526. DYNAMO-ELECTRIC MACHINES, W. R. Lake, Southampton-buildings, London.—A communication from J. J. Wood, Brooklyn, New York, U.S.—*27th May*, 1882.
2531. DYNAMO ELECTRIC MACHINES, W. R. Lake, Southampton-buildings, London.—A communication from J. J. Wood, Brooklyn, New York, U.S.—*27th May*, 1882.
2541. ARCHITECTURAL WORK, P. Ross, Harrow-on-the-Hill, London.—*30th May*, 1882.
2561. SCOURING, &c., LEATHER, F. A. Lockwood, Boston, U.S.—*31st May*, 1882.
2563. ELECTRIC LAMPS, W. R. Lake, Southampton-buildings, London.—A communication from J. J. Wood, Brooklyn, U.S.—*31st May*, 1882.
2570. ELECTRIC LAMPS, W. R. Lake, Southampton-buildings, London.—A communication from J. J. Wood, Brooklyn, U.S.—*31st May*, 1882.
2594. AMMUNITION-BOXES, W. R. Lake, Southampton-buildings, London.—A communication from E. G. Parkhurst, Hartford, U.S.—*1st June*, 1882.
2596. ORGAN PEDALS, W. C. Dyer, Weston-super-Mare.—*1st June*, 1882.

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

2161. LOOSE PULLEYS, J. Davis, Bristol.—*30th May*, 1879.
2179. FEED APPARATUS, E. Fromentin, Paris.—*31st May*, 1879.
2200. KNITTED FABRICS, J., J., J. W., and H. Kiddier, Nottingham.—*3rd June*, 1879.
2220. CUTTING BOARDS, S. H. Hodges, Bristol.—*4th June*, 1879.
2315. SHIRT COLLARS, F. Jaques, London.—*11th June*, 1879.
2596. ROOFING FELTS, W. B. Ritchie, Belfast.—*27th June*, 1879.
2181. PATTERNS for MOULDING, C. Pieper, Berlin.—*2nd June*, 1879.
2184. COTTON FIBRE, C. D. Abel, London.—*3rd June*, 1879.
2190. FIRE BRIDGES, W. Anderson, Dundee.—*3rd June*, 1879.
2362. TRUSSING BARRELS, B. Hunt, London.—*14th June*, 1879.
2364. BARRELS, B. Hunt, London.—*14th June*, 1879.
2452. HEATING INGOTS, W. D. Allen, Sheffield.—*19th June*, 1879.
2593. ELEVATORS, G. F. Redfern, London.—*27th June*, 1879.
2638. SEWING MACHINES, H. A. Dufrené, London.—*14th November*, 1879.
2193. CONDENSING, &c., ENGINES, F. Hurd, Wakefield.—*3rd June*, 1879.
2205. GRINDING WHEAT, J. A. A. Buchholz, London.—*3rd June*, 1879.
2227. EXTRACTION of GASES, R. Aitken, London.—*5th June*, 1879.
2231. ILLUMINATING POWER of LAMPS, F. Siemens, Dresden.—*5th June*, 1879.
2244. TREATING RAILWAY SLEEPERS, E. T. Hughes, London.—*6th June*, 1879.

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

2026. STEAM PUMPS, J. W. Blake, Manchester.—*2nd June*, 1875.
2044. SOLUBLE GUN COTTON, F. Greening, Essex.—*3rd June*, 1875.
1988. PREPARING MIRROR-PLATES, J. H. Johnson, London.—*31st May*, 1875.
2007. SEPARATING APPARATUS, A. M. Clark, London.—*1st June*, 1875.
2047. SUPPLYING FUEL to FURNACES, J. Proctor, Burnley.—*3rd June*, 1875.
2138. FLOORS for MALT KILNS, W. L. Wise, London.—*10th June*, 1875.
2157. FURNACES, F. B. A. R. de la Bastie, France.—*12th June*, 1875.
2033. STEAMING WOVEN FABRICS, H. Stead, Halifax, and B. Appleyard, Wakefield.—*2nd June*, 1875.
2039. MULTIPLE DRILLS, J. Buckton and J. H. Wicksteed, Leeds.—*3rd June*, 1875.
2064. ICE-MAKING, A. M. Clark, London.—*4th June*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 23rd June, 1882.

110. TREATING FISH, C. Pieper, Berlin.—A communication from J. H. G. Walkhoff.—*9th January*, 1882.
412. BUTTERS, L. A. W. Lund, London.—*27th January*, 1882.
419. COFFEE POTS, W. R. Lake, Southampton-buildings, London.—A communication from J. Herttan.—*27th January*, 1882.
425. WETTING PAPER, A. Stierlin, Manchester.—*27th January*, 1882.
432. TRIMMING BOXES, F. Myers, New York, U.S.—*28th January*, 1882.
441. ELECTRIC RAILWAYS, C. F. Varley, Bexley Heath, and W. Judd, Penang.—*28th January*, 1882.
442. NAILING MACHINES, F. Myers, New York, U.S.—*28th January*, 1882.
443. OPENING CARRIAGE DOORS, G. V. Fosbery, Bitton.—*28th January*, 1882.
450. HORSESHOES, H. Turner, Birmingham, H. Olver, Tamworth, and E. Price, jun., Birmingham.—*28th January*, 1882.
454. BRUSHES, G. and E. Ashworth, Manchester.—*30th January*, 1882.
456. CRUSHING APPARATUS, R. E. Shill, East Dulwich.—*30th January*, 1882.
470. DYEING, &c., W. W. Richardson, Leeds.—*31st January*, 1882.
483. LIQUOR FRAMES, W. Edge, Birmingham.—*31st January*, 1882.
487. BEATING APPARATUS, W. R. Lake, London.—Com. from Messieurs Gillet et fils.—*31st January*, 1882.
502. MARINE BOILERS, A. Gibb, Greenwich.—*1st February*, 1882.
506. SUSPENSION LAMPS, H. Salsbury, London.—*1st February*, 1882.
508. WITHDRAWING LIQUORS, F. E. Wood, Workington.—*2nd February*, 1882.
512. STEERING GEAR, T. Archer, jun., Dunston.—*2nd February*, 1882.
599. RAILWAY SIGNALS, A. Gough, Buckingham.—*7th February*, 1882.
918. VENTILATORS, H. J. Haddan, London.—Com. from P. Mihan.—*25th February*, 1882.
943. ELECTRICITY, H. E. Newton, London.—Com. from A. I. Gravier.—*27th February*, 1882.
1022. ELEVATING APPARATUS, W. Blythe, Liverpool.—*3rd March*, 1882.
1185. CLARIFYING SYRUPS, S. Pitt, Sutton.—Com. from G. A. Drummond.—*11th March*, 1882.
1211. ELECTRIC CURRENTS, H. E. Newton, London.—Com. from A. I. Gravier.—*13th March*, 1882.
1241. BROOMS, J. G. Horsey, London.—*14th March*, 1882.
1485. ILLUMINATING GAS, F. H. Wenham, London.—*28th March*, 1882.
1496. DYNAMO, &c., MACHINES, T. J. Handford, London.—Com. from T. A. Edison.—*28th March*, 1882.
1862. ELECTRICAL RAILWAYS, T. J. Handford, London.—Com. from T. A. Edison.—*18th April*, 1882.
1894. SPINNING SILK, W. R. Lake, London.—A communication from Messieurs Louis Martin and Company.—*20th April*, 1882.
1912. SPRINGS, W. Buckley, Sheffield.—*21st April*, 1882.
2052. GENERATORS, &c., T. J. Handford, London.—Com. from T. A. Edison.—*1st May*, 1882.
2072. ELECTRIC LIGHTS, T. J. Handford, London.—Com. from T. A. Edison.—*2nd May*, 1882.
2132. COMPOSITIONS, E. C. C. Stanford, Glasgow.—*6th May*, 1882.
2165. HOLDERS, F. Steitz, London.—*9th May*, 1882.
2213. SOFTENING SKINS, A. M. Clark, London.—Com. from J. L. Moret.—*10th May*, 1882.
2242. COLOURING MATTERS, J. Erskine, Glasgow.—Com. from C. Rumpff.—*12th May*, 1882.
2248. MEASURING CURRENTS, T. Varley, Walthamstow, & H. B. Greenwood, London.—*12th May*, 1882.
2264. ENGRAVING COPPER, T. R. Johnston, Edinburgh.—*13th May*, 1882.

Last day for filing opposition, *27th June*, 1882.

496. CENTRAL FIRE CARTRIDGES, C. S. Bailey, Waltham Abbey.—*1st February*, 1882.
499. SIZING HANKS, J. Conlong, Blackburn, and J. Robertshaw, Manchester.—*1st February*, 1882.
500. BRAKES, W. B. Holbech, Huncote.—*1st February*, 1882.
511. TURNTABLES, W. Morris, Birmingham. — *2nd February*, 1882.
524. VALVE GEAR, J. Jensen, Birkenhead, and C. W. King, Liverpool.—*3rd February*, 1882.
529. CLARIFICATION, &c., S. C. Davidson, Belfast.—*3rd February*, 1882.
533. GRAIN, A. W. L. Reddie, London.—A communication from H. F. S. Requier.—*3rd February*, 1882
549. BLEACHING FIBRE, P. Thomas, Elberfeld.—*4th February*, 1882.
576. ROLLERS, W. Barford, T. Perkins, and E. J. Chambers, Peterborough.—*6th February*, 1882.
580. FURNACES, W. Morgan-Brown, London.—Com. from A. C. Felton.—*7th February*, 1882.
640. STAMPING LETTERS, J. G. A. Haller, Hamburg.—*10th February*, 1882.
653. COMPOUNDS for BLEACHING, J. Young, Kelly.—*10th February*, 1882.
763. NUTS, &c., R. Harrington, Wolverhampton.—*16th February*, 1882.
882. MATCH BOX, G. Simons, Bow.—*23rd February*, 1882.
903. DRILLING APPARATUS, G. F. Wynne, Minera.—*24th February*, 1882.
975. ARTIFICIAL STONE, J. R. Nottingham, Washington, U.S.—A communication from A. Pelletier.—*28th February*, 1882.
1027. LIQUOR STANDS, J. Beresford, Birmingham.—*3rd March*, 1882.
1563. THRASHING MACHINES, A. W. Mantle, Eckernfoerde.—*31st March*, 1882.
1783. PERCUSSION CAPS, T. Spencer, Birmingham.—Com. from O. Adams.—*14th April*, 1882.
1882. TIGHTENING MATTRESSES, E. Hoskins, Birmingham.—*19th April*, 1882.
2092. ELECTRIC LIGHT, C. Lever, Bowdon.—*3rd May*, 1882.
2100. STAMPING MACHINES, J. Westwood and R. Baillie, Poplar.—*4th May*, 1882.
2102. STEAM GENERATORS, J. I. Thornycroft, Chiswick.—*4th May*, 1882.
2109. FIRE-ARMS, P. Mauser, Germany.—*4th May*, 1882.
2110. CARBONATE of SODA, S. Pitt, Sutton.—A communication from T. Schloesing.—*4th May*, 1882.
2128. ELECTRIC CURRENTS, W. Arthur, London.—*5th May*, 1882.
2129. AIR PUMPS, D. Johnson, Chester, and S. C. Tisley, London.—*5th May*, 1882.
2134. GAS METERS, W. C. Parkinson, London.—*6th May*, 1882.
2161. REFINING SUGAR, A., J. D. Scott and T. R. Ogilvie, Greenock.—*9th May*, 1882.
2167. ROTARY ENGINES, W. P. Thompson, Liverpool.—Com. from D. D. Hardy.—*9th May*, 1882.
2171. COOLING APPARATUS, W. P. Thompson, Liverpool.—A communication from Messrs. McMillan and Johnson —*9th May*, 1882.
2177. PURIFYING WATER, P. and F. M. Spence, Manchester.—*9th May*, 1882.
2197. ANCHORS, C. Martin, Brighton.—*10th May*, 1882.
2214. GRINDING, &c., GRAIN, W. Korth, Belfast.—*11th May*, 1882.
2238. BOILER FURNACES, J. H. Johnson, London.—Com. from E. J. Mallett, jun.—*11th May*, 1882.
2240. LOCKS, M. Gilmour, Paisley.—*11th May*, 1882.
2255. LOOPED FABRICS, J. and H. Kiddier, Nottingham.—*13th May*, 1882.
2302. DECORATIVE TRANSPARENCIES, J. Mitchell, Paris.—*16th May*, 1882.
2307. DRY CLOSETS, F. Versmann, New Charlton.—Com. from H. Kleucker.—*17th May*, 1882.
2479. STOPPERS, J. S. Davison, Sunderland.—*25th May*, 1882.
2526. DYNAMO MACHINES, W. R. Lake, London.—A communication from J. J. Wood.—*27th May*, 1882.
2531. ARMATURES, W. R. Lake, London.—A communication from J. J. Wood.—*27th May*, 1882.
2561. SCOURING LEATHER, F. A. Lockwood, Boston.—*31st May*, 1882.
2563. ELECTRIC LAMPS, W. R. Lake, London.—A communication from J. J. Wood.—*31st May*, 1882.
2570. ELECTRIC LIGHT, W. R. Lake, London.—A communication from J. J. Wood.—*31st May*, 1882.
2594. AMMUNITION BOXES, W. R. Lake, London.—Com. from E. G. Parkhurst.—*1st June*, 1882.

