THE MANCHESTER SHIP CANAL.

No. I.

THE Manchester public are, as our readers are aware, at the present moment much concerned regarding the project for uniting their city with the sea by means of a ship canal, and a Bill will be promoted in the next session of Parliament with the object of carrying the project into effect. We have already dealt with the scheme at some length, but as time lapses the project becomes more developed, and demands further consideration.

In giving an outline of the undertaking, it will be necessary to refer at some length to what has already been accomplished to place Manchester in water communication with the sea. But before doing so it will be well to allude to the physical features of the district of which Manchester may be regarded as the centre.

The rivers Mersey and Irwell drain an area of 918 square miles, enclosed by a watershed of about 25 miles in diameter. The drainage basin is of a horseshoe form, being surrounded for about three-fourths of its extent by hills, and opening at the western end to the sea. The general direction of the river Irwell is from north to south, whilst the Mersey proper runs from east and south towards the west. The two rivers unite at a point about half-way between Manchester and Warrington, and from the point of junction to the sea below Liverpool, the river —which receives below Warrington a number of smaller streams—is known for purposes of navigation as the Mersey. Both streams take their origin in high ground, for the most part consisting of the coal measures. The discharge from both is very rapid during the upper part of their course, but it becomes sluggish, and the course of both streams is exceedingly tortuous in the lower reaches. The consequence is that, during periods of heavy rainfall, considerable quantities of detritus are deposited below Warrington and Runcorn, and the lands along the rivers are extensively flooded; a remedy for this, it is expected, will be found in the construction of the projected canal. It has been disputed by at least one able authority, the late Mr. Palmer, whether the deposits in the estuary of the Mersey, below Runcorn Gap, were or were not due to the silt carried down from the Millstone Grit Hills; but in view of the delta formations which characterise almost all great rivers, there cannot be any doubt that much of the silting in the estuary of the Mersey is due to the degradation of the valley above by the rivers. Indeed, careful observations of these rivers, made during heavy floods, testify to the presence of quantities of suspended mineral matter, so large that, were the material not carried out to sea, it must, in the course of a very few years, completely fill up the channel of the river in the lower reaches.

As it is, the estuary of the Mersey between Runcorn and Liverpool, and indeed the river channel between Runcorn and Warrington, is constantly liable to shifting deposits of silt, which operate as a hindrance to traffic, except at periods of high tide. The low-water channel of the Mersey constantly changes from one side of the estuary to the other, sometimes completely breaking away from the ordinary line for a distance of half-a-mile; and it would appear that nothing but training the river with substantial walls can ever control its shifting tendencies and secure an approach of sufficient depth to Runcorn Gap and Warrington. It will be necessary to make further reference to the works which are proposed to be carried out for the training and control of the river, but it may here be surmised that the Liverpool Harbour authorities will regard with somewhat of suspicion and jealousy any operation that may be undertaken in the estuary. It is maintained, and with some reason, that the tidal scour at Liverpool, where the estuary is narrower than it is above Garston, is to a great extent maintained by the storage which the estuary affords, and that the scour produced by the impounded water is essential for the maintenance of the requisite draught of water below Liverpool.

It was not until the time of the restoration of Charles II. that the Mersey came to be recognised as possessing any degree of importance for purposes of commerce. At that time the traffic was limited to a small trade, which was carried on with Ireland, France, and Spain. At the beginning of the eighteenth century, however, the manufacturing industries of South Lancashire gave an impulse to Liverpool, and in 1709 the first dock was constructed. The Bill, which was promoted by the Corporation of that date, set forth, amongst other matters relating to Liverpool, that "it hath by long experience been found to be of great importance for advancing her Majesty's—Queen Anne—service and revenue and trade in general, and for breeding and employing great numbers of skilful mariners and seamen." The development of trade was but gradual, and it was not until 1730 that it became sensibly stimulated through the encouragement of Parliament by the slave trade. This traffic grew rapidly. The ships usually sailed from Liverpool to the west coast of Africa; they there shipped a cargo of slaves, which they took direct to the West Indian Islands, and the vessels returned to Liverpool laden with sugar and such other commodities as the islands afforded. The imports, the principal of which was sugar, gave rise to new industries, and it is notorious that never since the slave traffic commenced has Liverpool materially retrograded. It became, in fact, the port and entrance for the north-west of England, and continues so almost without competition to the present time. It was only to be expected that the people of Manchester should have regarded the Mersey and Irwell as being the natural course by which traffic should be conducted between their town and the sea; and in 1714, nearly a century and a-quarter before the completion of the Manchester and Liverpool Railway, a Bill was promoted in Parliament for "making and keeping the Mersey and Irwell rivers navigable and passable for boats, barges, lighters, and other vessels from Liverpool to Hunt's Bank, in Manchester." This Act gave the Board of Commissioners intrusted with its administration power to enlarge and straighten the river; to build bridges, sluices, locks, and weirs; to pull down, alter, and demolish any existing mills, weirs, or other obstructions. The Act contains certain provisions intended to preserve the interests of riparian owners of property against any flooding that might arise from the construction of locks and weirs on the river; but these provisions do not appear to have been taken advantage of, judging from the extensive flooding which at present occurs, and which must unquestionably have been enhanced to a considerable extent by the erection of the weirs on the river. In the year 1794 the undertakers were incorporated by Act of Parliament under the title of the Mersey and Irwell Navigation Company, and acting on the powers conferred by their Act, the company carried out certain works for the improvement of the river Mersey as far as Irlam, and of the Irwell from its junction with the Mersey as far as Manchester. It was evidently not thought at the time that the navigation was completed that the provisions which the Mersey and Irwell Company had made were sufficient to meet the requirements of the traffic from Manchester to the sea-board, for in the session 1758 and 1759 the Duke of Bridgewater applied to Parliament for power to make the first of English navigable canals—that from Worsley to Manchester—and the following year he obtained a second Act for the extension of the canal. In 1772 passage boats had commenced plying between Manchester and Warrington, and at the beginning of the following year the navigation was completed to the sea at Runcorn, though not by sea-going vessels, certainly by boats and barges, which appear to have been for the time sufficiently well suited to the requirements of the Manchester trade. Whilst there were three distinct interests in competition—the Bridgewater Canal, the railway company, and the Mersey and Irwell Navigation, or, as it was called, the old Quay Company—the people at Manchester had no reason to complain of the rates of carriage being excessive; on the contrary, they were hardly sufficient to remunerate the companies; but after a while a coalition became established between the three carrying companies, which, as might have been expected, resulted in the raising of the rates of carriage of goods to and from the sea-board. In 1844 the Bridgewater Trustees purchased the Mersey and Irwell Navigation, and subsequently the Irwell and Mersey Navigation, as well as the Bridgewater Canal, were sold to the present Bridgewater Navigation Company, Limited.

In 1840, the question of further improving the rivers for navigation by ships was strenuously advocated, and a very important *conversazione*, as it was called, extending over four days, was held at Manchester for the purpose of discussing the question to the fullest possible extent. The highest ambition at that period appeared to reach no farther than getting vessels of 400 tons to Manchester; but there was a complete consensus of opinion amongst the engineers assembled that such a scheme was not only practicable, but was calculated to prove remunerative to the promoters. Several engineers of eminence advocated the scheme, including the names of Hawkshaw, Palmer, Bateman, Buck, and Fairbairn, any one of whom would have commanded a respectful hearing. There is nothing to show why this scheme failed of accomplishment; all that is certainly known is that nothing was done, and up to the present time little improvement has taken place beyond the dredging of the rivers, which operation has been attended with but indifferent result. Indeed, the alteration effected in the river bed by a flood which occurred in the Irwell about two years ago was so considerable that the traffic was entirely suspended for about six months, and at the present time it is very trifling.

For about ten years past the ship canal project, under a new form, has presented itself spasmodically before the Manchester public, several different persons claiming credit for the idea of connecting Manchester with the sea. Mr. Hamilton Fulton, C.E., has done much to advance the question and to keep it before the public, and he appears to have been the first to suggest that the object should be accomplished by making a level cut, without locks or other obstructions, from Runcorn to Manchester; in short, to bring the salt waters from the Irish Sea up to the docks at the terminus, and make a level course for vessels of large tonnage up to the point where the cargoes would be delivered direct from the ship's hold into the warehouse.

Mr. Fulton's canal would have been "a practically straight and newly-excavated channel, with passing places constructed at intervals of every three or four miles," and the traffic would be worked similarly to the way in which it is managed on the Suez Canal. The channel below Runcorn it was proposed should be trained so as to secure a scour by the ebb and flow of the tide and the discharge of upland waters. The depth of water at the docks in Manchester was intended to be 22ft., which, with the extra depth of 15ft. which it was assumed would be occasioned by a spring tide, would bring the total depth to 37ft., a depth which it was hoped would be secured in the canal, as the minimum at high water of spring tides. It was expected that at low water spring tides there would be a minimum depth of 22ft.

The height of the ground at Manchester where it was proposed to construct the basin is 70ft. above the mean sea-level, so that the depth of the canal would constantly increase from the sea upwards, until, at the Manchester extremity, the bottom would be 90ft. below the surface of the ground at the site of the basin.

It is not necessary here to refer to the expedients which were suggested for overcoming certain difficulties—for example, the railway crossings, and the aqueduct which carries the Bridgewater Canal over the Irwell—as these points will be referred to in describing the alternative scheme of Mr. E. Leader Williams, which we propose to do in another article.

SOCIETY OF ENGINEERS.—The annual dinner of the Society of Engineers will take place at the Guildhall Tavern, Gresham-street, on Wednesday, the 13th December next, at six o'clock, p.m.

KING'S COLLEGE ENGINEERING SOCIETY.—At a general meeting of this society held on Thursday last, the 23rd of November, Mr. Llewellyn B. Atkinson read a very interesting paper on "The Transmission of Power by Electricity." There was a good attendance of members. The next meeting will be the terminal business meeting on December 7th.

THE SPEZZIA ARMOUR-PLATE EXPERIMENTS.

No. II.

THE carriage of the gun which had been constructed for the lighter charges at first contemplated and had fired about 200 rounds, many with the over charges, was now found to require a new bush to a recoil valve of the recoil press. This being attended to, firing was continued on Monday, November 20th.

Round 5 of the series was fired with the same weight of charge and nature of projectile used against Schneider's plate in round 4, that is, a charge of 217 kg. (478 lb.), and a 2000 lb. projectile of Gregorini chilled iron; initial velocity, 478 m.; striking velocity, 476·6 m. (1564ft.); stored-up work, 33,910; work per inch circumference, 612·0 foot tons; perforation of wrought iron, 25·17in. The projectile struck the bull'seye, producing the effect shown in Fig. 12. The plate was split into six main fragments—five are shown in Fig. 13—which were all dislodged except No. 5, which remained supported by two bolts. There was one fragment which fitted on the back of No. 4 which is not seen here; it is shown in Fig. 12. The shot apparently had not penetrated to any great depth, but had broken the plate. Its head detached itself, *vide* Fig. 18; also the head of the previous round, *vide* Fig. 17. The wood backing in the centre was split and torn; the side frame pieces were thrown outwards at the bottom ends. At the back, beams 7 and 8 numbering from the top were badly broken and forced back, besides many bolts were dislodged. The plate bolts were snapped or drawn, with the exception of the two shown in Fig. 12 holding up piece 5.