Patents Sealed.

List of Letters Patent which passed the Great Seal on the 2nd June, 1882.)

5012. BILGE BARRELS, R. E. Gibson and D. Pope, Liverpool.—*16th November*, 1881.
5293. STEAM BOILERS, E. A. Brydges, Berlin.—*3rd December*, 1881.
5326. WASHING MACHINES, A. Mill, Glasgow.—*6th December*, 1881.
5334. MAIN SHEETS, H. B. McIntosh, Great Grimsby.—*6th December*, 1881.
5350. ENGINES, C. W. Siemens, London.—*7th December*, 1881.
5351. WARMING APPARATUS, T. Rowan, London.—*7th December*, 1881.
5354. INDICATING APPARATUS, P. Cardew, Chatham.—*7th December*, 1881.
5361. NAIL MACHINES, J. Imray, London.—*7th December*, 1881.
5365. SELF-CLOSING COCKS, J. Barr, Kilmarnock.—*8th December*, 1881.
5385. TELEPHONES, G. W. Foster, London.—*9th December*, 1881.
5404. PROTECTING BOILERS, S. Schuman, Glasgow.—*10th December*, 1881.
5456. GAS MOTOR ENGINES, H. Williams, Southport.—*14th December*, 1881.
5490. ELECTRIC LAMPS, W. R. Lake, London.—*15th December*, 1881.
5519. MECHANICAL PENS, J. H. Johnson, London.—*16th December*, 1881.
5542. GALVANIC BATTERY, W. R. Lake, London.—*17th December*, 1881.
5558. CRANK SHAFTS, J. Dickinson, Sunderland.—*19th December*, 1881.
5616. SUGAR, J. H. Johnson, London.—*22nd December*, 1881.
5619. NET-HAULING WINCHES, C. R. Mitchell, Aberdeen.—*23rd December*, 1881.
5638. EXHIBITING APPARATUS, E. Webster and T. M. Williams, London.—*23rd December*, 1881.
12. AXLE-BOXES, W. Clark, London.—*2nd January*, 1882.
34. FLYING APPARATUS, J. K. Smythies, London.—*3rd January*, 1882.
236. ARTICLE of DIET, W. R. Lake, London.—*17th January*, 1882.
473. UTILISING ALKALI WASTE, J. Brock, Widnes.—*31st January*, 1882.
1015. REFLECTING LIGHTS, W. Brass, jun., London.—*2nd March*, 1882.
1052. VELOCIPEDE, &c., T. H. Ward, Tipton.—*4th March*, 1882.
1056. FOLDING BOATS, J. P. Wright, Redhill.—*4th March*, 1882.
1225. GAUGING CARBON FILAMENTS, M. Evans, Wemyss Bay.—*14th March*, 1882.
1293. CUTTING MACHINE, H. A. Bonneville, London.—*17th March*, 1882.
1403. GAS BURNERS, J. Lewis, London.—*23rd March*, 1882.
1408. ADMINISTRATION of FLUIDS, F. Kingston, St. John's.—*23rd March*, 1882.
1479. SOAP, &c., L. Varicas, London. — *28th March*, 1882.
1719. WATER METERS, A. J. Boult, London.—*11th April*, 1882.

(*List of Letters Patent which passed the Great Seal on the 6th June*, 1882.)

5360. TELEPHONE TRANSMITTERS, E. H. Johnson, New York.—*7th December*, 1881.
5366. NICKEL, &c., W. Galbraith, Sheffield.—*8th December*, 1881.
5373. RABBIT TRAP, J. C. B Fox, Brislington.—*8th December*, 1881.
5377. WATER-CLOSETS, C. G. Cameron, Lambeth.—*8th December*, 1881.
5379. VENTILATING SHIPS, &c., J. C. Baker, Liverpool.—*9th December*, 1881.
5396. ELECTRIC LAMPS, C. F. Varley, Bexley Heath, and F. H. Varley, London.—*9th December*, 1881.
5411. SPANNERS, B. Godfrey and F. Brittain, Sheffield.—*10th December*, 1881.
5460. FENCES, &c., D. Rowell, London.—*14th December*, 1881.
5465. RAILS, &c., W. Seaton, London.—*14th December*, 1881.
5466. LOCKS, W. and S. Bash and N. S. Damsa, Manchester.—*14th December*, 1881.
5486. PICTURES, &c., A. A. Hely, South Lambeth.—*15th December*, 1881.
5493. MAKING BUTTON-HOLES, A. Helwig and J Dewdney, London.—*15th December*, 1881.
5544. ALKALINE LIME MUD, J. Simpson, Liverpool, and E. W. Parnell, Widnes.—*19th December*, 1881.
5553. PACKING, J. H. Chapham, Forest Gate, and R. H. Harper, London.—*19th December*, 1881.
5567. ELASTIC METAL BANDS, B. W. Fase, London.—*20th December*, 1881.
5576. GRATINGS, &c., H. S. Cregeen, Bromley.—*20th December*, 1881.
5592. BAND SAWS, J. H. Johnson, London.—*21st December*, 1881.
5604. GALVANIC BATTERIES, E. B. Burr, Walthamstowe, and W. T. Scott, Stratford.—*22nd December*, 1881.
5649. GAS BURNERS, W. T. Sugg, Westminster.—*24th December*, 1881.
5715. COCKS or TAPS, W. R. Lake, London.—*29th December*, 1881.
486. HOT BLAST STOVES, E. A. Cowper, London.—*31st January*, 1882.
607. TELEPHONE TRANSMITTERS, R. and M. Theiler, London.—*8th February*, 1882.
634. VENEERING WALLS, T. Brindle, Southport.—*9th February*, 1882.
788. HOOPS, &c., T. Brown, Sheffield.—*18th February*, 1882.
1044. TELEPHONE TRANSMITTERS, R. and M. Theiler, London.—*4th March*, 1882.
1066. LUBRICATING SPINDLES, T. Watson, Paisley.—*6th March*, 1882.
1226. PROPULSION of SHIPS, W. T. Lithgow, Port Glasgow.—*14th March*, 1882.
1404. MANURE, E. Fisher, Beverley.—*23rd March*, 1882.
1453. COLOURING MATTERS, J. A. Dixon, Glasgow.—*27th March*, 1882.
1476. ORNAMENTING CHINA, H. Doulton, London, and J. Slater, Burslem.—*27th March*, 1882.
1478. TREATING SUGAR, J. H. Johnson, London.—*27th March*, 1882.
1484. TIN PLATES, C. S. B. Gardner, Glamorganshire.—*28th March*, 1882.
1708. LACING STUDS, W. R. Lake, London.—*11th April*, 1882.
1738. DINING TABLES, W. R. Lake, London.—*12th April*, 1882.
1840. SELF-OPENING UMBRELLAS, W. Grant, New York, U.S.—*18th April*, 1882.

List of Specifications published during the week ending June 3rd, 1882.

4582, 6d.; 4586, 6d.; 4592, 8d.; 4594, 6d.; 4597, 6d.; 4619, 2d.; 4622, 2d.; 4623, 2d.; 4624, 6d.; 4627, 6d.; 4628, 6d.; 4638, 6d.; 4644, 4d.; 4649, 2d.; 4668, 6d.; 4670, 6d.; 4672, 10d.; 4682, 8d.; 4683, 6d.; 4703, 2d.; 4705, 4d.; 4710, 6d.; 4714, 6d.; 4718, 2d.; 4720, 2d.; 4721, 2d.; 4730, 6d.; 4731, 2d.; 4732, 2d.; 4735, 2d.; 4736, 6d.; 4737, 6d.; 4740, 6d.; 4741, 6d.; 4742, 6d.; 4743, 6d.; 4744, 6d.; 4746, 2d.; 4748, 6d.; 4750, 2d.; 4752, 4d.; 4757, 2d.; 4758, 4d.; 4759, 2d.; 4761, 6d.; 4765, 6d.; 4766, 2d.; 4767, 6d.; 4769, 2d.; 4770, 6d.; 4771, 2d.; 4772, 2d.; 4773, 6d.; 4774, 6d.; 4778, 2d.; 4782, 6d.; 4783, 2d.; 4784, 6d.; 4785, 4d.; 4786, 2d.; 4787, 6d.; 4788, 2d.; 4790, 6d.; 4792, 6d.; 4793, 2d.; 4794, 4d.; 4795, 6d.; 4797, 6d.; 4798, 6d.; 4799, 6d.; 4801, 4d.; 4802, 2d.; 4803, 6d.; 4804, 2d.; 4805, 2d.; 4807, 2d.; 4809, 2d.; 4810, 2d.; 4811, 6d.; 4812, 2d.; 4813, 4d.; 4814, 8d.; 4816, 6d.; 4817, 2d.; 4820, 6d.; 4822, 2d.; 4824, 6d.; 4827, 2d.; 4828, 2d.; 4830, 8d.; 4831, 2d.; 4832, 2d.; 4833, 6d.; 4834, 6d.; 4835, 6d.; 4836, 2d.; 4837, 2d.; 4838, 2d.; 4840, 4d.; 4841, 4d.; 4842, 2d.; 4843, 2d.; 4844, 6d.; 4845, 2d.; 4847, 8d.; 4848, 6d.; 4850, 2d.; 4852, 4d.; 4854, 2d.; 4855, 6d.; 4857, 1s.; 4858, 2d.; 4859, 2d.; 4862, 4d.; 4863, 4d.; 4866, 6d.; 4867, 6d.; 4868, 6d.; 4870, 6d.; 4873, 8d.; 4876, 1s.; 4877, 4d.; 4883, 8d.; 4887, 6d.; 4888, 4d.; 4898, 6d.; 4202, 6d.; 4903, 6d.; 4906, 4d.; 4919, 6d.; 4937, 6d.; 4967, 6d.; 5100, 6d.; 5263, 8d.; 5293, 4d.; 5600, 6d.; 1025, 6d.

*** Specifications will be forwarded by post from the Patent-office on receipt of the amount of price and postage. Sums exceeding 1s. must be remitted by Post-office order, made payable at the Post-office, 5, High Holborn, to Mr. H. Reader Lack, her Majesty's Patent-office, Southampton-buildings, Chancery-lane, London.

ABSTRACTS OF SPECIFICATIONS.

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

1025. LOCK NUTS FOR SCREW BOLTS, *W. R. Lake, London.*—*3rd March*, 1882.—(*A communication from W. H. Paige, Springfield, U.S.*)—(*Complete.*) 6*d.*

The lock nuts comprise a sectional flange on one face, which flange has openings between its sections whose inner surface is on the same plane as the bore of the nut, and whose exterior surface is inclined.

4584. BOXES AND PACKING CASES, *W. H. Bennett, London.*—*20th October*, 1881. 6*d.*

This relates to a means for fastening together the sides and ends of a box, and consists in the use of tongues fitted into grooves in prepared corner pieces.

4597. SAFETY ENVELOPES, *W. W. de la Rue, London.*—*22nd October*, 1881. 6*d.*

The safety envelope consists in effect of two complete envelopes, the one enclosed within the other.

4619. FILTER PRESSES, *E. A. Pontifex and R. Gunning, London.*—*21st October*, 1881. (*Void.*) 2*d.*

This relates to mechanism for moving the press plates.

4622. HANDLES FOR CANES AND UMBRELLAS, *E. Edwards, London.*—*21st October*, 1881.—(*A communication from W. Rossler, Bohemia.*)—(*Not proceeded with.*) 2*d.*

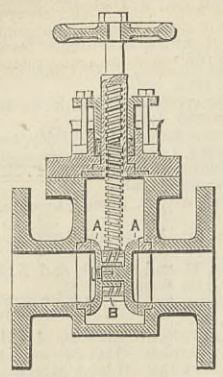
This relates to the construction of the handles so that they may contain phials or other vessels filled with perfume, or suitable for receiving a burning cigar or other small article.

4624. SCREW PRESSES FOR BALING OR BUNDLING HAY COTTON, &c., *C. S. Mair, Glasgow.*—*22nd October*, 1881. 6*d.*

The press consists of a long rectangular wooden box fitted with pressing rams or pistons actuated by screws at each end. A hinged door at top allows the hay to be fed in, and the finished bale is withdrawn from a similar door in front. The front door and the back of the box have slots cut in them, and corresponding transverse grooves are formed in the faces of the rams to allow for the passage of cords or wires to bind the bale.

4586. STOP VALVES, *J. A. and J. Hopkinson, Huddersfield.*—*20th October*, 1881. 6*d.*

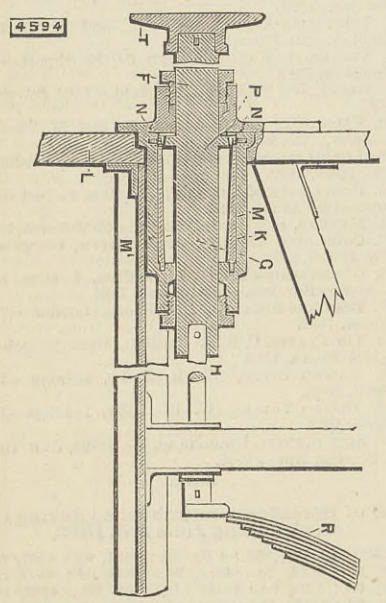
This relates to stop valves in which the valve is formed with two parallel faces which slide on faces surrounding the inlet and outlet apertures, and it



consists in forming such valve of two discs A capable of sliding one on the other, a spring B being interposed between them to force them well against their seats.

4594. HYDRAULIC BUFFER BRAKE FOR RAILWAY CARRIAGES, &c., *W. H. Beck, London.*—*20th October*, 1881.—(*A communication from J. B. G. A. Canet, Paris.*) 6*d.*

The buffer plate or disc T is pinned on to a rod F which forms part of a piston P moving in a cylinder K filled with a liquid which is not liable to be frozen in winter time. This cylinder is secured by bolts to the buffer bar L of the carriage. In the cylinder is or are fixed one or more tapered rods or bars M M1, which



correspond with and enter holes or slots N N in the piston P. This piston P is furnished with a tail rod G which passes out through a stuffing box in the end of the cylinder K opposite to that where the buffer plate is situated. The latter piston rod G is further extended either by a solid prolongation or by a piece H attached thereto, so that the ordinary buffer spring R may act thereon to press the buffer rod F outwards under normal conditions.

4623. BILLIARD MARKING BOARDS, *G. W. W. Edwards, Wolverhampton.*—*22nd October*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to a marking board suspended over the billiard table, and which is numbered on both sides.

4627. SHOES FOR HORSES, &c., *J. Bidder and M. J. Rowley, London.*—*22nd October*, 1881. 6*d.*

This relates to the construction of shoes for horses and other animals with projections and inclined surfaced indents in the working or tread faces.

4628. TREATING PEAT AND TURF FOR THE PRODUCTION OF RAILWAY SLEEPERS, &c., *A. Wilkinson, London.*—*22nd October*, 1881. 6*d.*

This consists in subjecting peat and turf to hydraulic pressure in moulds after having been amalgamated with coal tar, green oil, Stockholm tar, bitumen, naphtha, petroleum, ground slate, sand, or a silicate or other body in combination with or without india-rubber, gutta-percha, or other product which would give a slight elasticity and flexibility.

4638. VENTILATING ENCLOSED LAMPS, &c., *F. H. Smith, Winchmore Hill.*—*22nd October*, 1881. 6*d.*

The object is to prevent draughts in enclosed lamps; it consists in fitting above the reflector a false cover with a central opening smaller than that in the reflector, and to which a short chimney is attached. A second and taller chimney surrounds the latter, and through the base holes are formed to convey air to the space between them, the products of combustion passing out through such space. The outer edge of the false cover is bent down so as to fit on the reflector, and is perforated to admit cold air between the two; and the outer casing is also perforated at its upper edge opposite the oil chamber.

4644. APPLIANCES FOR CLEANING HAIR BRUSHES, &c., *E. S. Norcombe, Birmingham.*—*24th October*, 1881. 4*d.*

The appliance consists of a series of ribs or bars provided with a handle.

4649. ADVERTISING, *H. J. Haddan, Kensington.*—*24th October*, 1881.—(*A communication from H. Joussaume, Paris.*)—(*Provisional protection not allowed.*) 2*d.*

This consists in printing advertisements on the internal lining of hats, &c.

4668. STOVES FOR COOKING AND HEATING PURPOSES, &c., *A. H. Hearington.*—*25th October*, 1881. 6*d.*

This relates, First, to compound burners, consisting of an inner tube, into which air and gas are admitted, an outer tube containing water, and tubes leading through the water space into the place to be heated; Secondly, in combination with such burners of openings and regulating cocks surrounded by spaces containing water, and through which air and gas are admitted to the burner; Thirdly, to regulating cocks surrounded by water spaces, and through which gas is admitted to the burner, and arranged so as to be operated independently of the others; and Fourthly, to the general arrangement of the heating apparatus.

4670. METALLIC PILLARS, &c., *R. B. Lee, Manchester*, —*25th October*, 1881. 6*d.*

This relates to improvements on patents No. 1597, A.D. 1871, and No. 190, A.D. 1873, and relates to means for facilitating the production of the pillars, &c., from steel or iron coiled on a mandril. A plain mandril of the desired shape is provided with pins fitting into holes in its periphery at the points of intersection of the different coils, which are first secured at one end, and then as the mandril revolves and the coil is laid on the mandril by hand, holes in it pass over the pins, and when all the coils are in position the pins are removed, and the different coils secured by rivets at the points of intersection.

4672. STEAM PUMPS, *T. H. Ward, Tipton.*—*25th October*, 1881. 10*d.*

This relates to improvements on patent No. 1650, A.D. 1881. The air vessel consists of a plain cylinder fitted with end covers tied together internally by bolts, and so as to prevent the water when passing through absorbing the air therein. A skin, such as mackintosh, is provided to separate the air space from the space through which the water passes. A centre rod passes right through the centre of the piston rod, and is common to the steam and water cylinders, and serves to secure the cylinder covers together, the ends of the piston rod being packed to prevent leakage between the cylinders. The invention further relates to improvements of the valve which regulates the admission of steam from the boiler to the cylinder; to stuffing-boxes in which thin and thick discs, plates, and rings are employed, which respectively fit the valve rod and stuffing-box; and also to balanced slide valves. Various other improvements are also described.

4682. LOCKS, *J. Jackson, jun., and C. Sheekey, Westminster.*—*26th October*, 1881. 8*d.*

The objects of this invention are the production of simple keyless locks (with or without springs), and upon a series of projecting arms or lugs being placed to a given mark, letter, or (by preference) figures, the locks may be locked or unlocked as desired.

4683. RAILWAY AND TRAMWAY WAGONS, *R. Hudson, near Leeds.*—*26th October*, 1881. 6*d.*

This relates to means or apparatus for preventing railway or tramway wagons from becoming accidentally uncoupled or detached from one another during transit by jolts or jerks to which they are liable. For this purpose, to the end of the wagon, and immediately over the drag hook or drawbar by which it is drawn along, is fixed a suitable pawl or detent, in such wise that it will pass into or over and from a block to the opening of the said hook, to prevent the coupling link from being jerked out of the hook by any sudden concussion or other irregular motion, such as railway and tramway wagons are liable to.

4703. AXLE-BOXES, *R. McIntosh, Dundee, and J. Wright, Kingston-upon-Hull.*—*27th October*, 1881.—(*Void.*) 2*d.*

The axle-box is constructed with a cylindrical interior accurately bored or turned, and contained within this is a circular cage or framework, in which are carried the bearings of a series of cylindrical rollers arranged in a circle. The journals of the axles are also made cylindrical, and their diameter is such that they pass into the circle represented by the distance apart of two of the interior portions of the peripheries of two diametrically opposite rollers of the series.

4707. WINDOW SASHES, &c., *J. H. Miles, Southampton.*—*27th October*, 1881. 4*d.*

This consists in the arrangement and construction of window sashes, the glazed frame of which swings upon a hinge or joint connecting it to the fixed frame, the frames being formed with rabetted joints, so as to be nearly wind and water-tight and adjustable at different angles for ventilation.

4710. MANUFACTURE OF CERTAIN WOVEN FABRICS, *O. Drey, Manchester.*—*27th October*, 1881.—(*Not proceeded with.*) 2*d.*

The invention consists in using in the manufacture of the same piece any suitable twofold or further varied mode of attaching the face weft threads to the back or foundation of the cloth.

4714. SPRING MATTRESSES, &c., *W. R. Lake, London.*—*27th October*, 1881.—(*A communication from E. Hinckley, San Francisco, U.S.*) 6*d.*

This consists in a double helical spring having the outer coil provided with a bend, at which point the free end of wire composing the said spring is made fast and attached to the adjacent spring by metallic clips.

4717. PILLS, *W. R. Lake, London.*—*27th October*, 1881.—(*A communication from J. A. Whitney, Dobbs Ferry, New York.*) 10*d.*

This relates to machinery for manufacturing pills with such accuracy as regards size and weight that all those of any given standard or size will be practically uniform, while the cost of their production will be much less than by the ordinary hand method.

4718. RIVETTING MACHINES, &c., *G. D. Edmeston, Manchester.*—*28th October*, 1881.—(*Void.*) 2*d.*

This relates partly to improvements on patent No. 82, A.D. 1860, and No. 1130, A.D. 1877; and consists in making the resisting or holding-up pillar of the De Bergue and similar machines separate from the other part of the framing carrying the moving ram and gearing, and in hinging or jointing this pillar to the lower part of the main framing or casting, and in securing the pillar to the main casting by one or two bolts—two by preference—which bolts pass from the pillar and through the flanges of the cylinder of an hydraulic ram attached to the main casting, or the cylinder may be attached to the casting and the bolts to the ram, or the bolts may be attached to the casting and the cylinder or ram to the pillar.

4719. TREATMENT OF MALT TO PRODUCE AN ARTICLE OF DIET WHICH MAY BE USED AS A SUBSTITUTE FOR COFFEE, *A. and M. Conroy, Liverpool.*—*27th October*, 1881. 2*d.*

Roasted ground coffee is exhausted by percolation with water at a temperature of 212 deg. Fah., and the resulting percolate is incorporated with a mixture in powder of raw malt and malt that has been roasted in the same manner as ordinary coffee berries. The product is then thinly spread on suitable trays and dried at a temperature not exceeding 140 deg. Fah.

4720. REFRIGERATING AND FREEZING, &c., *J. Chambers, New Zealand.*—*28th October*, 1881.—(*Void.*) 2*d.*

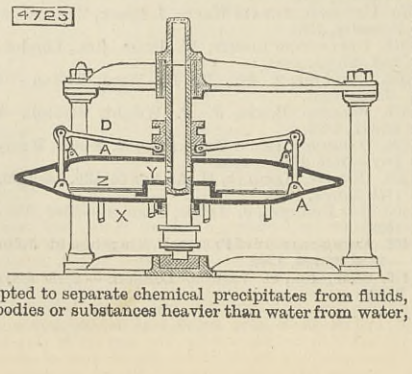
It is proposed to produce the cold in the first place by means of any of the well-known gases ordinarily employed for this purpose, such as sulphurous oxide, ammonia, and others, but instead of transmitting this cold to the refrigerating or freezing chamber by means of a non-congealable liquid, a current of air is caused to pass through the refrigerator, where it becomes cooled or frozen, and then passes on direct into the refrigerating or freezing chamber by means of a fan or blower.