Round 6 was fired with similar projectile and charge :—Muzzle velocity, 479·4 m.; striking velocity, 477·0 m. (1565ft.), giving stored-up work of 33,960 foot-tons, 613 foot-tons per inch circumference, and a perforation of wrought iron of 25·19in. The effects are shown on Figs. 14, 15, and 16. The shot did not penetrate the plate, but bulged it, *vide* Fig. 16. It brought down the entire plate, however, snapping or drawing all bolts. In the back No. 6 beam from the top was broken and some others started and split.

The seventh round was fired on November 21st at Schneider's plate, against which it was decided to try the effect of a Whitworth forged steel projectile. The charge was 217 kg. (478 lb.), the projectile weighed 942·5 kg. (2078 lb.). The initial velocity was 471·4 m., the striking velocity 468·8 m. (1538ft.), giving a total striking energy of 34,080 foot-tons, or 615·1 foot-tons per inch circumference, equal to the perforation of 25·23in. of wrought iron. The gun was aimed at the upper right-hand portion of the plate and struck it, producing the following effects: —The portion of the plate struck was broken up, some fragments being driven into the backing, *vide* Fig. 19, and part driven a little to the right, the right-hand frame being thrown aside and left hanging by its bolts nearly drawn. The top frame was thrown to the front, so as to hang over the face of the target. A part of the plate was brought down by the shot, which rebounded and lay in front, *vide* Fig. 19. This shot was set up as shown in Fig. 20, the extreme point being broken off. The original length of this shot was about 44½in.; it was set up to a length of 28in. The impression of the head and point was left on a curiously shaped piece of steel shown in Figs. 21 and 22, which was purple and blue with heat, as were two other pieces of steel plate lying close to the shot, shown in Fig. 23. We notice these details particularly, because in the contact of steels of such excellent quality we need to note every indication of the enormous shock that must undoubtedly have been produced. The wood backing was rent and split, as seen from the front of the target. At the back the horizontal beams 3, 4, 5, 6, 7, 8, and 9 from the top were seen to be broken and split; some of the upper tiers of beams were lifted with the top frame. The effects are roughly shown in the small sketch—Fig. 24—taken from the bank at one end of the target. One large plate bolt was driven far out. The entire broken portion of backing beams projected about 4ft., and long splinters much farther. Since the firing we have been informed that this projectile was not a Whitworth, but one of Terre Noire manufacture sent over from San Vito by mistake. It certainly resembled Whitworth's very closely, having a point inserted, and behaving very differently from the competitive Terre Noire shot supplied to England.

It was thought that if the target props were looked to the effect of one more shot might be tried with advantage, and for this purpose a cast steel Italian projectile was selected. The same charge, 478 lb., was employed. The projectile weighed 952 kg., with gas check 963·5 kg. (2124 lb.). The striking velocity was 461 m. (1512ft.). This gave a total striking energy of 33,670 foot-tons and 607·7 foot-tons per inch circumference, equivalent to the perforation of 25·08in. of wrought iron. The gun was aimed at a bull'seye made on the left top portion, but the shot did not strike as accurately as usual, a portion of the bull'seye being visible after impact—*vide* Fig. 25. The shot thus struck the portion of plate close to the edge, driving it over as shown in Fig. 25, the shot burying itself in the backing. The natural effect of such a shot was to render the whole structure a wreck. On approaching the target there appeared to be a kind of broken palisading hiding the lower part of it, which consisted of the top frame, which was dislodged, and fell down in the position shown in Fig. 26. The condition of the backing, which was reduced to a complete wreck, is also shown here. Eventually the shot was extracted, and found to be broken. It had received a more severe blow than was probably supposed by most of those present. The posterior fragments appeared to be of inferior quality, but the fracture and appearance of the head was very good—*vide* Figs. 27, 28. This is due, no doubt, to the fact that this projectile had been tempered in oil as far as the head extends. Another shot point—Fig. 29—was found incidentally in front of the targets, but it is difficult to say exactly to which Gregorini projectile it belonged. We regard it as an unsatisfactory fragment, because it is not a characteristic

one, and implies, in our judgment, a less good break up than is usual in these shot.

This last round concluded the series of plate experiments. We do not make a practice of recording the names of visitors, however distinguished. It may, however, be noticed that the experiments were conducted under the direction of Admiral Albini, the Director of Naval Ordnance; Admiral Racchia, President of the Experimental Committee, with the assistance of that committee and Admiral Franklin Martin, the Superintendent of the Royal Arsenal, Spezzia. Representatives attended from foreign Powers, including England, especially the Admiralty. Elswick, Cammell's, Brown's, and Schneider's firms were also well represented.

We may add that experiments commenced with the 100-ton breech-loading gun on Nov. 21st, on which it fired its first blank round. The firing and behaviour of both gun and carriage is reported as most satisfactory. With a 661 lb. charge and 2005 lb. shot a velocity of 1676ft. was obtained, and 39,050 foot-tons energy, with only 12·5 tons pressure. With 776 lb. and 2000 lb. shot the velocity was 1834ft., implying a total energy of 46,640 foot-tons.

In our first report on Spezzia trials, the hair crack in Fig. 7 Schneider's plate beneath the words "first shot" is an error. Also the equivalent weight of 149 kg. given as 320·85 lb., should be 328·5 lb. For more ready reference we give herewith a table of charges, velocities, &c., of the M.L. gun.

No. of round.	Charge, weight of.	Projectile, weight of.	Initial velocity, metres.	Striking velocity. Metres.	Striking velocity. Feet.	Stored-up work, foot-tons.	Work per inch circumference, foot-tons.	Equivalent perforation of wrought iron, inches.
1	149 kg. (328·5 lb.)	907 kg. (2000 lb.)	377·5?	371·5	1219	20,600	371·7	19·3
2	,,	,,	377·8	375·5	1232	21,050	379·8	19·5
3	,,	,,	374·8	372·5	1222	20,710	373·8	19·3
4	217 kg. (478·3 lb.)	,,	476	474	1555	33,500	605·0	25·0
5	,,	,,	478	476·6	1564	33,910	612·0	25·2
6	,,	,,	479	477	1565	33,960	613·0	25·2
	,,	942·5 kg. (2078 lb.)	471·4	468·8	1538	34,080	615·1	25·2
8	,,	963·5 kg. (2124 lb.)	464	461	1512	33,670	607·7	25·1

It is almost necessary to review these experiments in immediate context with the above description with its drawings; we therefore will at once do so in preference to taking up the matter in a separate article. The general character of the experiments reminds us of those conducted at Spezzia in 1876. There was the same strictly comparative trial, each maker's plate being subjected to the same test, round after round, and we may add that these experiments, like those of 1876, are likely to be very important in their influence on the armour of other nations as well as that of Italy. Whatever may be said to the contrary, there is no doubt that the Spezzia experiments of 1876 were the immediate cause of steel coming into our own armour instead of wrought iron. To consider the chief points in succession.

Plates.—Messrs. Schneider are to be congratulated on the wonderful plate they have brought forward on this occasion. After receiving 122,300 foot-tons energy there remains a considerable portion of the plate and a considerable measure of protection on a great part of the target. Having said so much, however, we must examine the question very carefully, in order to make a fair comparison between the plates of different makers. We noticed before the experiments began that Messrs. Cammell and Brown wished to say that their plates were not sufficiently rolled, and specified by how much they considered the process incomplete. Apart from this, in our opinion, the trial was one in which a "prize fighter" was matched against a "sailor." That is to say, Schneider's plate was one which was made for this particular trial, not for service. We will notice three particulars in which the Schneider plate had a great advantage:—(1) The number of bolts; (2) the arrangement of bolts; (3) the tempering of the plate. As to the number of bolts, we are informed that a paper was originally sent to the firms supplying the plates, in which a backing was specified, that only allowed of three vertical rows of bolts. Messrs. Cammell and Brown on this fixed their six bolts. Messrs. Schneider, however, objected to the paucity of bolts, and so the backing was altered to meet their requirement. Messrs. Cammell and Brown might undoubtedly have done the same. They may be considered to blame for not doing so. Our business, however, is not to review the makers, but their plates, and it is obvious that these are made to appear at a great disadvantage when the bolts are so few that fracture causes the pieces to fall down in front of the target, instead of being still held up as in the case of the Schneider. The Italian Committee may undoubtedly give the proper weight to this, but it is necessary to point it out to readers who are not in their position. (2) The distribution of bolts in the Schneider plate is very peculiar. A diagram was sent to the firms concerned, of which we have a copy in our possession, on which is drawn the plate and the points to be struck, with dimensions. We have shown the back of the Schneider plate with position of bolts (in Fig. 11 first article); the front of this plate is shown in Fig. 30 as if it were transparent, showing the bolt holes through it, the dotted circles being the spots marked to be struck. The bolt holes, it will be seen, are in irregular positions, obviously adjusted to meet the case of the three blows specified. This then is not a service condition. (3) With regard to the temper. The plate was made in a peculiar manner. We have already said that we have but little authentic information as to details. We understand, however, that it was hammered—not rolled—down from a thickness of 7ft. to its present thickness of 18·9in., and the front then tempered in oil. We are informed that plates so treated, while they improve greatly in quality, become slightly contorted, and we are told that the second plate of Messrs. Schneider, which was lying on the ground, showed evidence of this. It is said to have measured only 462 mm., or 18·2in., instead of its full 18·9in. in thickness at the ends, and that it thus projected slightly in the face; and it is suggested confidently that it had warped from the true position shown in an exaggerated way by the lines A A, C C, in Fig. 31 to that shown by B B, D D, and that in order to fit fair on flat backing, the portion between C C and D D had been removed, leaving the plate bounded by the fires B B and C C. This, no doubt, leaves the plate practically uninjured for this particular experiment and beautifully tempered, but it is not a service condition. Even in a flat face of plate it would be objectionable, but it is urged that on a turret it could not be carried out; in fact, that it would be impossible to treat curved plates of any form in this way, and that as a matter of fact every single plate on the Italia is a curved one. Consequently Cammell must supply untempered plates, and these compare with highly-tempered ones at a great disadvantage. We do not give these statements as to thickness on our own measurements, having only been informed of this too late to verify it; but the plate is on the ground, and the statement admits of verification by those on the spot. As to the behaviour of the compound plates, the fracture of the iron would probably have been better had there been more rolling. We have noticed already one peculiarity in them, namely, the existence of concentric cracks, which have already attributed to a bend back of the plate—*vide* Fig. 32—while Schneider's plate stands up and cracks radially only. We question if a concentric crack could be produced in Schneider's plate. Fig. 32 is intended to represent roughly Brown's plate after the first round, and Fig. 33 Schneider's after the first and second rounds. We noticed that the crack in the compound plate extended very likely only through the steel face. We must point out, however, that the plate on the next blow broke along the line of fracture marked by the crack of the first round—*vide* Fig. 13 and Fig. 6 of first report. Taking the whole case of the plates into consideration, we should like to see a trial between them again, when conditions as to bolts and tempering are the same, and the compound plates such that no excuse or apology is to be made for them.

The next question is the projectiles. On this point we have already said something. Our Committee on Plates and Projectiles have declared that chilled shot are not effective against steel-faced armour. Can anyone say this has proved so at Spezzia? Look at Figs. 12 and 14, which show the effect of two blows each with chilled projectiles, one only a match for wrought iron the same thickness as the plate, and one a match for this thickness of compound armour or steel. We tried this Gregorini iron in England

FIG. 24

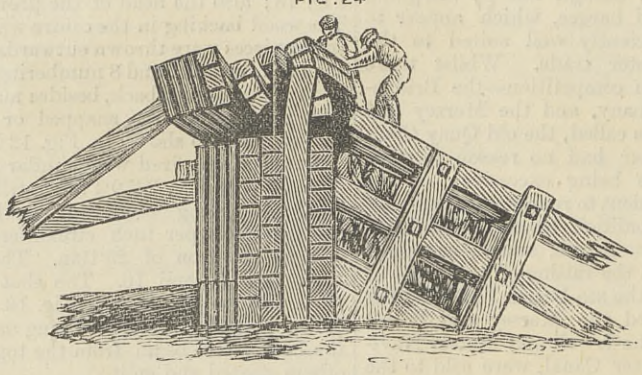


FIG. 25

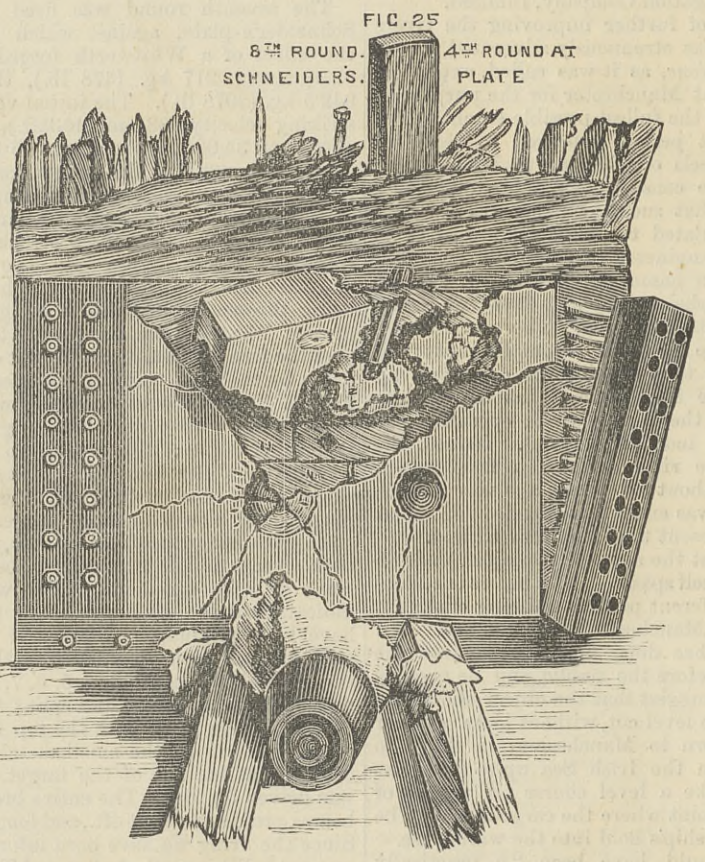


FIG. 26

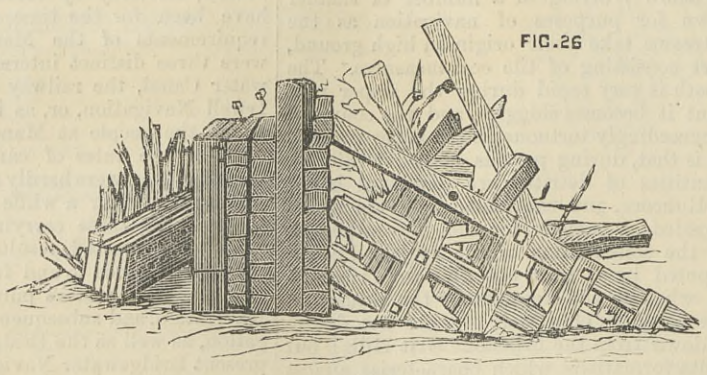
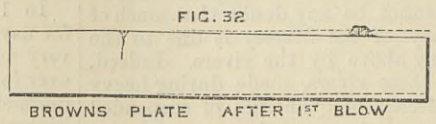
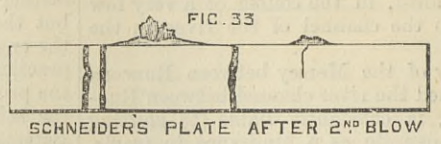


FIG. 32



BROWNS PLATE AFTER 1ST BLOW

FIG. 33



SCHNEIDER'S PLATE AFTER 2ND BLOW

FIG 31

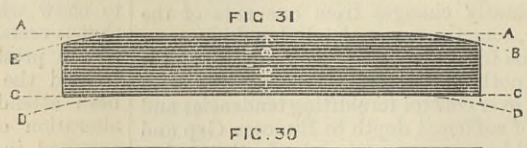
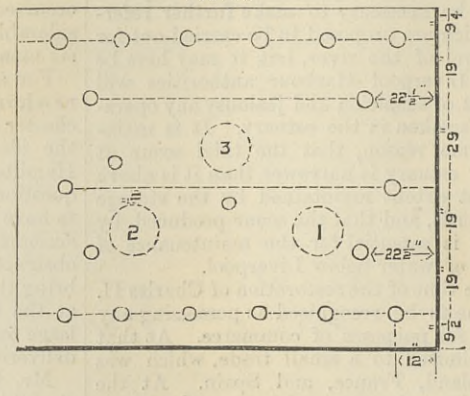


FIG. 30



THE SPEZZIA ARMOUR PLATE TRIALS.

(*For description see page* 403.)

FIG. 12

5TH ROUND—2ND ROUND AT BROWN'S PLATE

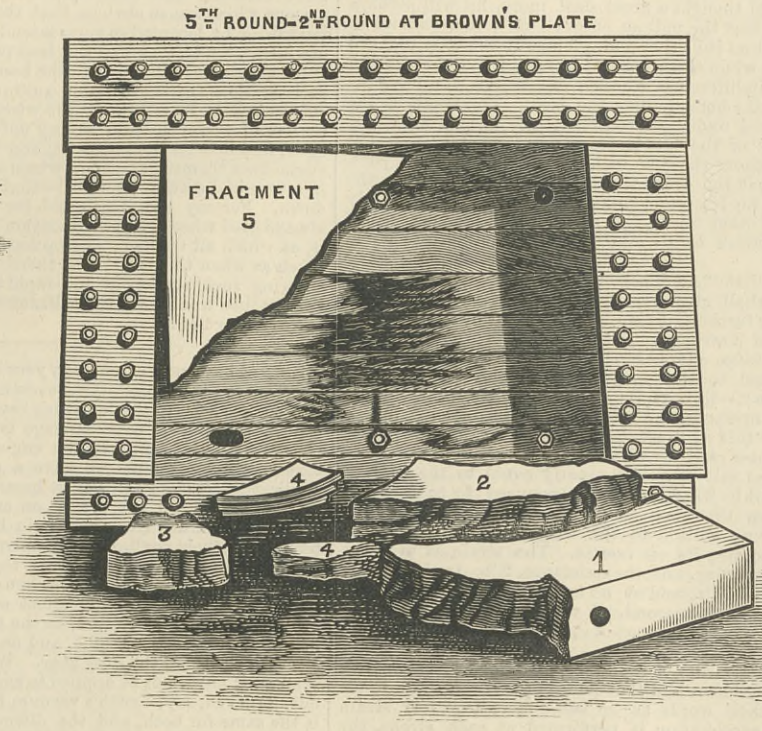
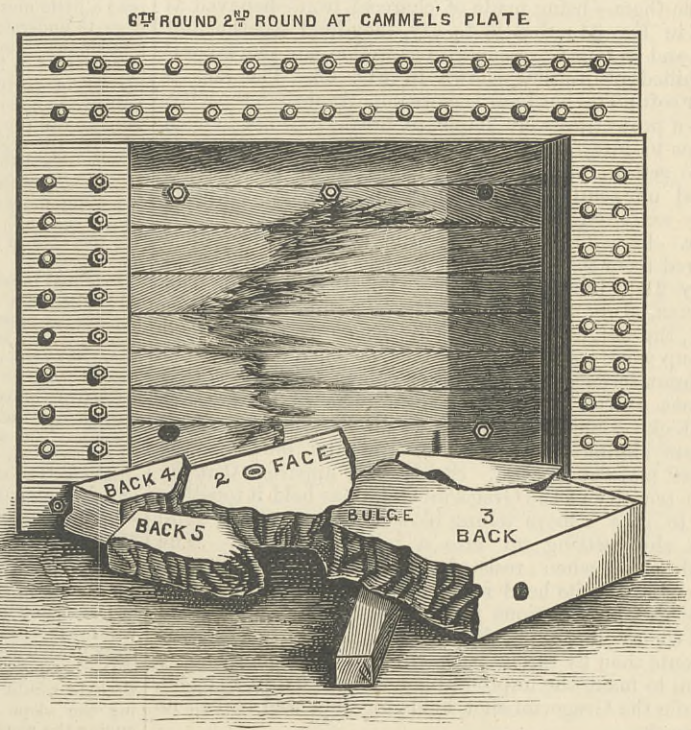


FIG. 14

6TH ROUND 2ND ROUND AT CAMMEL'S PLATE



SHOT POINTS FROM BROWN'S PLATE

FIG. 18
ROUND 2

FIG 17
ROUND 1.

7TH ROUND. 3D ROUND AT SCHNEIDER'S PLATE.
FIG. 19.

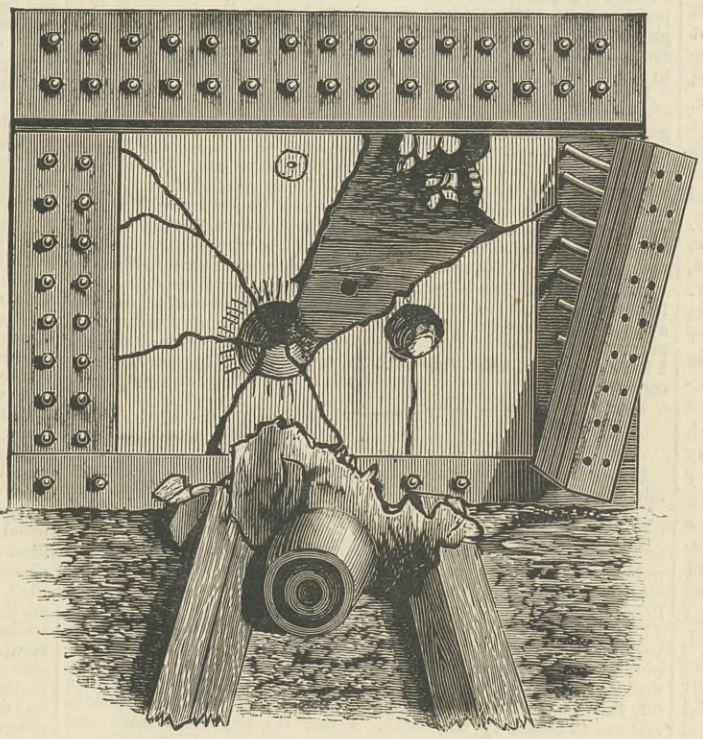
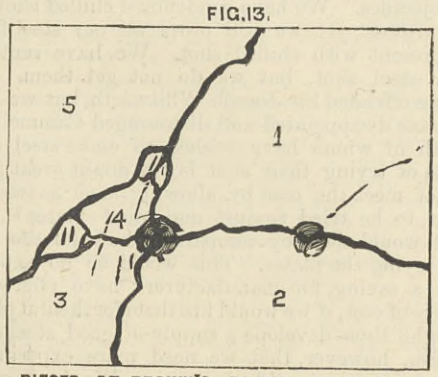
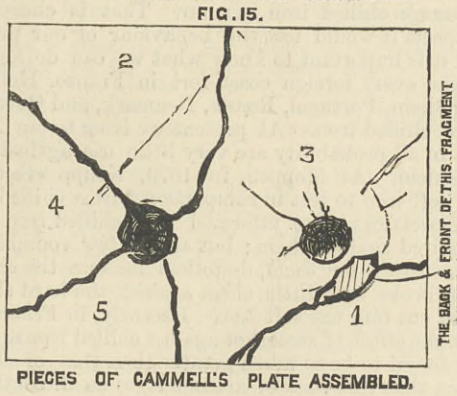


FIG. 13.