4721. LOADING SHIPS, &c., *W. G. Herbert, Liverpool.*—*28th October*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to an apparatus in part self-acting for transferring from flats or lighters to ships or navigable vessels, and loading such vessels with salt or other cargo suitable for being raised or lifted by buckets, boxes, trucks, or similar receptacles.

4723. MACHINERY FOR EFFECTING THE SEPARATION OF SOLID BODIES FROM EACH OTHER OR FROM LIQUIDS, &c., *H. J. Smith, Glasgow.*—*28th October*, 1881. 8*d.*

The drawing shows one modification of a machine



adapted to separate chemical precipitates from fluids, or bodies or substances heavier than water from water, or heavier fluids from lighter fluids, and it consists of two vessels A fitting one over the other so as to form a single vessel divided longitudinally, a washer being placed between them to form a tight joint at the edges. The lower vessel can slide on the rotating shaft, to which the upper vessel is secured. The substance to be treated is admitted from a tank above, either through the shaft or through a suitable tube. Within the space enclosed and round the shaft is a partition Y fixed to the bottom vessel, its top being closed and the sides perforated and covered with a filtering medium. The bottom vessel is also fitted with perforated plates Z forming a false bottom, and covered with a filtering medium covering them. The substance is divided by the centrifugal force, and the parts of different specific gravity escape by exit pipes X. The radial levers D draw the lower vessel upward and ensure a tight joint at the edges.

4730. LOCKS, LATCHES, AND BOLTS, *T. Galloway, Gateshead-on-Tyne.*—*28th October*, 1881. 6*d.*

The invention relates to the actuating of the snecking bolt of locks or latches in such a manner that not only can the snecking bolt be snecked from either side of the door to which such lock or latch is attached, but also from one determinate side; the said snecking bolt may be further shot out so as to form a locking bolt, and when thus thrown out is securely held in its position and incapable of being moved back from the other side of the door.

4731. IMPERVIOUS COMPOSITIONS, &c., *J. H. Johnson, London.*—*28th October*, 1881.—(*A communication from G. O. Kramer and Co., Osnabrück, Prussia.*) 2*d.*

The composition consists of a mixture of boiled tar and sawdust, which is applicable to the treatment of stone, wood, iron, and other metals, sail cloth, paste board, and the like.

4732. MANUFACTURE OF MERINO, &c., *J. Kershaw, Macclesfield.*—*28th October*, 1881.—(*Void.*) 2*d.*

This consists in interweaving as "weft," one, two, or more pieces of elastic, the length whereof is regulated, according to the effect desired to be produced.

4735. WATCHES, &c., *L. Weill, London.*—*29th October*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to watches and like timekeepers, and more particularly to keyless watches, the object being to dispense with certain of the working parts now employed.

4736. SAFETY LETTER BOXES, *A. J. Little, Twickenham.*—*29th October*, 1881. 6*d.*

This consists in the construction of letter and equivalent boxes with flaps hinged or fixed, having cord or wire catching and severing edges in or on them.

4737. BEAM SCALES, *W. B. Avery, Birmingham.*—*29th October*, 1881. 6*d.*

This consists in making the cross or rest detachable from the cranked rod for convenience of packing, and at the same time provide for a perfectly rigid connection when the two parts are put together for use.

4740. PURIFYING WAX, FAT, OR RESINS, &c., *A. J. Boult, London.*—*29th October*, 1881.—(*A communication from D. T. Gray, Brooklyn, U.S.*) 6*d.*

This consists, First, in causing a stream of wax in a fluid state and a stream of naphtha or other solvent to flow together and form an intimate mixture, and thence pass through a filter: Secondly, to apparatus for holding the wax and the naphtha, and causing them to flow together as described; Thirdly, in the combination with the filter of a perforated receptacle arranged above the filtering material, and connected with the supply.

4741. CHIMNEY-PIECES, *J. Thomas, Bangor.*—*29th October*, 1881. 6*d.*

The chimney-piece is made of piece iron or steel formed to the desired shape, and ground on an emery wheel to a smooth face and enamelled, and the different pieces are then fastened together in the required positions.

4742. CABINET DESKS, *F. H. F. Engel, Hamburg.*—*29th October*, 1881.—(*A communication from J. Huhlmann, Hamburg*) 6*d.*

This relates to desks with turnable wings or boxes applied for closing the desk, and which, when opened, swing towards the outer end of the desk and give access to the inner space. The object is, by separating the sides, boxes, or wings by a centre part, to form such desks with a double flap, of which the upper one can be used as a standing desk, and the lower one as a writing table; also to allow the desk to be closed without removing the papers hung on the lower desk plates; also in constructing the bottom flap so that its position may be adjusted; and finally, the improvements enable the upper flap to be used without opening the desk by simply unlocking this flap and turning it down.

4743. PRESERVATION OF MILK, *E. G. Brewer, London.*—*29th October*, 1881.—(*A communication from L. Scherff, Berlin.*) 6*d.*

The milk is placed in bottles, which are then closed by corks, a small space being left between the bottom of the cork and the top of the milk. The top of the corks are then covered with paraffine wax, and the bottles are placed in a closed chamber and heated, so as to drive out all air, which escapes through the pores of the cork and the wax, which is melted by the heat. They are then allowed to cool, when the wax will again close the bottle hermetically.

4744. EXTRACTING FAT AND GREASE FROM BONES, *E. Edwards, London.*—*29th October*, 1881.—(*A communication from E. Pyrkosch, Germany.*) 6*d.*

The bones are submitted successively, but in the same vessel, to the action, First, of the vapour of benzine, sulphuret of carbon, or other volatile solvent fluid of the like kind under pressure; Secondly, of the same vapour in vacuo; Thirdly, of the same fluid itself under pressure; and Fourthly, of the fluid in vacuo. The fluid containing the fat and grease in solution then passes to a distilling vessel, and the solvent is distilled off.

4746. LOOMS, *A. P. Dickinson and J. Crook, Blackburn.*—*29th October*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to apparatus for operating the picking sticks of under pick looms, and consists of a cross shaft with tappet surface, which at each revolution of the shaft are acted upon by the tappets and caused to partially revolve, and by means of levers and connections actuate the picking stick.

4748. IMPROVEMENTS IN GALVANIC OR ELECTRIC BATTERIES, *W. R. Lake, London.*—*29th October*, 1881.—(*A communication from J. F. Aymonnet, Grignon, France.*) 6*d.*

This consists of one fluid battery. The negative plate is of iron or other metal; the positive of charcoal, coke, or the like. The liquid in which they are immersed is a mixture of two aqueous solutions, one of which contains either chlorine, hydrochloric acid, a chloride, or a mixture of these; the other nitric acid, a nitrate, chromic acid, a chromate, &c., or a mixture of them. The cells may be connected by syphons. The inventor states that the electromotive force of this battery is nearly as great as that of a Bunsen, and its resistance less.

4750. HORSESHOES, *J. F. Bell, Fulham.*—*31st October*, 1881.—(*Not proceeded with.*) 2*d.*

The under or wearing surface of the shoe is formed with two, three, or more rows of pointed projections of different heights, so that as one set wears down another set will be brought into use.

4752. WEAVING OR BRAIDING HOLLOW ARTICLES, *M. Bauer, Paris.*—*31st October*, 1881.—(*A communication from P. Besté, St. Denis, France.*) 4*d.*

The object is to weave or braid hollow articles without the use of a fixed core, the hollow article being filled with air during the last operation, and in the braiding an apparatus is applied outside the article and receives the weights employed for stretching the part of the web in the course of formation. The apparatus consists of several fingers each adjustably fixed to an angle piece, and arranged so that the upper end approaches closely to the article being woven and catches in part of the web, thus giving it form and effecting the stretching.

4757. STRAINING OR TIMSING SLIP OR OTHER SEMI-FLUIDS, &c., *W. S. Scott, Sunderland.*—*31st October*, 1881.—(*Void.*) 2*d.*

A lawn or silk sieve is strained on a frame which fits tight over a flange 4in. or 5in. from the bottom of a box, to which a second box is attached and communicates therewith. In the latter works a plunger so as to force the slip up through the lawn, and it then passes out through a spout in the first box.

4758. IMPROVEMENTS IN APPARATUS FOR THE TRANSMISSION OF VOCAL AND OTHER SOUNDS, *F. J. Smith, Taunton.*—*31st October*, 1881.—(*Not proceeded with.*) 4*d.*

For transmitting musical or vocal sounds the inventor uses a rectangular box of wood with holes cut in its sides, and pine wood sounding boards attached to two or more sides for carrying the carbon conductors. Sounds coming in any direction will thus strike some one of the sound boards, and cause vibration of the carbon. In transmitters for talking uses the inventor employs carbon rods that have not been shouldered down. Each of these is carried in a cell fixed in a frame. The more carbon rods employed the better the transmission.

4759. TESTING MILK, *F. Wolff, Copenhagen.*—*31st October*, 1881.—(*A communication from Burmeister and Wains, Maskin-og-Skibsbyggeri, a Joint Stock Stock Company, Incorporated, Copenhagen.*—(*Not proceeded with.*) 2*d.*

This relates to a centrifugal apparatus in which bottles containing milk are placed, and when caused to revolve cream is formed on the milk, so that when the machine is stopped the heights of the cream layers in the bottles indicate the quality of the contents of the bottle.

476.1 PRODUCTION OF SPIRITS DIRECTLY FROM THE WASH, *P. Jensen, London.*—*31st October*, 1881.—(*A communication from A. Deininger, Berlin.*) 6*d.*

The object is to produce spirits of high strength and purity direct from the wash, and it consists in passing the alcohol vapours coming from the rectifier, before they come to the condenser, through a layer of chlorcalcium and a layer of charcoal which has been glowing hot. The former absorbs nearly all the water which the alcohol vapours contain and divides the fusel oils, which are carried along therewith into their chemical constituents, whereupon these substances so prepared are withdrawn from the alcohol by the charcoal. A suitable apparatus is described for carrying out the operation.

4765. MATTRESSES, &c., *J. T. Lockey, Northwich.*—*1st November*, 1881. 6*d.*

This relates to spring mattresses, and consists principally in the combination of longitudinal stretchers of thin canes with metal fixings.

4766. AERATED AND OTHER BEVERAGES, &c., *T. Maugham, London.*—*1st November*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to improved method of manufacturing beverages containing, in addition to other materials, acetate of iron, so prepared as not to be liable to decomposition or deterioration in the presence of alkalies or their salts when mixed with or taken in conjunction with such beverages.

4767. FURNACES, *W. P. Thompson, Liverpool.*—*1st November*, 1881.—(*A communication from E. A. Prevost, Paris.*) 6*d.*

This consists, First, in discontinuing the use of the chimney as an aspirator of air, and keeping it merely for the expulsion of the useless products of combustion, the opening of the damper being reduced to a minimum; Secondly, in reducing the quantity of air introduced to a minimum, and introducing it above the bars by means of tubes supplied by blowing apparatus and placed at front and back, and if necessary at the sides of the furnace, at about half the height of the bed of coal; Thirdly, in closing the ash pit by a door fastened hermetically to the water tank; Fourthly, in the employment of broad bars only slightly separated to allow for lighting and removing ashes.

4769. MANGLES, *J. Deacon, Birmingham.*—*1st November*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to an improved mangle, in which a table or top plate governed by springs is substituted for the ordinary weighted box, and to improved reversing action, by which the table is caused to travel backwards and forwards by the same turning action.

4770. APPARATUS FOR PLAYING A NEW GAME OF CHANCE, *E. A. Glazbrook, W. H. O. Taylor, and W. P. B. French, Lombard-street.*—*1st November*, 1881. 6*d.*

This relates to apparatus to enable persons to play a parlour game imitating cricket, and consists of a revolving disc with a bowler in the centre, and a number of different chances in the game of cricket, such as bowled, 1, 2, or more runs, &c., marked on the edge, and a revolving cross beam carrying a batsman at each end, one being turned with his bat inwards when the game is being played, so that he will either score or be dismissed, according to the indication on the edge of the disc opposite which he stops.