PIECES OF BROWN'S PLATE ASSEMBLED.

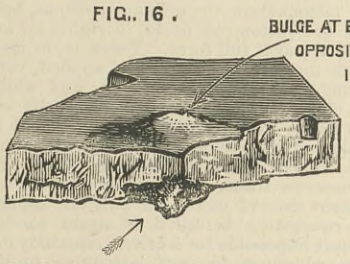
FIG. 15.



THE BACK & FRONT OF THIS FRAGMENT DIFFER A LITTLE IN SHAPE HERE.

PIECES OF CAMMELL'S PLATE ASSEMBLED.

FIG. 16.



POINT OF SHOT SET & FLATTENED INTO CAMMELLS PLATE. ROUND. 2.

FIG 29

FIG 22

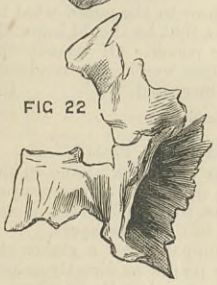


FIG 21

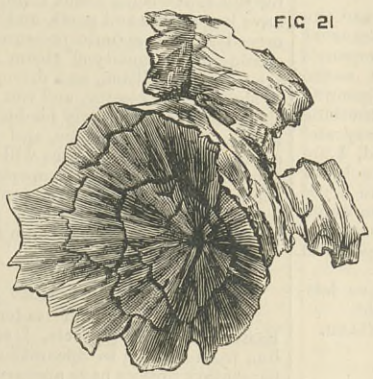


FIG 23

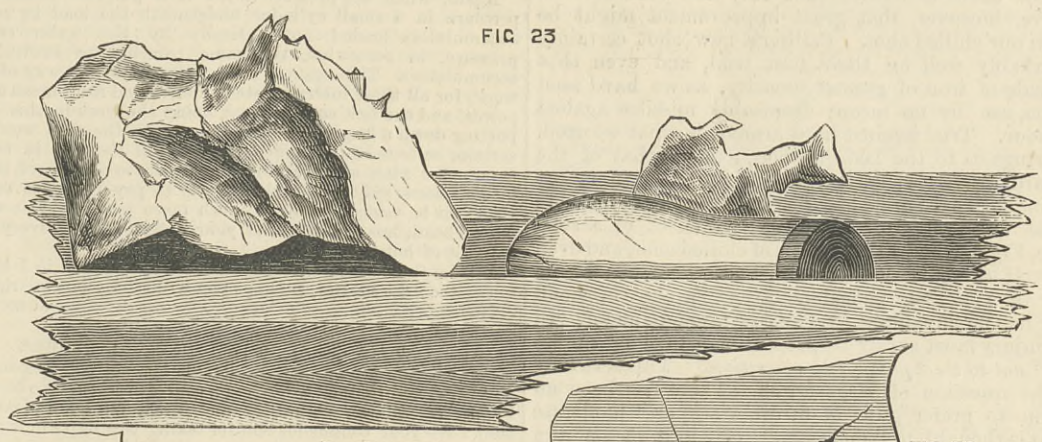


FIG 20

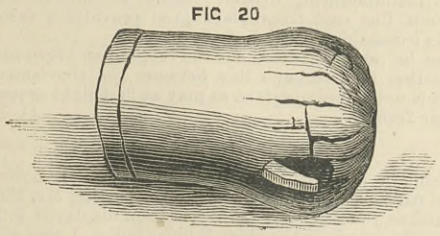


FIG 34

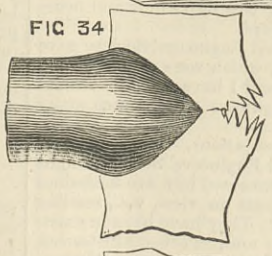


FIG. 38

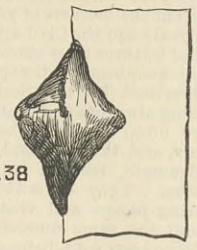


FIG 39

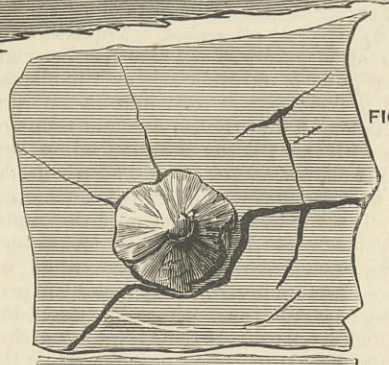


FIG 35

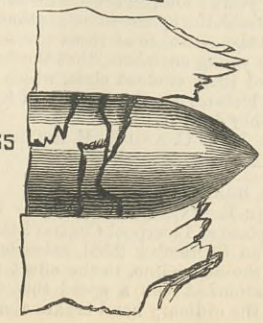


FIG 36

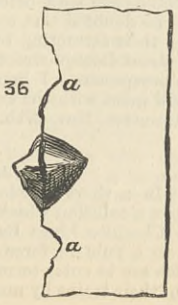


FIG 37

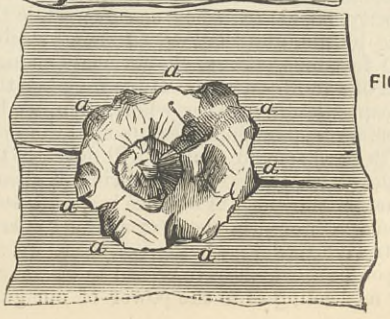


FIG 28

FIG 27

in 1878, and were disappointed in the result—*vide* Engineer, April 12th, 1878. We believe we now see the reason, and it is important to trace it out. We tried our metal against soft wrought iron plates. The Gregorini shot were cast in our arsenal, and we think were hardly representative ones. The Finspong, which a good deal resemble them—being made of charcoal iron—behaved as shown in Fig. 34; that is to say, they held together but set up, and so failed to penetrate as well as our own laboratory chilled projectiles—shown in Fig. 35. The fact is that for soft plates hardness is more important than tenacity. Our own projectiles were liable to break, but not in such a way as to interfere with their penetration so much as did the setting up of the Finspong shot. On this we declared our chilled projectiles to be the best. Subsequently we found them almost useless against steel-faced armour. Figs. 36 and 37 show the effect of the chilled shot fired from the 38-ton gun against steel-faced armour on July 21st, 1880, already quoted last week—*vide* The Engineer, July 30th, 1880. The striking velocity was 1504ft., the weight of shot 828 lb., consequently the total stored-up work was 12,980 foot-tons, or 332·6 foot-tons per inch circumference, and the power of penetration was that of about 18·7in. of wrought iron. The plate was but 18in. thick. Compare this result with Figs. 38, 39, which illustrate similarly the effect of the first blow on the Cammell plate at Spezzia. Surely it is apparent that the greater tenacity of the Gregorini metal has held it together so as to give a more telling blow on the target in spite of the shot setting up into a misshapen form. The English shot, when resisted by a hard surface, flies asunder because its head is not buried in the plate, and in this position, for obvious mechanical reasons, an outward thrust comes on it which it has not tenacity to resist; the fragments then fly into a wide circle, with enough energy in them to make the unprofitable holes *a a a a* in Figs. 36, 37, while the Gregorini shot holds together and makes no such marks.

Our position in England is peculiar as to armour-piercing projectiles. We have condemned chilled shot for steel-faced armour, yet we still prove all our steel-faced armour at present with chilled shot. We have sent out tenders for steel shot, but we do not get them. Not only have we offended Sir Joseph Whitworth, but we have by some means disappointed and discouraged Cammell and Brown, both of whom have wished to make steel shot. The expense of trying their shot is no doubt great; but might we not meet the case by allowing steel as well as chilled shot to be tried against our proof plates? The chilled shot would show by comparison how far the steel shots were trying the plates. This would be no expense, but rather a saving, for manufacturers have offered us steel shot free of cost, if we would fire them for them at plates, and we might thus develope a supply of good steel shot. We maintain, however, that we need more experiments against hard armour in this country. We have never tried Gruson's chilled iron armour. That is cheap; in many respects it would test the behaviour of our projectiles, and it is important to know what we can do against it. Almost every foreign coast fort in France, Holland, Belgium, Spain, Portugal, Russia, Denmark, and Germany is made of chilled iron. At present we issue to our Navy shot that in all probability are very little use against this class of shield. At Meppen, in 1879, Krupp erected a shield of soft iron to test in comparison with a chilled iron shield. Spectators were informed that chilled iron shot would be fired against them; but after a few rounds steel were substituted for them, doubtless because the chilled projectiles broke with little effect against the hard shield, while they cut into the soft one. Recently, in France, we hear that the effect of steel shot against chilled iron armour has been found to be so much greater than that of chilled projectiles, that this class of armour is to be discontinued for inland forts, for which it was thought to be suitable so long as the effect of chilled shot only had been known. We believe, however, that great improvement might be effected in our chilled shot. Palliser's new shot certainly did remarkably well on their first trial, and even shot simply made of iron of greater tenacity, as we have seen at Spezzia, are by no means despicable missiles against hard armour. Trial against hard armour is what we need.

This brings us to the last question, namely, that of the gun. Hard armour is destroyed, not by perforation, but by racking. There are almost figures enough here to settle that question—*vide* Fig. 19, the effect of a steel projectile, Figs. 12 and 14, the effect of chilled shot, and even Fig. 37. If there is no hole punched, there can be no diameter of a hole to consider. Hence a shot of small diameter has no advantage over one of large diameter. In fact the injury must surely be proportional to the "*stored-up work*," *not to the* "*power of perforation*." This seriously affects the question of size of gun. There has been an inclination to prefer guns of medium size or "moderate size," as it is thought, to "monsters." Our new 43-ton gun doubtless, owing to its length and power, does not compare badly in *penetration* with the 100-ton muzzle-loading gun fired at Spezzia in these experiments. Our 43-ton gun has achieved a velocity with its shot which argued a penetration of about 26in. The 100-ton gun has only the same, with as high a velocity as 1615ft. This looks very encouraging, but the case is entirely changed when we contemplate steel-faced armour destroyed by racking in proportion to the striking energy of the shot, for while the 43-ton gun shot has only 23,320 foot-tons energy, the 100-ton gun shot has, with this velocity, 35,500 foot-tons energy; while the new breech-loading 100-ton gun shot, with 1834ft. velocity, would have 46,640 foot-tons energy, or, curiously enough, exactly double that of our 43-ton gun. Have we taken this into account? We question it. On the whole, then, we believe that these Spezzia trials should press upon us the need of experiments with hard armour such as will develope the shot required to deal with it, and also to bring us clearly to the proof of whether the effect of our fire is not for such armour, proportional to stored-up work or striking energy rather than penetrative power; whether, in fact, we are not still following on lines which have ceased to be correct, and are positively misleading as to the power of our guns.

LETTERS TO THE EDITOR.

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

ELECTRICAL STANDARDS OF MEASUREMENT.