4771. LIGHTING BY GAS, &c., *C. Crastin, jun., London.*—*1st November*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to a lamp for producing light from a suitable material, arranged to be heated to incandescense by a flame of a suitable mixture of gas and air in combination or not with an electric current.

4772. OIL, TALLOW, AND GREASE LAMPS, *J. Darling, Glasgow.*—*1st November*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to readily raise the wicks of lamps used by miners or stokers on board ship, and it consists of a prong or picker lever mounted outside the wick tube, but which can be made to project within the tube and so raise the wick.

4773. COMBINED HAND AND STEAM STEERING APPARATUS, &c., *A. W. Cooper, Dundee.*—*1st November*, 1881. 6*d.*

Two outside high-pressure cylinders are combined with a central low-pressure cylinder, the steam being supplied to the former over the outside edges of the controlling slide valve through ports, and passes through a recess in the controlling slide valve from the high-pressure cylinder to the piston valves of the low-pressure cylinder, and leaving as exhaust at the opposite recess in the controlling slide valve, changing ends as the gear is run from port to starboard or starboard to port. The invention also relates to an arrangement for effecting the cutting-off of the steam automatically in order that the movement of the engine may coincide with the movement of the hand wheel; to clutch apparatus or gear for effecting the disconnection of the hand wheel gear from the steam power gear, and the construction of the rudder chain wheel and chain links.

4774. SHAFT MACHINES FOR LOOMS, *C. A. Barlow, Manchester.*—*1st November*, 1881.—(*A communication from N. Anderson, Sweden.*) 6*d.*

The object is to produce a large quantity of cloth in a given time with a small expenditure of power, and it consists in the use of a row of needles at each side of the machine, and a vertical division board is placed in the middle of the shaft machine, and is fitted in grooves in the frame ends and divided horizontally and slotted at the divisions to receive the inner ends of the needles, which are kept in place by the weight of the upper part of the division board, and press the needles outwards, their outer ends passing through two needle boards, one at each side. The wires are held between projections on the needles; the pressers that carry the cylinders which operate the needles swing radially from centres near the top of the machine, and are actuated by pulleys and springs;

levers by means of springs act on the swell of the cylinders, which are caused to move at each motion by catches connected to the frame ends; two lifting frames slide between the end frames, and are worked up and down by two levers, each frame having a lifting bar resting under catches on the wires that are not pushed back by the blanks on either of the cylinders pressing the needles inward. The wires are placed in two rows, one on each side, and connected with the rods that lift the healds by cords passing through the bottom board. The lifting rod on one side, and the next following lifting rod on the other side, connected respectively to corresponding wires, work on the same heald.

4778. IMPROVEMENTS IN INCANDESCENT ELECTRIC LAMPS, *F. Wright, London.—1st November*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the construction of an incandescent lamp. The carbon is enclosed in a glass globe, with elongated neck, which is flattened where the connecting wires, of platinum, pass through it. The carbon is connected to these by copper wires and very small pieces of platinum wires next to the carbon. A small glass tube is provided for exhausting by.

4782. SEWING HEAVY MATERIALS, SUCH AS SAIL CLOTH, &c., *E. H. Smith, New York.—1st November*, 1881. 6*d.*

One breadth of the material is supported and secured so as to leave a margin free, and another breadth is sewn on to it with a lap-seam by a travelling sewing machine on an elevated railway.

4783. NAVIGABLE SHIPS AND VESSELS, *G. Hepburn, Liverpool, and W. Parker, Catford Bridge, Kent.—2nd November*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to construct iron and steel plated ships, so that the vertical butt joints are stronger and less liable to give way or open, and it consists in providing such joints with internal straps or plates, so shaped that a longitudinal section of the strip would have externally an undulating or waving outline.

4784. SHIPS' RUDDERS, *W. Cooke and D. Mylchreest, Liverpool.—2nd November*, 1881. 6*d.*

This consists essentially, First, in making rudders of one piece of metal; Secondly, in strengthening them by constructing them with ribs, projections, or corrugations; and Thirdly, in annealing or smithing rudders made in one piece.

4785. COMPOSITION FOR PREVENTING INCRUSTATION IN BOILERS, *E. Edwards, London.—2nd November*, 1881.—(*A communication from H. Kolker, Breslau.*) 4*d.*

The following substances are boiled in a vessel with water:—Catechu of Pegu, 55 lb.; English white caustic soda of 60 to 62 per cent., 45 lb.; and dried granate-shell, 3 lb., the boiling being continued until a homogeneous solution is obtained, and in it is dissolved 50 lb. dried and coarsely pulverised chestnuts. The solution thus obtained is added to the water of the generator.

4786. CAR COUPLINGS, *G. W. von Nawrocki, Berlin.—2nd November*, 1881.—(*A communication from G. Lippmann, Germany.*)—(*Not proceeded with.*) 2*d.*

This relates to an arrangement of couplings by which the buffers serve to receive the parts of the coupling, so as to dispense with the usual central coupling, and whereby the same may be operated on from the side of the car.

4787. STOVES OR HEATERS FOR APARTMENTS, *J. Dunnachie, Lanark, N.B.—2nd November*, 1881. 6*d.*

One modification consists in a square pedestal, the sides of which are fire-clay slabs held in position by a light iron framework, and closed at top by an ornamental cover. A door is made near the bottom of the front, and inside at the lower part the grate is situated. Above the fuel space the interior is divided by a mid-feather of fire-clay extending from the lower part of the back upwards in an inclined direction towards the front, but leaving a space between it and the front; and the products of combustion pass up the front side of this partition, and return down between it and the back of the stove to the flue pipe.

4788. RING HOLDERS FOR RING SPINNING, *H. Ziffer, London.—2nd November*, 1881.—(*Not proceeded with.*) 2*d.*

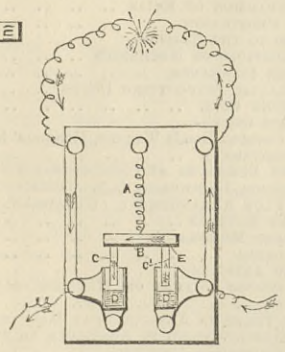
The holder consists of a cast iron ring with one slot cut right through it so as to render it expansive. This holder fits loosely on the ring rail, and the spinning ring which carries the traveller is rather larger than the opening in the holder, so that when forced in it is held firmly in position.

4790. VACCINATING APPARATUS, *T. Smith, London.—2nd November*, 1881.—(*A communication from Dr. V. Burq, Paris.*) 6*d.*

This relates to means for providing or arming set of vaccinating needles with vaccinating matter; and consists of a case to hold the needles while the vaccine is applied, and then closing them up and embedding them in cotton wadding, so as to prevent the vaccine being acted upon by the air.

4792. IMPROVEMENTS IN SWITCHES OR APPARATUS EMPLOYED IN CONNECTION WITH ELECTRIC LAMPS, FOR CLOSING THE CIRCUIT ON THE EXTINCTION OF ONE OF THE LAMPS, AND FOR LIGHTING AND EXTINGUISHING THE LAMPS, &c., *W. E. Hubble, Lincolns-inn-fields.—2nd November*, 1881.—(*A communication from J. M. A. Gérard Lescuyer, Paris.*) 6*d.*

The diagram shows the method of carrying out this invention. Two metal rods C C^1 are connected by a cross-bar B, the cups D D^1 are partly filled with mercury, and are arranged so that when the lamp is working correctly, rod C is always immersed in the mercury, but rod C^1 is elevated above it. When the



lamp goes out or ceases working, the current passes through the mercury in cup D by rod C, and through a platinum helix A, by which the rods are suspended. The latter becomes heated, and losing its elasticity, allows the rods to descend by gravity, until C^1 makes contact with mercury in D^1, and cuts the lamps out of circuit. Various modifications in the means for carrying this invention out are described, including a method for using the apparatus as a switch to re-light the lamp.

4793. MEMORIAL MIRRORS, *C. D. Cannon, London.—2nd November*, 1881.—(*Provisional protection not allowed.*) 2*d.*

This consists in securing on the face of the glass texts, mottoes, or other subjects, it is desired to impress on persons using the glass.

4794. FURNACES AND APPARATUS CONNECTED THEREWITH FOR EVAPORATING AND INCINERATING ALKALINE LEYS, &c., *W. Malcolm, Midlothian, N.B.—2nd November*, 1881.—(*Not proceeded with.*) 4*d.*

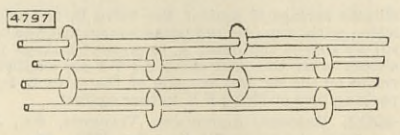
This relates to the roasting furnace for evaporating and incinerating the leys, and consists in the use of mechanical breakers to break up the hard crust formed on the top of the leys by the heat from the furnace acting thereon. A further improvement relates to scraping and agitating appliances fitted to pans for evaporating leys.

4795. KILNS FOR BURNING BRICKS, &c., *G. W. von Nawrocki, Berlin.—2nd November*, 1881.—(*A communication from E. Arnold, Prussia.*) 6*d.*

This relates to brick kilns in which are two or more firing chambers combined with each other and with heating chambers or regenerators in the following manner:—Each firing chamber has one or more grates whose ashpits can be closed; an opening near the top leading both to a chimney stack and to a flue leading to the lower part of the second chamber, an opening near the bottom from which a flue leads into a heating chamber beneath the second firing chamber, which heating chamber is provided with extended surfaces to take up heat for one portion of the highly heated air passing through the same, and for imparting it to another portion of the air required for combustion, and which also communicates with the inner end and underside of the fire-grate of the second chamber.

4797. IMPROVEMENTS IN AND RELATING TO TELEGRAPHIC OR TELEPHONIC CABLES AND CONDUCTORS, *C. L. Gore, New York and London.—2nd November*, 1881. 6*d.*

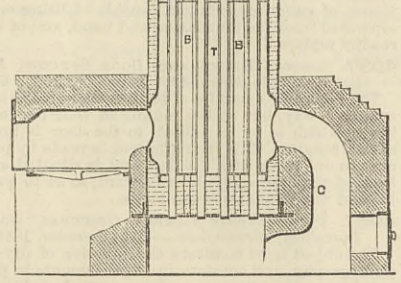
This relates to the insulation of wires. The inventor threads a series of rings of glass, earthenware, or other material on the wires, in the manner shown in the figure. For underground work a cable composed



of wires thus insulated is inclosed in an inner tube of porcelain, which again is inclosed in an outer tube of iron, both of which are formed of two parts fitted to one another and secured by bolts. The inner tube is also filled with insulating material.

4798. TUBULAR STEAM BOILERS, *G. Kamensky, Paddington.—2nd November*, 1881.—(*A communication from D. Novikoff, Russia.*) 6*d.*

The boiler consists of an upper chamber A and lower chamber C connected by tubes B on a level with the lower surface of the upper chamber. Within the tubes



are placed interior flues T, starting from the lower surface of chamber A and terminating at the lower surface of chamber C. A feed is fitted to the boiler to supply it with water, and the furnace is arranged in one side, the flames circulating among the tubes B and then under the boiler and through the flues T, and pass to a chimney E.

4799. SELF-GOVERNING GAS BURNERS, *J. B. Fenby, Sutton Coldfield, Warwick.—2nd November*, 1881. 6*d.*

The burner consists of a cylindrical body partly open at bottom to admit gas and screwed on to the supply pipe. Within it is a double piston with a space between them, and both mounted on a short rod. At the top of the cylinder is a plate with a small central hole for the passage of gas to the burner tip. A boss on the top disc governs the size of this opening. The discs do not fit the cylinder closely, so that the gas can pass upwards. Above the top plate is a small chamber into which the burner tip is screwed; and in it is a small disc fixed a little distance above the central hole in the top plate, so as to prevent the gas making a hissing sound.

4801. SIZING PAPER, &c., *W. R. Lake, London.—2nd November*, 1881.—(*A communication from P. E. Minor, New York.*) 4*d.*

This consists partly in the process of sizing paper and paper stock, by the use of mucilage extracted from Irish moss, in combination with resin sizing, the whole being precipitated on the fibre of the pulp by a solution of alum or sulphate of iron.