Sir,—When your correspondent, "An Electrical Student," has read a little more and thought a great deal more, he will perhaps begin to understand that the pull on one end of a rope cannot be greater than the pull on the other end. Thus, if the rope be fixed at one end to a boat while the other end is fixed to a horse, it is a matter of perfect indifference whether we regard the boat as pulling the horse or the horse pulling the boat. The result is the same to the rope; and under all circumstances and at all times, whether the velocity of the boat is being accelerated or not, the tensile strain throughout the rope will be the same in every part. It will be just as great 1in. from the boat as it is 1in. from the horse—no more and no less—and therefore the resistance exactly equals the pull. In other words, the resistance is the measure of the force, or in Newton's words, "action and reaction are equal and opposite."

It is just possible that "An Electrical Student" may have misunderstood me. I shall give him the benefit of the doubt, and explain my meaning further. If we have a weight of 1 lb. hanging quietly at the end of a string, your correspondent will, I suppose, admit that the resistance offered by the string to the fall of the weight will be equal to the pull of the weight. Now let us attempt to impart to it—through the string—a velocity of 32·2ft. per second, vertically, upwards, the operation to be effected in one second. Now to do this we must just double the pull on the string. The strain on it now will be 2lb., not 1 lb., and the resistance offered by the weight will again be exactly equal to the upward pull. That pull will be 2 lb., 1 lb. being required to balance the action of gravity on the mass of metal. The other pound is expended in imparting motion to the weight, or, to use another expression, in overcoming its *vis inertia*. The strain is still the same throughout the string, and the resistance, 2 lb., is the precise equivalent of the pull 2 lb., and at no instant of time is it greater or less than 2 lb. during the second. I venture to hope that this will make what I have said about $x\ x_1\ x_2$, &c., and $n\ n_1\ n_2$, &c., clear to your correspondent.

Concerning the statements of Rankine and Pambour, a moment's thought would have shown him that he is entirely wrong in limiting the scope of their words as he has done. In every steam engine the work of acceleration is performed at each stroke, the piston being started from a state of rest; and I can assure him that at each instant the resistance of the piston is precisely equal to the pressure of the steam on its face, no more and no less. It by no means follows, however, that the strain on the crank pin is just the same as the push on the piston, because the inertia of the piston with its rod, crosshead, connecting rod, &c., has to be overcome, but it none the less follows that the resistance is just equal to the driving pressure and no more.

I have no doubt all this reads like a paradox to "An Electrical Student." Like him I long held that the impelling force must be greater than the resistance, but I found that the logic of facts could not be disputed, and I was compelled to seek for the reason why under the conditions motion ever takes place. I shall not attempt to take up your space here with an explanation of this; it must suffice to say that one of the most important deductions which can be drawn from the facts is that gravity cannot be a form of attraction, but must be the direct result of the motion of some form of matter. To assert a very few years ago that attraction was a myth would have been to make myself ridiculous, but I am happy to say that the word is now only used by men of science in a conventional sense. Thus, in all that relates to electricity and magnetism "lines of force" have taken the place of attraction. I have no doubt that this at least is quite well known to your correspondent. Φ. Π.

London, November 27th.

HYDRAULIC BALANCE LIFTS.

Sir,—I agree with you that a direct-acting ram lift has many advantages over suspended lifts; but I cannot see the advantage of all the apparatus designed apparently with the sole purpose of returning part of the water used to the accumulator. It is just another way of balancing the cage, and rather a costly way. By putting on balance weights hung over say 12in. or 15in. pulleys by steel wire ropes, you can then use a smaller cylinder and ram, and, in consequence, not so much water from accumulator will be used. The power lost in friction, &c., in working these secondary rams is very much greater than that absorbed by balance weights hanging over pulleys, and very much more costly both to keep up and for first cost. Should, through some accident, a balance weight fall off, then the cage cannot come down any faster than the water is allowed to escape by the valve. I fear the secondary rams and cylinders would be found to give much more trouble than simple balance weights ever would do.

Again, when the pressure is low it is proposed to increase the pressure in a small cylinder underneath the load by means of accumulators loaded automatically by the water company's pressure, in somewhat the same principle as Brown's steam accumulators. This again is, I think, a roundabout way of going to work, for all these intermediate cylinders and rams mean absorbing power, and the first cost between doing the work in this way and putting down a larger cylinder underneath the cage would, I am certain, be found to be much the least of the two in the latter case. The plan of returning the water to the top of the house into a cistern may be "robbing Peter to pay Paul," as one would then just be using exactly as much more water as you would do with a head, less the height of your cistern from delivery point of exhaust of hoist.

I make these remarks in a friendly spirit, and if I have misunderstood the matter, perhaps you will kindly put me right.

November 27th. John Barr.

THE SOCIETY OF ENGINEERS' LECTURES.

Sir,—I have read with considerable interest your account of the President and Council arranging a course of lectures to be delivered by Messrs. Adams, Walmisley, and Birch, and I am pleased to see they have your commendation for taking this important and beneficial step in the interest of young engineers.

Some years ago the Civil and Mechanical Engineers' Society gave a series of lectures in a similar manner, which were well attended by junior members of the profession, and I have do doubt those now advertised by the Society of Engineers will attract many engineering students and draughtsmen.

I have often thought these two associations, the Society of Engineers, and the Civil and Mechanical Engineers' Society, ought to amalgamate, for the following reasons:—They are next-door neighbours. They have the same objects in view, viz., reading engineering papers and visiting works. They have been in existence about the same number of years; and, in several instances, papers have been read before both societies by the same gentlemen. There is no doubt it was owing to the existence of these two societies, and their attracting so many young engineers, that the Institute in Great George-street started their student class, which has been so prosperous. I hope the lectures at the Society of Engineers will meet with the success they deserve.

Westminster, Nov. 27th. Mem. C. and M. E. Society.

DELUSIVE BRAKES.

Sir,—In a short article in The Engineer of November 17th last, upon a collision which took place at Liverpool Central Station on the Cheshire Lines Railway on September 22nd, attention is drawn to a rule in force upon the above line, to the effect that "Drivers are to enter terminal stations at such a speed that they can stop their trains by means of the ordinary hand brakes alone;" and objection is taken to this regulation as being one "which is always ignored, and which is only necessary to cover the shortcomings of bad brakes." Will you allow me to point out that the rule above is a wise and salutary one, and made as much in the interest of the enginemen themselves as of the railway companies or the travelling public?

A terminal station must at all times be approached far more carefully and cautiously than a through station, and for reasons which are so obvious that they need not here be particularised. As a locomotive superintendent, I should certainly require my men, even if they had the best possible brake behind them, to enter a terminal station with the hand brakes only applied, and, at such stations, to reserve the continuous brakes for accidents and emergencies. It is always the wisest and safest policy to keep a reserve of power in hand for any unforeseen emergency which may arise, and it is for this purpose, and to protect and take care of the enginemen themselves—upon whom the chief blame of a collision in a terminal station must fall—that the rule above has been laid down. For my own part, and for the sake of my men, I am always glad when a terminal station has a ticket platform outside it, at which all trains must stop for the collection of tickets, inasmuch as when this is the case there is little or no fear of a train entering such station at too rapid a rate, and of the enginemen getting into trouble for the collision which may occur.

November 25th. R. W. G.

Sir,—I have read attentively your article in issue of 17th inst., also Mr. Stretton's letter in last issue respecting the above, and will be glad if you give space to the following remarks regarding this brake. As is generally known, each carriage is fitted with vacuum cylinder, reservoir, pipes, &c., but the engine and tender are fitted with steam cylinders; thus we have a combination which in case of application by the guards or a breakaway is not continuous, as in neither case would the brakes on engine and tender be applied; they are separate from the train brake, and not automatic, and require for their application an operation from the foot-plate of the engine, over which only the men there have control. It will thus be seen how couplings are broken; when the guards or leakage applies the brake, it takes effect on the carriages only—not the engine and tender. In fact, at the time of application, steam may be pretty full on the engine, and no brake being applied to it, puts a severe strain on the drag gear. Why should this vacuum brake system, if good, not be applied to engine, tender, and train throughout, same as, say, Smith's vacuum brake? The pressure available is the same for both, and the difficulty in getting accommodation for sufficiently large parts should be pretty much alike. Can the reason be that on account of the leak-off arrangement, which permits of the power, after application, to disappear in from thirty seconds to two minutes—as reported in connection with the accident on the Great Western Railway—if applied also to the engine and tender would soon show the system to be quite unreliable—in fact, if thus put on its merits, almost worthless. But as now arranged the steam brakes are brought into requisition to stop the train when the vacuum has disappeared. Thus a poor brake is bolstered up, has its defects and shortcomings covered and hidden by the powerful steam brake. Then with regard to the efficiency of this brake to control trains descending long steep inclines, &c. As soon as the driver or guards admit air sufficient to move the pistons from the cylinder bottoms, breaking the air-tight joint at the piston-rod necks, in rushes air at each piston-rod, and on go the brakes full force. There is no taking a little and adding a little more as wanted; once applied, you soon get all, and after getting all it rapidly leaves you; and while it is leaking off, should an emergency arise, the driver is really without a train brake until he has re-created a vacuum, which will be too late to be of any service. He therefore, as a rule, will apply his steam brake, the train brake remaining a misnomer. Surely for the working of express passenger trains it is ridiculous to fit a brake system having a sufficient store of power for only one application, and which requires re-creating before it is again serviceable, knowing that it is almost impossible for a driver, especially in dark, dirty, weather, when whistling for and attending to signals, approaching junctions and stations, requiring the use of the brake to reduce speed, to give the necessary attention in front and at the same time attend to the needful working of the vacuum ejectors and gauge. I am therefore not at all surprised that with trains fitted with such appliances the recommendation is to stop, or at least slow to walking pace at the home signal; no reliance is thus placed on this train brake. In my opinion, proper brakes for the work are those that the driver can take a hundredweight of power or, if necessary, a ton, and can do this, not only once, but keep adding to and repeating beyond all possibility of working requirements, and that, too, without trouble, or requiring the driver to give any of his attention to the storing of power; and only under such conditions is it possible for engine-drivers to be master of the situation and give, under ordinary and exceptional circumstances, the needful attention to the proper performance of their very onerous duties. The pressure available for this brake being about 12 lb. per square inch, it is necessary to have large pipes and parts, and large volumes of air require to be moved at atmospheric pressure, which means slow action and a considerable quantity of steam used. Gauges in the guard's van are a useful addition, as a driver, if short of steam, may be induced to shut off the ejector, and run without maintaining a vacuum on the train, preparing only for his usual stops and expected requirements. This can be done, and no one knows except those on the engine; but gauges in vans will show to the guard what is done in this way, and it is very important that he should know the actual condition of the train for brake power. Of course where considered troublesome, and not much worth, the tendency to run without maintaining a vacuum is increased. Brakes.

November 27th.

NORTH-EASTERN RAILWAY PROJECTS.

Sir,—In reading your leader in last week's issue on the North-Eastern Railway projects, I see no notice of the company's new line from Scorton to Spennithorne, in Wensleydale, of which Parliamentary notices have appeared in the newspapers.

I am not in the secrets of the company, but a glance at the map will show that the proposed line points as directly as possible for Coverdale, the natural route to Kettlewell, Skipton, and the Lancashire manufacturing district; whilst at the other end the proposed new line east from Darlington provides a fairly good route to the ironmaking district of Cleveland.

There can be no local reason for the Scorton and Spennithorne, but as a section of a through line between the above-mentioned districts, it is not so unimportant as may at first sight appear.

November 28th. C. J. W.

COMPLEX CASTINGS.

Sir,—Being a constant subscriber of yours, I notice your remarks on page 395 of your last issue respecting Mr. Fletcher's castings, and as you say great skill has been displayed in making the same, more especially the cross tubular boiler, I may also state that we are making patterns for one a size larger to be cast in one piece; and we are pleased to inform you that all the intricate castings that your correspondent saw have been made and cast by us, and the least Mr. Fletcher could have done would have been to mention this fact at the time. Honour to whom honour is due in all cases.

Manchester, November 29th. H. Wallwork.

PRESSURE OF FLUIDS IN MOTION.

Sir,—Your correspondent of last week mistakes. He might as well state that one column of falling water could generate pressure sufficient to raise two columns. $\frac{Wv^2}{g} = 2\ W$, not P. I have given proof and shown the way to experiment, and am rather vexed at mere *assertions* being published. G. Pinnington.

RAILWAY MATTERS.

IT is proposed to make a railway from Paris to Auneau, thus giving the Auneau and Chartres line, which belongs to the State, a footing in the metropolis.

THE directors of the Midland Great Western Railway of Ireland have appointed Mr. G. Newenham Kelly, C.E., as chief engineer of the company, in succession to the late Mr. R. R. Greene.

THE South Australian Chief Secretary has introduced a Bill authorising the construction of a railway from Nairne to the Victorian border. The total length is to be 360 miles, and the cost £928,000.

THE Great Northern Railway Company intend to apply to Parliament for powers to construct a loop line to its proposed new goods station off Gaol-square, Stafford. The line will commence on and follow the Doxey side of the river Sow for some distance, and will then cross it close to the Corporation Gasworks of Stafford.

ACCORDING to an official document lately issued, the aggregate net earnings of all the railways in India during the year ending 1881 was £6,952,714 on 9875¼ miles of road, or £5 3s. per cent. per annum, as against £4 15s. per cent. per annum in 1880. Such figures speak for themselves, and should warrant the Government in taking energetic action.

MR. THOMAS LONGRIDGE GOOCH, whose death is announced, was a coadjutor of George Stephenson, to whom he was apprenticed. He became Stephenson's chief draughtsman in the construction of the Manchester and Liverpool Railway, and his principal assistant in the construction of the London and Birmingham Railway. Mr. Gooch was the elder brother of Sir Daniel Gooch.

THE Lancashire and Yorkshire Railway Company is about to extend the roofing at its Southport station, so as to about double the present covered-in accommodation. A large extension is also being carried out at the Preston goods yard, where it is intended to erect large new warehouses. At Bradford extensive sheddings and warehouses are also being put up, contracts for which will shortly be let, and the plans have now been got ready for the superstructure at the Victoria station extension, Manchester.

SEVEN men were killed by the fall of the Ivy Bridge, just below Bromley, over the London, Chatham, and Dover Railway, on Friday last. It was a three-arch bridge, one large span over the up and down line, a small span over a siding on the down-line side, and a small span on the up-line side, this being on an embankment. It was under this small span or arch that the accident occurred. Under the arch was a hut in which the workers on the line kept their tools and warmed their tea, and they were in the hut when the arch fell. The bridge was a private way between property on the sides of the line, and had became dangerous, in consequence of which the large arch had been removed and the whole was in course of removal.

IN reporting on the fall of the Cattistock Bridge, about a mile and a-half north of Maiden Newton station, on the Weymouth branch of the Great Western Railway, Colonel Rich says: "This bridge was built about the year 1856. It showed no signs of weakness up to the moment of its fall, which appears to have been caused by the sudden rise of the water of the stream, which got at the back of the wing walls. The stream probably first brought down the wing wall at the south-east side, and then formed a whirlpool that scoured away the bed of the stream and undermined the foundations of both abutments. The foundations of the abutments appear to have been about 4ft. below the present surface of the stream. I think that such a catastrophe could not well have been foreseen."

AN Illinois paper, rejoicing in the name *Aurora Beacon*, of the 19th ult. says:—"The best time that has ever been made on the Chicago, Burlington, and Quincy Railway was made by engine No. 47 last Sunday. The train consisted of six cars, and contained Vanderbilt, the railroad king, together with several of the chief officials of the road. From Galesburg to Mendota the time was one hour and 39 minutes, a distance of 80 miles. From Mendota to Aurora the run was made in 54 minutes, a distance of 45 miles. Here engine No. 169, with Cooley at the throttle, was coupled to the train, and in 39 minutes had the train going over the Columbus, Chicago and Indiana Central crossing, a distance of 34½ miles. Mr. Cooley claims that he could have made better time, but the brakes were dragging, and thus made his train much heavier than necessary. Yet the distance of 158 miles, between Galesburg and the C., C. and I. C. crossing, was made in three hours and twelve minutes."

M. RIBOT, the reporter of the French Budget Committee, has drawn up a report on the situation of the Public Works Estimates. He states that the Freycinet railway scheme at the present moment stands thus—there are 3600 kilometres completed, 5600 in course of construction, 4100 sanctioned as likely to be of public utility, but not in course of construction, and 4400 simply proposed but not yet sanctioned. Of these different classes, the completed lines and those in course of construction have thus far cost altogether 1,490,000,000f. The expenditure still necessary to complete the scheme is as follows:—170,000,000f. for the lines already opened, 1,170,000,000f. for those in course of construction, 860,000,000f. for those sanctioned as of public utility, and 1,525,000,000f. for those proposed, but not yet sanctioned; total, 3,725,000,000f. Thus the entire outlay, past and future, upon the railways required for the completion of the Freycinet railway programme is 5,215,000,000f. Add to this sum 2,025,000,000f. for the improvement and construction of ports, canals, and navigable channels, and the grand total is brought up to 7,240,000,000f.

THE *Brisbane Daily Observer* says:—The agreement between the Government and the gentlemen known as the Australasian Syndicate, for the construction of the Warrego Railway, has been laid before Parliament, and it appears that the railway is to commence at a point thirty miles east of Charleville, to which the extension of our Southern and Western line has already been authorised, and is to run to Charleville, thence to Cunnamullah, and thence down the Warrego to the border of New South Wales. Measured in straight lines from point to point, the length of the line is about 225 miles; but as a railway, even in an easy country, can scarcely take a course as straight as the "crow would fly," it is probable that the length of the line to be made will approach 250 miles. As soon as the contractors receive from the Government the necessary authority, they are to make the survey, plans of which, with books of reference, &c., are to be forwarded to the Minister for Works, and laid before Parliament for approval in the usual manner. The whole line is to be completed and opened for traffic within three years from the date on which the Government line shall be open to the point of commencement, thirty miles east of Charleville.

A DISASTROUS fatal accident on the Great North of Scotland Railway occurred on Monday evening on the Macduff and Turriff branch, by which five persons have been killed and several injured, through the failure of a bridge across the Turriff turnpike road. It was built more than twenty years ago of iron with wood cross beams. It was about 18ft. from the level of the road, and about 40ft. span. Telegrams from the spot state that the engine of the train and the guard's van had passed over the bridge in safety, but when the three wagons were crossing the bridge gave way, and the vehicles were precipitated on to the road beneath. The carriages, in which there were a considerable number of passengers, were pitched into the roadway and were piled in a heap. Five persons have been killed and eleven seriously injured. It is stated that "after the engine had passed over the bridge, one of the beams by which the structure was supported tilted up, catching the wagons and causing the violent check which dragged the tender off the rails and snapped the couplings." The bridge is said to have been in a shaky condition for some time, and was under repair at the time of the accident. In consequence of this orders had been given that all trains should pass slowly over it.

NOTES AND MEMORANDA.

THE first sheet of the geological map of Europe, decided upon at the Bologna Congress of last year, has been engraved.

A CORRESPONDENT writes that a cheap battery for generating electricity has been devised by Dr. Brard, who turns to account the action of nitrates in igneous fusion on incandescent charcoal.

M. DEBAUVE, in a paper in the *Annales des Ponts et Chaussées*, gives the cost of rolling roads by steam roller as 8½d. per cubic yard of material used, as against 15d. by horse rolling; thus effecting a saving of 6½d. per cubic yard of material used, which in three years would pay the cost of a steam roller.

THERE were 190 patents granted in Germany between May and October for inventions connected with electricity. Telephones are being adopted on a scale of increasing importance in that country; there being now—according to the statements made at a recent meeting of the Berlin Electro-technical Society—telephonic arrangements in eighteen German cities, comprising 3788 different stations. The total length of the telegraphic lines used in the above telephone service is 540 miles, these lines comprising single wires 4017 miles in length.

AT a recent meeting of the Physical Society, Mr. W. R. Browne read a paper on the conservation of energy and central forces. He showed that the doctrine of the conservation of energy necessarily involved central forces, and could not be proved unless on the assumption of a system of central forces. This involved the hypothesis of Boscovich that matter consists of a collection of centres of force, and the author criticised the objections of Clerk Maxwell, Tait, and others, to Boscovich's theory. The paper will appear in the "Transactions" of the Society.

IN consequence of representations made to the Board of Trade by Chambers of Commerce and others as to the loss and inconvenience which arises from the variety of the sizes of wire gauges now in use, the question of legalising a standard wire gauge is now under consideration by the Department. The Board expresses the hope that the consideration which is now being given also to the want of a standard system of screw threads by those practically interested, may result in the application of a standard suitable to the requirements of all manufactures.

AT a recent meeting of the Academy of Sciences, Paris, a paper was read on Dr. C. W. Siemens's new theory of the sun, by M. Hirn. The recombination of the elements dissociated in space could occur only at a notable distance from the sun's photosphere, and on falling into this they must be anew entirely dissociated, an action which would cost the heat developed by combination, Again, the work done by solar radiation in dissociation must reduce the intensity of radiation; so that the brightness of the sun, stars, and planets should diminish much more rapidly than inversely as the square of the distances.

PROFESSOR S. P. THOMPSON recently read some historical notes on physics before the Physical Society, in which he showed that the voltaic arc between carbon points was produced by a Mr. Etienne Gaspar Robertson—whose name indicates a Scotch origin—at Paris in 1802. This reference is found in the *Journal de Paris* for that year. Laboratory note-books at the Royal Institution, however, are said to show that Davy experimented with the arc quite as early. The experiment usually attributed to Franklin of exhausting air from a vessel of water "off the boil" and causing it to boil afresh, is found in Boyle's "New Experiments touching the Spring of the Air."

THE English ships, excluding collision cases, which appear to have foundered or to have been otherwise totally lost on and near the coasts of the United Kingdom from defects in the ships or their equipments during the year 1880-81 is 34; while 92 happened through the errors, &c., of masters, officers, crews, or pilots, 319 through stress of weather, and 95 from other or unknown causes. The number of casualties arising from the same causes during the year, and resulting in serious damage, is as follows:—Through defects, 32; errors, 86; stress of weather, 368; other causes, 122; and the cases of minor damage were, through defects, 82; errors, 155; stress of weather, 954; and other causes, 230.

DR. BECKERT, of Spandau, has patented in Germany an india-rubber oil which is intended to serve as a protective against rust. According to the description published in the German technical press, the rough oils obtained in the dry distillation of brown coal, peat, or other bituminous substances are subjected to a further distillation. Thinly rolled india-rubber cut into small strips is saturated with a fourfold quantity of this oil and is let stand for eight days. This mass thus composed is subjected to the action of vulcan oil or a similar liquid until a homogeneous, clear substance is formed. If this substance is applied in as thin a layer as possible on a metal surface, it forms after slow drying a kind of skin which ensures an absolute protection against atmospheric influences. The durability of this covering is said to be most satisfactory. India-rubber oil is also said to be effective in the removal of rust which has already been formed, though we do not see in what way it can operate to do this.