4802. MANUFACTURE OF WHITING, *W. Brothers, near Blackburn.—2nd November*, 1881. 2*d.*

This consists in mixing in suitable vessels caustic lime and water. The vessels are furnished with arms, dashers, or other appliances, which when set in motion thoroughly incorporate the atoms of lime with the water, and so completely shake them. Ordinary furnace gases arising from the combustion of coke, coal, or other substances yielding carbonic acid, or gases derived from other sources containing a sufficient quantity of carbonic acid, are then pumped or forced into the mixture through a hole or holes in or near the bottom of the vessels.

4803. KEELS, STEMS, &c., FOR SHIPS AND NAVIGABLE VESSELS, *W. Cooke and D. Mylchreest, Liverpool.—3rd November*, 1881. 6*d.*

The keel, stem, stern posts, and screw frames are made of cast steel.

4804. MANUFACTURE OF FILTERING PAPER, *S. H. Johnson, Stratford.—3rd November*, 1881. 2*d.*

This consists in the manufacture of filtering paper by mixing carbon with paper pulp and forming it into sheets.

4805. FLYERS FOR SPINNING, DRAWING, AND TWISTING WOOL AND OTHER FIBRES, *J. Murgatroyd, J. Croad, and S. Murgatroyd, Luddenden, Yorks.—3rd November*, 1881.—(*Not proceeded with.*) 2*d.*

The objects are to dispense with tubes and caps, obtain a higher speed, diminish the friction, and use less power to drive the flyers. Two arms on the wharle extend upwards, and on one of them is a sliding thread guide having a projection which enters a recess in the ring of the lifter rail, so that the latter slides the thread guide up and down the flyer arm; the wharle is loose on the spindle, there being a collar in the spindle to carry the bobbin. The two arms are connected at top by a hinged cross-piece.

4807. CONSTRUCTION AND PROPULSION OF SHIPS, &c., *W. R. Kinipple, Westminster.—3rd November*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the arrangement of the paddle-wheels.

4809. COMPOUND STEAM ENGINES FOR MARINE AND STATIONARY PURPOSES, *R. S. Boyer, Cardiff.—3rd November*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in so constructing marine and stationary compound steam engines—high and low-pressure—in such a manner that the cylinders—two or more—are all worked from and by one crank, the high-pressure cylinder being placed within the low-pressure cylinder, when the latter would be fitted with an annular piston with double packing rings, or the high-pressure cylinder may be placed side by side with the low-pressure cylinder, as is usually done.

4810. NON-CONDUCTING COMPOSITION APPLICABLE TO BOILERS, CYLINDERS, &c., FOR PREVENTING THE RADIATION OF HEAT, *L. Masche, Hamburg.—3rd November*, 1881. 2*d.*

The composition consists of infusorial silica, kisselguhr, guhr or fossil meal mixed with clay, and with a little horse or cow hair as a binding substance.

4811. APPARATUS FOR DISPLAYING CLOTHING AND OTHER ARTICLES IN SHOP WINDOWS, &c., *F. M'Ilvenna, Manchester.—3rd November*, 1881. 6*d.*

This relates to the manufacture of the horizontal rods or tubes used for displaying articles in shop windows, and also the corresponding notches in the supporting brackets of a square or other section, which will enable the rod or tube to slip into its notch, and when in the notch be incapable of rotation, and that will enable articles with correspondingly shaped notches to be placed therein, so that the shape of the notch and rod or tube shall prevent the article from turning upon the rod or tube.

4812. IMPROVEMENTS IN APPARATUS FOR USING ELECTRIC LAMPS IN LOCOMOTIVES AND OTHER VEHICLES, *H. J. Haddan, Kensington.—3rd November*, 1881.—(*A communication from W. de Busscher, Brussels.*)—(*Not proceeded with.*) 2*d.*

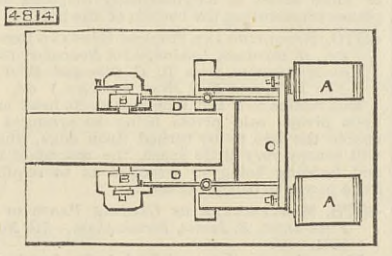
This invention consists of an electric lamp placed in front of the engine with a movable reflector, the current for which is generated by a dynamo machine driven from one of the axles of the engine wheels, by a belt and friction wheels.

4813. TIN ROLLERS FOR MULES FOR SPINNING. *W. Gledhill, Mossley, Lancashire.—3rd November*, 1881. 4*d.*

The object is to make tin rollers that will not slip or turn on their shafts, and so prevent "soft yarn" in spinning and the risk of fire caused by the slipping of the rollers. A slot is formed in the shaft longer at the base than at the opening, and a key is inserted therein and projects at each place where a roller coupling has to be fixed, a corresponding slot being formed in the boss of the coupling, which are provided with set screws to bind on the shaft. The tin is fixed to two or more couplings.

4814. STEAM ENGINES, *N. Macbeth, Bolton.—3rd November*, 1881. 8*d.*

This relates, First, to forming the main frame of horizontal stationary engines with one or more wrought metal stay pieces D placed parallel to the piston-rod, and connecting the crank shaft bearing B to a cross girder frame C, which connects the front ends of the two cylinders A in coupled pairs of engines and the front end of the cylinder and a side wall of the engine-house in a single engine. The specification also describes an arrangement for fixing the different parts of vertical engines. A second improvement



consists in placing the air pump at such a height above the level to which the overflow water from the condenser has to flow that the atmospheric pressure acting on the water at the open end of the overflow pipe cannot sustain a column of water sufficiently high to reach the pump. The pump draws air or vapour from the space in the condenser between the point of injection and the top of the column of water which balances the atmospheric pressure. The invention also relates to fly-wheels with their grooved peripheries for driving by ropes, and consists in forming the rim of a number of strips of metal secured to the main structure by suitable means.

4816. MANUFACTURE OF CANDLES, *L. A. Groth, London.—3rd November*, 1881.—(*A communication from L. C. A. and C. E. Motard, Berlin.*) 6*d.*

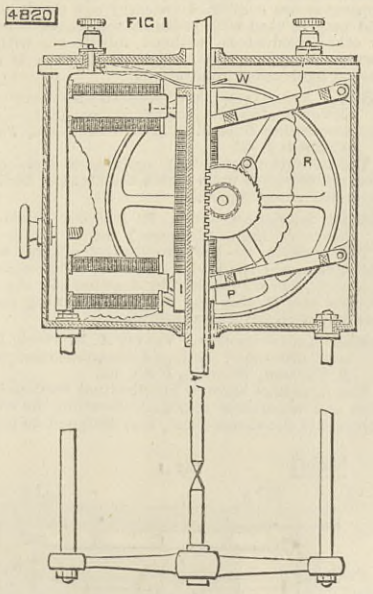
This consists in the combination of candle machine with a specially constructed cutting machine.

4817. SPOOLING APPARATUS FOR SEWING MACHINES, *L. A. Groth, London.—3rd November*, 1881.—(*A communication from R. Steiner, Austria.*)—(*Not proceeded with.*) 2*d.*

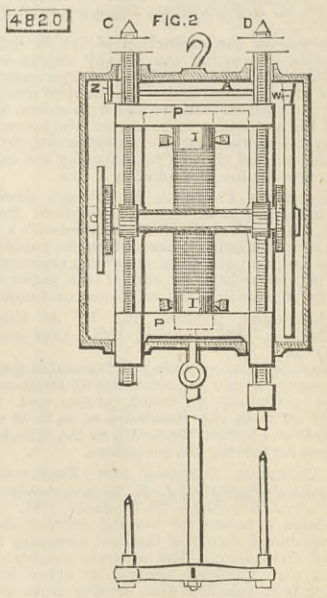
The spooling apparatus is made independent of the sewing apparatus, the driving pulley is separate from the fly-wheel, and a special self-spooling apparatus is described.

4820. IMPROVEMENTS IN ELECTRIC LAMPS OR REGULATORS, *W. L. Wise, Westminster.—3rd November*, 1881.—(*A communication from E. Bürgin, Basel, Switzerland.*) 6*d.*

This invention relates to a mode of regulating arc lamps with two sets of carbons, as shown in Figs. 1 and 2. When a current traverses the lamp, armature I is attracted, raising it and the two carbon holders with their support P. By this movement brake wheel R makes contact with spring W, which



prevents it rotating. Carbon C is not raised so far as carbon D, owing to the action of a spring lever A on D, which bears heavily against it, but only lightly against C. When the arc gets longer the current through the magnet gets weaker, armature I descends, the pressure of W on R lessens, the wheel rotates, until the arc regains its normal length, and wheel R is again held by W. When the first set of carbons are consumed the upper carbon holder passes below the plane of the spring lever A. As the arc increases in length the attractive power of the magnet diminishes, until the armature falls sufficiently low for A to pass below a fixed stop Z, and occupy a position in the other side of it, where it no longer bears against carbon holder D, which accordingly descends, completes the circuit, and the arc is again established between the



fresh pair of carbons. The patent also describes modification of the above lamp in which one pair carbons only are used. Fig. 1 shows a front elevation and Fig. 2 a side elevation of the lamp with two carbons.

4822. CHRONOMETRIC OBTURATOR FOR USE IN PHOTOGRAPHY, *E. G. Brewer, London.—3rd November*, 1881.—(*A communication from P. Boca, Paris.*)—(*Not proceeded with.*) 2*d.*

The obturator automatically produces the measurement of time of the sitting and the action of the opening and closing of the object glass or lens. A needle being placed on the division of a dial which indicates the duration of the sitting, it is only necessary to press on a detent for a first shutter to open a passage to the light, and a second shutter closes this passage after the period of exposure required has taken place.

4827. BRACELETS, *W. A. and W. J. Bancroft, Birmingham.—3rd November*, 1881.—(*Not proceeded with.*) 2*d.*

The object is to make the bracelets in such a way as to increase their flexibility and without the use of solder, and it consists in forming them of a number of plates hinged together by transverse joints, the two end plates being bent or formed so as to provide a suitable fastening.

4828. LOCKS, *W. S. Frost, Peckham.—3rd November*, 1881.—(*Not proceeded with.*) 2*d.*

In the box of the lock is fitted a pin or tube, on which is placed loosely one or more discs; the bolt is guided in the box by any suitable means, and is formed with a curve or curves thereon, into one of which curves a part of the circumference of the disc or discs take in order that the bolt cannot be pushed back without the key. The disc or discs have each a slot therein extending to their periphery, and the bolt has also a slot, so that when the key is inserted and turned it turns the disc or discs round, and the ward of the key takes into the slot in the bolt and pushes it backward or forward as the case may be, either to lock or unlock the other curve now fitting over the disc or discs on the bolt.

4830. BOATS TO BE PROPELLED BY GAS, &c., *W. R. Lake, London.—3rd November*, 1881.—(*A communication from J. L. Lay, Paris.*) 8*d.*

This consists, First, in the use in a boat whose movements are controlled by the agency of electric currents sent from a distant station, of a governing cylinder and piston, actuated so as to give by varying series of strokes the requisite motion to effect the required operations; Secondly, the use of apparatus by means of which a throttle valve or similar valve is controlled by the agency of electric currents sent from a distant station; Thirdly, the combination of parts consisting of a cylinder whose piston is controlled by electric current, which has connected with it ports, valves, and other devices, so as to control the various operations. Other improvements are described, including the coiling and paying out of the cable to transmit the current to the boat.

4831. SPRINGS, &c., *J. Tranfield, Sheffield.—4th November*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in improved appliances used with an ordinary steam or hydraulic press for bending a set of spring plates at one operation to their ultimate shape, and in improved appliances for conveying the bent spring plates from the press to the hardening tank and hardening them.

4832. HEATING FEED-WATER IN SURFACE CONDENSING ENGINES, *H. Dansey, London.—4th November*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in conducting the whole or a portion of the exhaust steam down to the bottom of the condenser, and then bringing it in contact with the condensed water in a suitable recess in the bottom of the condenser, which is so arranged that there always remains a ceil of water for the steam to impinge upon below the level of the air pipe suction.