THE name *isanemones* has been recently applied by M. Brault to curves of equal velocity of wind, and he has made a drawing of such curves for the North Atlantic in summer, using for the purpose 240,000 observations on board ship. It is shown that an approximate numerical value may be attached to each of the ordinary terms used in ships' logs to denote the wind's force. M. Brault's map, which appears in *Comptes Rendus*, is remarkable in that it reproduces almost exactly the map of *mean isobars*. Thus, during summer, that is to say, when the atmosphere is most stable over the great North Atlantic basin, the mean *isanemones* and the mean *isobars* are the same, presenting only differences that are nearly equal to possible errors of observation and of construction. It remains to be seen in what measure this important law is general; *Nature* says M. Brault believes it to be so for every surface of the globe which is under what he calls fundamental maxima and minima—such as the maximum and minimum of Asia, the maximum of the Azores—the fixity and permanence of which are such that they form together, and at six months interval two distinct systems which suffice to define the two great phases of the annual circulation. (*Ephemeral* maxima and minima are such as appear and disappear daily in our latitudes; while *mobile* or *tempestuous* minima such as cyclones or squalls, are grouped as a third class.)

EVEN in Russia it seems that the reclamation of marsh ground may in some cases be renumerative in spite of plenty of land. Very extensive operations of the kind have been for some years past carried on in different parts under General Jilinsky. The principal districts operated upon are situated between the Dneiper, Pripet, Berezina, Svislotsch, and Plitch rivers. According to the *Moscow Gazette* this area, which has now been made available for agriculture, is 790,000 deciatines (1 deciatine = 2¾ acres), of which 150,000 are Crown lands. In addition to these, 360,000 have been brought into cultivation in the central and western districts of Polessia. These results have been obtained by means of a system of canals, varying in breadth from five to eighteen archines (three archines = 18ft.), and in depth from one and a-half to four, while a few are as much as thirty archines broad. A large proportion of these canals are adapted for the floating of timber, to that there is not a single forest farm which is now more than seven versts from its waterway, whereas many of them were previously over thirty versts distant. Besides these undertakings, many subsidiary works of importance have been completed, such as the building of 138 bridges, the levelling of 23,800 versts of land, borings at 535 points, and the collection of a vast number of meteorological and hydrometric observations. It is hoped that by the end of 1884 the reclaimed land in Polessia alone will amount to 1,400,000 deciatines, and with the view of advancing the operations as rapidly as possible, the owners of property have been called upon to pay a *pro ratâ* contribution of amounts varying from 400 to 3000 roubles.

MISCELLANEA.

THE Civil and Mechanical Engineers' Society will hold its opening meeting of the session, 1882-3, on Thursday, December 7th, when the president, Mr. R. Harkness Twigg, M.I.C.E., will deliver an address.

ON the occasion of the Paris Cattle and Implement Show from 22nd to 31st January, 1883, a congress is to be held at the Hotel Continental, at which eleven subjects, connected with the application of mechanical engineering and agriculture, will be discussed.

THE Local Board have adopted the recommendation of Mr. I. C. Melliss, C.E., of London, for the disposal of the sewage of the Shirley and Freemantle district, and have instructed him and Mr. Pim, C.E., of Southampton, to proceed with the necessary works.

AN International Electrical Exhibition is to be held at Vienna in August, September, and October, 1883. No charge is made for space nor for motive power for the general illumination, and no prizes are to be awarded. Exhibits not patented will be protected until the end of the year.

"THE ELECTRICIAN'S VADE MECUM" is the title of a dictionary of electricity, which is shortly to be published under the auspices of the New York College of Electrical Engineering, by Edward Weston and W. R. Pope, electricans, of East 26th-street, New York. It is proposed to leave out frictional electricity, and to give illustrations of all the modern machinery and apparatus.

THE North Staffordshire Chamber of Commerce have just had under further consideration an old proposal to connect the Mersey and the Potteries by a ship canal. A map of several suggested routes was presented, but no decision was arrived at. This proposal is the outcome of the excessive railway rates that have long been charged by the railway companies trading between North Staffordshire and Liverpool.

THE Corporation of London have agreed, on the motion of Mr. John T. Bedford, to contribute towards the costs of the legal proceedings promoted by Mr. Dobbs for obtaining a judicial determination of the meaning of "annual value," as adopted by most of the water companies, as the basis of charge upon which water rates have to be levied. It is expected that the appeal of the Grand Junction Company against the decision of Justices Field and Bowen in the High Court of May last will be heard shortly.

THE Birmingham Corporation have adopted a new cistern for flushing lavatories, &c., manufactured and patented by Messrs. Charles Winn and Co., sanitary engineers, Birmingham, in which the emptying is done, not by an ordinary valve, but by a syphon controlled by a cap. A single pull of the lever suffices to raise the cap and admit the water to the syphon, which then becomes self-acting. There is thus effected a copious discharge increasing in velocity till the cistern is empty. The supply is renewed by the ordinary ball tap arrangement.

IN their twenty-second report to the President of the Local Government Board on the metropolitan water supply, Mr. W. Crookes, F.R.S., W. Odling, F.R.S., and Dr. Tidy say: "During the latter part of the month, the condition of some of the samples of water examined was unsatisfactory in respect to their colour, turbidity, and proportion of organic matter. Having regard, however, to the exceptionally flooded state of the river, and its occurrence at a period of exceptionally high tides, the condition of the water supply as a whole, though comparing disadvantageously with that prevailing during the summer and early autumn, is scarcely open to unfavourable comment."

A NEW twin screw hopper dredger built and engined by Messrs. Wm. Simons and Co., has just been launched complete from their works at Renfrew. This vessel is named The Forth, and is the property of Messrs. Lawson and Best, Glasgow. It will dredge to 30ft. depth, and carry 800 tons of its own soil at a speed of seven knots per hour. It is intended for the deepening operations at Grangemouth, and is the second hopper dredger the builders have supplied to these works. It is fitted with two independent sets of compound engines of 400-horse power collectively, and steam appliances throughout. Messrs. Simons and Co., who are the inventors and patentees of this system, have several other hopper dredgers in progress for Denmark, the Mediterranean, and Australia.

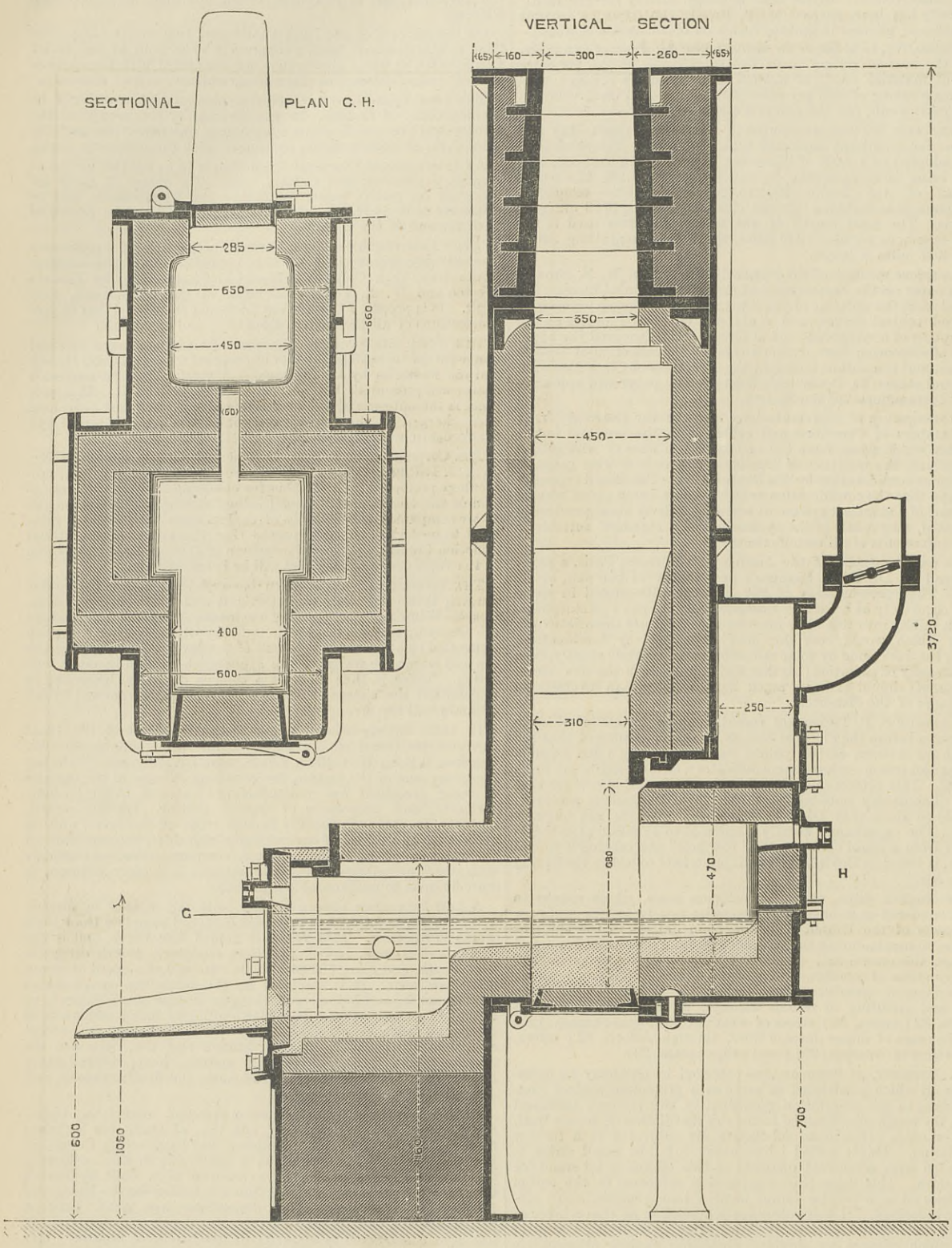
ON Wednesday a fine steel screw steamer, named the Cairo, for Messrs. Thos. Wilson, Son, and Co., of Hull, was launched from the yard of Earle's Shipbuilding and Engineering Company, Limited, Hull. This steamer is a sister ship to the s.s. Kovno, Grodno, and Draco, which have recently been built by Earle's Company for the same owners. She is intended for the Baltic and Mediterranean service. Her dimensions are 270ft. between perpendiculars, 34ft. beam, and 18ft. 3in. depth of hold; and she has been constructed to class A1 in her Liverpool register. Her gross tonnage will be about 1800 tons, and her dead-weight carrying capacity 2350 tons. The engines, which also have been made by Earle's Company, are 140 N.H.P., having cylinders 25in. and 50in. diameter by 45in. stroke.

ON the 9th inst. a new pier was opened with much rejoicing and ceremony at Larnaka. The pier is a substantial structure 450ft. in length and 22ft. wide, with a T end 80ft. in length, and in other respects similar to the iron pier which was opened a year ago at Limassol, and has proved of the greatest service during the late war in loading and unloading materiél, troops, and horses. Iron screw piles support a superstructure of creosoted timber. A double line of railway affords communication between the T end on which is fixed a five ton crane and the custom-house sheds. A quay wall 450ft. in length has been built, behind which there is a spacious esplanade 70ft. wide. The new works and buildings have been designed and carried out by the Government engineer, Mr. Samuel Brown, M.I.C.E., assisted by Mr. James Cunningham, superintendent of works.