4833. LOCKS, *H. J. Haddan, Kensington.—4th November*, 1881.—(*A communication from O. Flagstad, Norway.*) 6*d.*

The tube in which the axle of the latch moves is connected with the latch by an arm and intermediate lever, and the latch is guided by a shackle and block kept in position by a spring, which yields when the handle is depressed and the latch drawn back. The tube has a bottom provided with a square opening and grooves and notches crosswise to each other, while the handle has a corresponding number of tappets fitting into the grooves in the tube. A square pin threaded at its end fits into the opening in the bottom of the tube, and shifts the latch when the handle is depressed, and the handles are fastened to the ends of the pins by screws fitting into the threads, and to the lock case by rings and screws. The bolt can be secured in two positions by a tumbler with a projecting pin, which alternately fits into two notches in the bolt.

4834. INSTANTLY AND AUTOMATICALLY ATTACHING HORSES TO SHAFT VEHICLES, *H. Dickinson, Huddersfield.—4th November*, 1881. 6*d.*

The trace and the tug are connected, so dispensing with that part of the trace which is attached to the front part of the vehicle. The tug and the breech strap are then connected, so doing away with the breech strap round the shaft. The tug simply slides on the shaft, and is secured by a self-fastening catch, formed so that for either drawing or backing it performs the office of the ordinary trace and breech, thus being automatically secured and instantly released.

4835. SPRING SAFETY HOOKS, *J. Carter, Salford.—4th November*, 1881. 6*d.*

This relates to hooks in which a spring latch is employed to prevent the hook becoming uncoupled, and consists of means to prevent the hand being caught between the latch and the side of the hook when opening the hook. A metallic strap is hinged

to the latch and passes round to the back of the hook, where it is shaped so as to receive the hand of the attendant, who can thus open the hook without bringing his hand near the working part.

4836. EXTINGUISHING FIRE AND PREVENTING EXPLOSIONS OF GASES ON BOARD SHIP, *Lieutenant-Colonel the Hon. W. E. Fitzmaurice, Tipperary.*—*4th November*, 1881.

This relates to the extinction of fire in ships or buildings by exhausting the air, by means of air pumps from the holds, bunkers, compartments, or chambers of any kind, and when further necessary, by filling the vacuum thus created with steam, and by means of the air pumps to ascertain the presence of gas in any holds, bunkers, or compartments, or other stores, and to expel the gas therefrom by the said air pumps to prevent fire or explosion of gas.

4837. CIGARETTE PAPER, *J. H. Johnson, London.*—*4th November*, 1881.—(*A communication from E. A. G. d'Argy, Paris.*)—(*Not proceeded with.*) 2*d.*

This relates to means for preventing the paper sticking to the lips, and also from absorbing moisture, and consists in converting the end of the paper to be placed between the lips into vegetable parchment.

4838. LAUNCHES, BARGES, &c., *W. R. Kinipple, Westminster.*—*4th November*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in compressing inflammable gas to as high a pressure as can be conveniently obtained into reservoirs contained on board ships, and which gas is led off from the reservoirs so as to be mixed with the air and burned therewith in the cylinders of the engines for driving the propellers.

4840. CONCRETE SUITABLE FOR RECEIVING AN ENAMELLED SURFACE, *J. B. Spence, London, and E. Ormerod, Belvedere*—*4th November*, 1881. 4*d.*

This relates to means for making concrete slabs or articles capable of standing the heat necessary in the process of enamelling. The concrete employed consists of 1 part Portland cement or other binding material, 1 part calcined flint or slag from iron or copper works or other suitable material—ground to powder—which has been subjected to the action of fire and about 10 per cent. of red hematite also in powder, the whole being mixed in a dry state, and then water, crushed bricks, burnt ballast, breeze, pottery refuse, or other suitable material which has been previously subjected to great heat is added in the proportions of from one of ballast to one of cement, to three of ballast to one of cement.

4841. PIANOFORTE ACTIONS, *G. H. Brockbank, Camden Town.*—*4th November*, 1881. 4*d.*

This relates partly to the check, screwed or otherwise suitably fixed into the action butt; as near as possible to the working centre of same is a piece of bent wire or its equivalent to act as the check; the front lower end of the butt is bevelled at the same angle as the bevel on the top of the striker. The effect is to cause a more rapid check and release than is the case with ordinary check actions.

4842. ROLLING MILLS, *P. Jensen, London.*—*4th November*, 1881.—(*A communication from Schmidt Bros., Germany.*)—(*Not proceeded with.*) 2*d.*

This relates to improvements on patent No. 3736, A.D. 1880, for rolling iron and thin sections. Instead of or besides the hexagon preparatory rolls, octagon and oval rolls are also employed.

4843. LOOMS FOR WEAVING, *T. Singleton, Darwen.*—*4th November*, 1881.—(*Not proceeded with.*) 2*d.*

This relates principally to a weighing motion for the warp beam, no weights being required.

4844. CLEANSING AND PREPARING FIBROUS SUBSTANCES FOR THE MANUFACTURE OF PAPER, &c., *T. H. Cobley, Dunstable, and G. Tidcombe, jun., Watford.*—*4th November*, 1881. 6*d.*

This consists in cleaning all substances available for the manufacture of paper by passing it through a machine or apparatus for first washing and cutting the fibre, and then treating the same in a steam-jacketted or fire-heated vessel or engine having a triturating roller therein, and the engine itself has a cover to suppress or contain the form caused by the process.

4845. FLUSHING OR CLEANSING WATER-CLOSETS, &c., *J. H. Johnson, London.*—*4th November*, 1881.—(*A communication from T. Quinier, Paris.*)—(*Not proceeded with.*) 2*d.*

This consists in constructing the apparatus in the form of a reservoir with an internal syphon.

4847. PREPARING WOOL, COTTON, &c., *G. Little, Oldham.*—*5th November*, 1881. 8*d.*

This relates to the combination of movable coiler box or boxes having radial or sliding motion (from can to can) imparted thereto.

4848. LOCKS AND LATCHES, *H. Gibbons and A. Anthony, Hungerford.*—*5th November*, 1881. 6*d.*

This consists in constructing locks or latches with a bolt that is held in the locked or unlocked position by a stud in the lock box taking into a notch on its under side, the bolt being raised off such stud, and moved backwards or forwards by studs on a disc plate rotatable in the lock box by a handle, which studs take into other notches in the bolt.

4850. IMPROVEMENTS IN THE MANUFACTURE OF CARBON TO BE EMPLOYED FOR THE PRODUCTION OF ELECTRIC LIGHT, *C. J. Allport, London, and R. Punshon, Brighton.*—*5th November*, 1881. 2*d.*

The inventors immerse a thread of asbestos in a saturated solution of sugar or other saccharine matter, and carbonise the same by dipping the thread into a hydrocarbon and setting fire to it. This is the method of preparing carbons for incandescent lamps; for arc lights the asbestos is so disposed as to serve as a binding agent to prevent large pieces of carbon from breaking off.

4852. STEAM PLOUGHS, &c., *R. Grimmer, Walsoken.*—*5th November*, 1881.—(*Not proceeded with.*) 4*d.*

The implement consists of a main framing with three or more wheels, which serve to support the entire weight of the machine. Two of the wheels are disposed one on either side; one runs in the furrow, and the other on the unploughed land. The third wheel, which is at the rear, is made also to serve as a steering wheel; it is fitted into the frame so as to admit of it locking to any desired angle. One or both of the side wheels are driven by spur or bevel gear, or by means of an endless chain or other convenient arrangement of gearing from the crank shaft of the engine.

4854. IMPROVED MEANS AND APPARATUS OR APPLIANCES CONNECTED WITH THE PRODUCTION, THE STORAGE, AND UTILISATION OF ELECTRICITY FOR LIGHTING OR POWER PURPOSES, *J. B. Rogers, London.*—*5th November*, 1881.—(*Not proceeded with.*) 2*d.*

This relates to the production of electricity by means of a dynamo driven by the axle of the engine or any carriage of a train, which electricity is stored in receivers of special construction, and subsequently used to feed incandescent or other electric lamps.

4855. IMPROVEMENTS IN ELECTRIC LAMPS, *J. B. Rogers, London.*—*5th November*, 1881. 6*d.*

This relates to a form of arc or incandescent lamp constructed as follows:—The lower carbon is hollow, and of large section, the centre being filled with asbestos. The upper carbon can, it is claimed, be adjusted to touch the upper edge of the lower one, and so produce an incandescent light, or made to rest in the centre of the lower carbon on the asbestos, when an arc is formed. The inventor also claims a method of automatically making and breaking connection with lamps fixed on a chandelier or bracket, also methods of employing two or more carbons abutting on a single one to produce an arc light.

4857. DRYING, AIRING, OXIDISING, &c., FIBROUS AND OTHER MATERIALS, *W. R. Lake, London.*—*5th November*, 1881.—(*A communication from P. St. A. Basquin, Paris.*) 1*s.*

This relates to the employment of compressed, uncompressed, or rarefied air, oxygen, ozonised oxygen, chlorine, sulphurous acid, carbonic acid, ammonia, and other gases or vapours mixed or separately at a low or high temperature, in a dry state or in conjunction with aqueous vapour for treating fibrous and other materials.

4858. FIRE-BARS, &c., *F. Erskine, Manchester.*—*7th November*, 1881.—(*Not proceeded with.*) 2*d.*

This consists in constructing fire-bars in the form of a hollow rectangular box in cross section, the length-way of the bar being divided by partitions to form separate compartments or boxes.

4859. FIRE-GRATES FOR FURNACES, &c., *J. Adams, Sheepbridge, and J. Bonehill, Rotherham.*—*7th November*, 1881.—(*Not proceeded with.*) 2*d.*

The grate or set of fire-bars is so constructed that it can be lowered and turned partly round or completely revolved, the fire and coals being at the same time held up by a grid or false grate, which is inserted into the grate above the fire-bars.

4862. ASTRAGALS AND SASH BARS FOR CARRYING GLASS, &c., *J. Harley, Glasgow.*—(*Not proceeded with.*) 4*d.*

The sash bar is a combination of a core, and a system of sheet lead glazing is attached to the core.

4863. BRACELETS AND SCARF-RINGS, *H. Allsop, Birmingham.*—*7th November*, 1881. 4*d.*

This refers, First, to an improved spring action for opening the parts of band bracelets and rings; and, Secondly, to improved forms for such bracelets and rings.

4866. IMPROVEMENTS IN VOLTAIC OR GALVANIC BATTERIES, *T. Coad, Finsbury.*—*7th November*, 1881. 6*d.*

This relates to a battery in which the carbon electrode is formed of a number of carbon plates separated by pieces of carbon, the whole being connected by carbon bolts and nuts. This gives greater surface for the negative electrode. The inner or porous cell is provided with a discharge spout, as also is the outer one. The porous cell is hermetically sealed, and the space between it and the outer cell is closed by a removable cover fitting liquid-tight. Each cell is provided with an opening and stopper for charging.

4867. A NEW OR IMPROVED CABINET FOR VOLTAIC OR GALVANIC BATTERIES, *T. Coad, Finsbury.*—*7th November*, 1881. 6*d.*

This invention relates to a cabinet for holding batteries, provided with doors at the ends, as well as front and back, so as to facilitate inspection of the cells; the latter are fitted on to slides working in grooves, and provided with hinged frames, so that a cell can be slid out and turned over so as to drain its liquid away if required. The specification is accompanied by drawings of the cabinet.

4868. SHIPS FOR INLAND AND OCEAN NAVIGATION, *J. Dickie, London.*—*7th November*, 1881. 6*d.*

This relates to the construction of ships, &c., provided with air ducts or passages communicating between the atmosphere and the under surface of one or more series of longitudinally disposed inclined planes constituting the bottom of the hull.

4870. REVOLVING AND FOLDING BEDS AND BEDSTEADS, &c., *H. Gardner, London.*—*7th November*, 1881.—(*A communication from D. C. Otis and C. G. Clark, New York, and E. C. Hine, Brooklyn.*) 6*d.*

This relates to a bed mounted at its head and foot upon pivots, said pivots being so arranged as to enable the bed to be turned upon edge, whereby it will occupy very little space, the weight of the bed and bedding being so arranged as to require very little power to balance them.

4873. MANUFACTURE OF CERTAIN PARTS OF SMALL FIRE-ARMS, *E. James, Birmingham.*—*7th November*, 1881. 8*d.*

This refers to the combined body, break-off, and tang of breech-loading small fire-arms, and to the fore end iron of breech-loading small fire-arms, and to the tang and break-off of muzzle-loading small fire-arms.

4876. VENTILATING MINES, &c., *W. Teague, Illogan, Cornwall.*—*8th November*, 1881. 1*s.*

This consists in causing draught or exhaust by means of a current of compressed air carried into a larger pipe or cylinder, and the drawing and propelling of smoke and noxious fumes.

4877. PICKLING AND COATING STEEL AND IRON PLATES WITH TIN, &c., *T. H. Cobley, Dunstable, and C. Moncton, Harefield.*—*8th November*, 1881. 4*d.*

This consists in a method for preparing a pickling for steel and iron plates and coating them with tin and its alloys. Two kinds of solutions are employed, the one acid and the other alkaline.

4883. A NEW OR IMPROVED ELECTRO-PNEUMATIC APPARATUS FOR WINDING AND REGULATING CLOCKS, *M. Bauer, Paris.*—*8th November*, 1881.—(*A communication from C. A. Mayrhofer and W. Otto, Paris.*) 8*d.*

This invention consists of the combination of a central clock and an electric distributor, which at certain intervals, regulated by the central clock, sends out into electric conductors in various directions electric currents of short duration; also an electro-pneumatic relay for receiving the current arriving from the central clock, which relay sets in motion a pneumatic apparatus in accordance with the electrical impulses received; also a group normal clock, as the inventor terms it, which is kept in corresponding time with the central clock by the pneumatic apparatus; also a three-way air cock opened and shut by the last-mentioned clock; and, finally, ordinary clocks which are wound up and regulated by the compressed air immediately the three-way cock opens. The above apparatus are combined to carry out the invention, and may be used with ordinary telephone, telegraph, or other conductors, without interfering with their services in other ways. The specification is accompanied by detailed illustrations.

4887. APPARATUS FOR AERIAL NAVIGATION, *E. Edwards, London.*—*8th November*, 1881.—(*A communication from J. C. Ribeiro de Souza, Paris.*)—(*Complete.*) 6*d.*

The invention consists in applying to aerial navigation the principle upon which the flight of birds with extended wings depends.

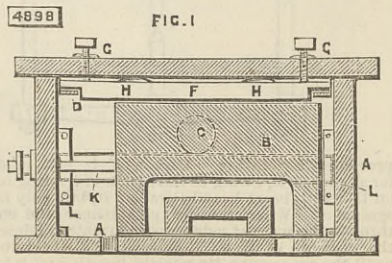
4888. SULPHURIC ACID, *T. Richters, Breslau.*—*8th November*, 1881.—(*Complete.*) 4*d.*

This relates to the process by which, without enlargement of the leaden chamber, the production of sulphuric acid is increased by drawing and circulating the gas, and in this way intimately mixing the more weighty with the less weighty gas.

4898. BALANCED SLIDE VALVE, *A. M. Clark, London.*—*8th November*, 1881.—(*A communication from W. B. Turman, Waldron, U.S.*) 6*d.*

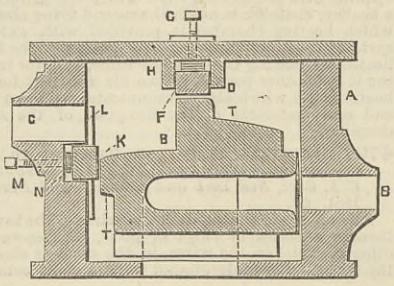
The drawings show a longitudinal sectional elevation and transverse sectional elevation, in which A represents the steam chest, &c., designed to be set on

4898 FIG. 1



the steam cylinder, and to have its ports A A correspond with those in the said cylinder at either end thereof, whereby steam may be supplied and exhausted. The said chest A is provided on one side with a steam supply port B, and on the opposite side with a steam exhaust port C, and on the inside of its top or cover along the central line thereof is fixed a box D, in which is a packing strip F that is adjusted by set screws G G, and half elliptic springs H H against the valve B to regulate the pressure of the latter on its seat. On the inside of the exhaust side of the steam chest A there is another packing strip K, adjustably held in braces L, and pressed by set screws M and half

4898 FIG 2



elliptic springs N against the valve B, to hold the latter with any desired pressure against the steam supply side of the chest A, to prevent leakage thereabouts with the said chest A; T T are longitudinal ridges on the top and one side of the valve B for the packing bars or strips F K to bear against.

4902. BRIDGES, AQUEDUCTS, VIADUCTS, &c., *J. F. Smith, Leicester.*—*9th November*, 1881. 6*d.*

This consists in forming cylinders of iron or steel, or a combination of both materials, of suitable diameter and length, and sinking them so as to lie in the bed of the river with their axes parallel to the stream, one half or thereabouts being under water, and the other half above the water. The upper parts of the cylinders may be connected together by suitable girders so as to form the roadway.

4903. MANUFACTURE OF BOOTS AND SHOES, *H. Dickson, Leicester.*—*9th November*, 1881. 6*d.*

This relates more particularly to improvements in elastic side boots and shoes, the object being to provide a boot having no perpendicular seam up the back.

4906. MULES AND TWINERS, *J. Chisholm and J. Clegg, Oldham.*—*9th November*, 1881. 4*d.*

This relates to the driving of the cam, backing-off, and taking-in motion shafts of mules and twiners, and it consists in the application of a tightening pulley to secure the requisite tension of the ropes or straps employed.

4919. NECKTIES OR NECK SCARFS, *C. B. Ketley, Smethwick.*—*9th November*, 1881. 6*d.*

The object is to make the essential parts of the neckties or neck scarfs, that is, the knot and side pieces, of one piece of fabric, capable of being readily separated from the foundation and band, and of being readily replaced.

4937. SPRING HINGES AND DOOR SPRINGS, *F. R. Baker, Birmingham.*—*10th November*, 1881. 6*d.*

The flaps and knuckles of the hinge are made in the ordinary way, but at the middle of that flap of the hinge which is to be affixed to the door is made a spring tongue. This spring tongue is made by preference in one piece with the flap, and is situated at the back of the flap, and is bent forward, so as to project beyond the knuckles of the hinge.

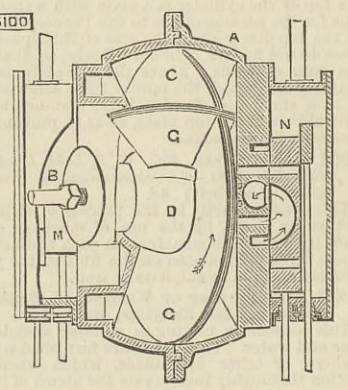
4967. PHOTOGRAPHIC CAMERA OBSCURAS, &c., *A. Pumphrey, Birmingham.*—*12th November*, 1881. 6*d.*

The object is to facilitate the practice of dry-plate photography, and consists in improvements in photographic camera obscuras and apparatus used or connected therewith, whereby dry photographic plates or films may be conveniently carried and stored, and in succession exposed to the action of the luminous image of the camera.

5100. ROTARY ENGINES, *J. Patten, San Francisco.*—*22nd November*, 1881. 6*d.*

This relates to a rotary engine in which the chamber of the cylinder is divided diagonally by a rotating disc and transversely by one or more pistons which bisect the disc and move through it from side to side as the two revolve together, so that the disc divides the chamber into two compartments, unto and from each of which steam or other working fluid is supplied and

5100



exhausted independently of the other, while it acts against the same piston or pistons in both compartments. A is the cylinder, B the engine shaft on which the disc C is placed diagonally across the interior of the cylinder. In the centre of the disc an opening is formed and receives a portion of a hollow sphere D. The pistons G work in slots in the disc, and are connected by a bar secured to shaft B. Suitable valves are worked by excentrics on the shaft B and control the admission and exhaust.

5263. MANUFACTURE OF TEXTILE FABRICS SUITABLE FOR SACKCLOTH, &c., *C. D. Abel, London.*—*1st December*, 1881.—(*A communication from F. Schmalbien, Cologne.*) 8*d.*

This relates partly to an improved manufacture of textile fabric having a warp consisting of spun yarn or thread and a weft consisting of the unspun stalks of flax, hemp, nettles, and such other fibre-bearing plants, the fibre of which has heretofore always been extracted from the plant and used in a spun condition for woven fabrics.

5393. HOLLOW PROJECTILES, *H. R. Brandon, Paris.*—*9th December*, 1882.—(*A communication from B. B. Hotchkiss, Paris.*)—(*Complete.*) 4*d.*

This consists in the use of a fuse-containing plug of a novel construction, whereby the pressure of the gases at the time of the explosion acts laterally on the same, thereby insuring its resistance to being blown out of the shell, and consequently the bursting of the shell.

5440. SECTIONAL WARPING AND BEAMING MACHINES, *J. C. Sewell, E. Hulton, and J. Bethel, Manchester.*—*13th December*, 1881. 6*d.*

The object is to secure a uniform rate of speed for the yarn while being wound upon the section, and it consists of a face-plate on one end of the driving shaft, and parallel to which is a shaft with a feather, and rotating in two bearings, one movable round an axis perpendicular to its axis, while the other can be moved nearer to or further from the face-plate. At the end of the shaft near the swivel bearing is keyed a driving pulley, and between the bearings is a friction pulley fitting the feather, and provided with a groove in its boss with which a forked lever engages, the length of the lever being the same as that of the presser shaft from the front of the presser to the fulcrum or presser shaft, and it is fixed on the latter immediately under the shaft carrying the friction pulley.

5580. BAGS AND LIKE CASINGS EMPLOYED TO CONTAIN FERTILISERS, &c., *C. E. Buck, Wilmington, U.S.*—*20th December*, 1881.—(*Complete.*) 4*d.*

This relates to means for preventing the rotting of sacks used for containing fertilisers, and consists in saturating the material of which they are composed with a silicate solution, such as silicate of soda or silicate of potash.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

257,872. UMBRELLA OR PARASOL, *Alphonse Iehl, Mazamet, France.*—*Filed March 2nd*, 1882.—*Patented in France, August 20th*, 1881; *in England, December 6th*, 1881; *in Belgium, December 23rd*, 1881; *and in Austria, December 27th*, 1881.

Brief.—The lock is fixed to the stick and serves as a

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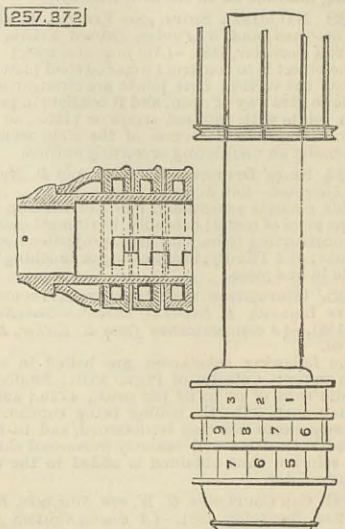

permutation lock for the runner and as a temporary holdfast for the same.

258,022. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES, *Charles A. Cooley, New Britain, Conn.*—*Filed March 14th*, 1882.

Brief.—The commutator bars are carried by, but insulated from, flanges mounted on the shaft of the machine. The armature wires are connected to the outer ends of these bars through the hollow shaft, and removable wearing plates are fastened to the bars by screws. *Claim.*—(1) In commutators, the flanged hubs

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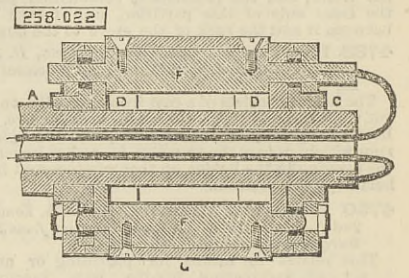

C, insulating washers D, rods F, and copper segments G, combined on the shaft A, substantially as described. (2) The recessed insulating washers D, in combination with the flanged hubs C of a commutator, substantially as described. (3) In commutators, the rods F, having enlarged middle portions, in combination with the flanged hubs C and washers D, substantially as described.

CONTENTS.

THE ENGINEER, June 9th, 1882.