ON Saturday afternoon Messrs. Raylton Dixon and Co. launched the Cairo from their dockyard at Middlesbrough, one of the finest vessels they have yet built, her lines and model having attracted considerable attention during her construction. She is a very similar vessel to the tea steamer Minard Castle, built about a year ago, her dimensions being, length, 340ft.; breadth, 38ft. 6in.; and depth of hold, 26ft.; and capable of carrying 4000 tons of tea besides her coals and stores. She has been built on her builder's own account, and will be finished in the highest style, suitable for passenger traffic or first-class trades. Her engines are of 300-horse power from the works of Messrs. Richardson, of Hartlepool. The Cairo is the sixteenth vessel launched by Messrs. Dixon during the present year, and they intend launching on December 9th H.M.S. Dolphin, and at the latter part of the month a large Spanish steamer.

THE electric light companies of Birmingham and district are putting forth efforts which should be of much benefit to the electric engineers. On Monday Messrs. R. W. Winfield, of Birmingham, had large numbers of the public visiting their works, where the firm had undertaken to prove that the electric light was admirably adapted to household as well as public purposes. A show-room was laid out as a drawing-room and illuminated by the arc and incandescent light in every variety of form. Altogether, 105 lamps were lighted, of which 42 could be employed at the same time. A special switch, designed by Mr. H. Lea, consulting mechanical engineer, of Birmingham, was used. It was shown that a 5-horse power engine would drive the machinery for supplying the current either to the collection of Swan lamps or to the Crompton arc lamps. The motive power for the generator was supplied by one of the engines which usually drives the machinery at Messrs. Winfield's works. It is a notable fact that at this exhibition, as at the Birmingham Festival, all danger from fire was obviated by the wires being substantially coated with ozokerit, india-rubber and tape, and in some instances laid in narrow wooden casing, which is coated inside with asbestos fireproof paint.

KRIEGAR'S FOUNDRY CUPOLA.

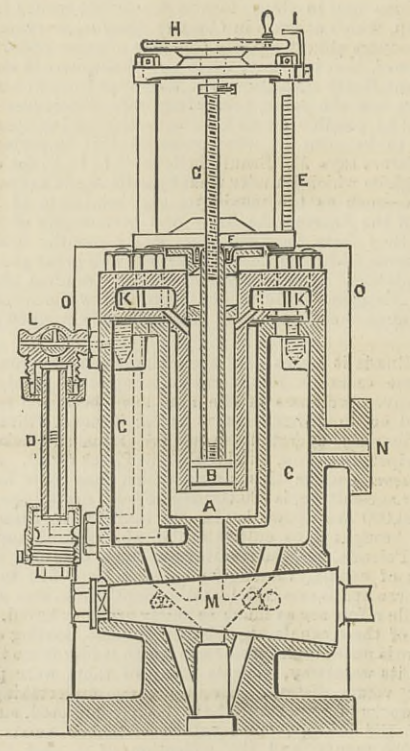


In our impression of the 7th of May, 1880, we referred to one of Kriegar's new foundry cupolas then just erected in Mr. Julius Pintsch's works at Fuerstenwalde, and to the remarkably high economy in fuel which it was said to secure. This furnace has now been at work about two years and a-half in Mr. Pintsch's works, with the results which we now give. The furnace is square in section, having a cast iron case and built up inside with fire-bricks, the lower part being covered with refractory sand. The blast enters at the curved pipe shown fitted with a throttle valve. In the door at H, which gives great facility for manipulation of the reduced materials, are eye pieces, through which the working of the furnace may be observed.

After two and a-half years' work Mr. Pintsch says he doubts whether for his purpose, namely, the production of very clean light castings, he could have a better cupola than Kriegar's. After it has been filled with coke to commence blowing he is able to melt 100 lb. iron with 4½ lb. Westphalian coke or with 5 lb. of Lower Silesian coke. The blower employed with the furnace is also Kriegar's, and works with 18in. water column pressure. The process of melting begins after about twenty-five minutes, the furnace rendering a good hot iron, and an addition of 30 per cent. of wrought iron may be added. For a daily casting of from one to two hours he believes it is the best furnace in use, but for periods of more than two hours it has been known to give trouble by slagging up.

APPARATUS FOR DETERMINING THE DEGREE OF MOISTURE IN STEAM.

In order to determine the degree of moisture of steam—that is to say, the quantity of water carried over by a given weight of steam—and the pressure of steam in the boiler or the steam chest, Messrs. Boye, of Bergen, Norway, and Müller, of Dresden, Saxony, have constructed an apparatus, the principles of which consist in causing the dilatation of a definite volume of steam, and keeping its temperature constant until it passes from the state of saturation to a superheated condition, and observing the volumes at the beginning and end of the operation. The apparatus is shown in the accompanying cut, which we take from the *Scientific American*, in section through the axis of the middle, the mercurial pressure gauge *d* and the lever being turned 90 deg. A given volume of steam from the boiler is let into the space *a* through the cock *m*, and the piston *b* is then raised by means of the hand wheel *h* and the threaded shaft *g*—which is movable in a nut *f* fixed on the hollow rod of the piston—so as to dilate the said steam. During this time the temperature of the latter is kept constant in the space *a* by means of a jacket *c*, which surrounds it, and in which constantly circulates fresh steam. When the piston has been raised so far that the steam no longer contains any moisture, or has passed from the saturated to the superheated state, there occurs in the space *a* a diminution of pressure that brings about a variation in the level of the mercurial column *d* that communicates on the one side with the space *a* and on the other with the jacket *c*. The

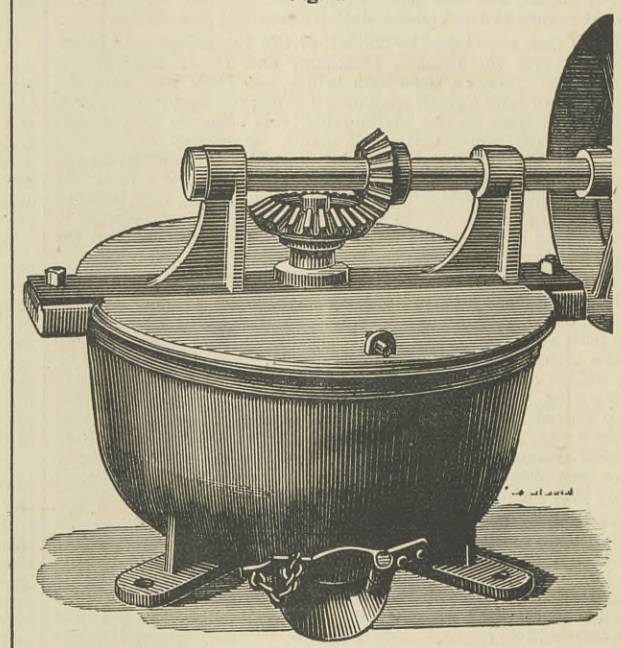


travel described by the piston and indicated by the displacement of the cross-piece *f*, on the scale *e*, gives the percentage of increase in volume of the space *a*. The pitch of the screw on the shaft *g* is calculated in such a way that every revolution of the latter shall correspond to an increase of 1 per cent. in the original volume of the space *a*. The circumference of the hand wheel *h* is divided into one hundred parts, so that the index *i* permits of estimating a hundredth of a revolution, or 0·01 per cent. of the volume *a*. To prevent cooling of the steam and leakages through the piston the cover *k* is provided with compartments that communicate with the jacket *c*, and steam is likewise let in over the piston. The three-way cock *l* placed over the mercurial column *d* allows the jacket *c* and the space *a* to be put in communication either singly or jointly with the external air, and the jacket *c* and space *a* to be connected. This cock serves likewise for moderating the too violent oscillations of the mercurial column. The cock *m* has two systems of conduits perpendicular to each other. The steam is first led through the cock *m* in such a way that *a* and *c* communicate with the boiler; then the cock is turned so that the steam shall only circulate in the jacket *c*. By turning the cock *m* 45 deg. it shuts off the entrance of steam to *a* and *c*. A metallic pressure gauge is fixed at *n* on the jacket *c*, so that the pressure in the boiler and dome or in the jacket may be determined when necessary. An external boiler plate casing *o* prevents the cooling of the jacket *c*. The difference between the moisture of the steam in the boiler and in the steam chest that may be determined by this apparatus indicates whether the steam ports are in a good state.

EVANS'S COKE AND COAL DUST GRINDING MILLS.

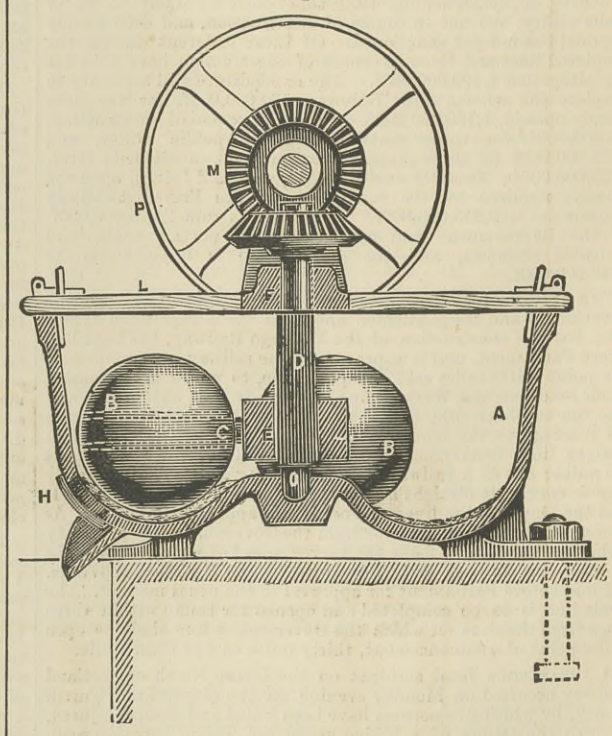
The accompanying engravings illustrate a coke and coal dust mill manufactured by Messrs. James Evans and Company, Trumpet-street, Gaythorn, Manchester. Fig. 1 is a perspective view, and Fig. 2 a section. The pan A stands on three feet, which are provided with holes for bolting to a strong bench or

Fig. 1.



other foundation. Three solid balls B are rolled round the bottom of the pan by means of round wrought iron arms which project from the boss E, and upon which the balls are free to revolve. The boss E slides loosely upon the square shaft D, and therefore adjusts itself by rising and falling to suit the inequalities of the material under the balls. The machine is driven by means of a belt, for which fast and loose pulleys P are provided. The mitre wheels M communicate the motion to the shaft D, which runs in a footstep at O, at a speed of about 30 to 40 revolutions per minute. The upper end of the shaft is

Fig. 2.



supported and prevented from rising by a horizontal cross bar F, which is bolted to the top of the pan. The coal is put in from the top by raising one of the wooden lids L, and when it is reduced to the requisite degree of fineness, it is only necessary to open the small doors H, through which the revolution of the balls forces it out by degrees. The machine we illustrate is 24in. diameter inside the dish, and about 11in. deep, and at the speed named is estimated by the makers to produce about 1 cwt. of the finest coal or coke dust in one hour from coal or coke of small size. The balls are 8in. diameter, and the pulleys about 16in.

Accident to a Mail Steamer.—The Anchor line American mail steamer Devonia had her machinery disabled on the 18th inst. and had to proceed under sail, but required no assistance.

SHEARING MACHINE FOR LARGE SHEETS.

M. CHAS. DONNAY, PARIS, ENGINEER.

(*For description see page* 416.)

FIG. 1

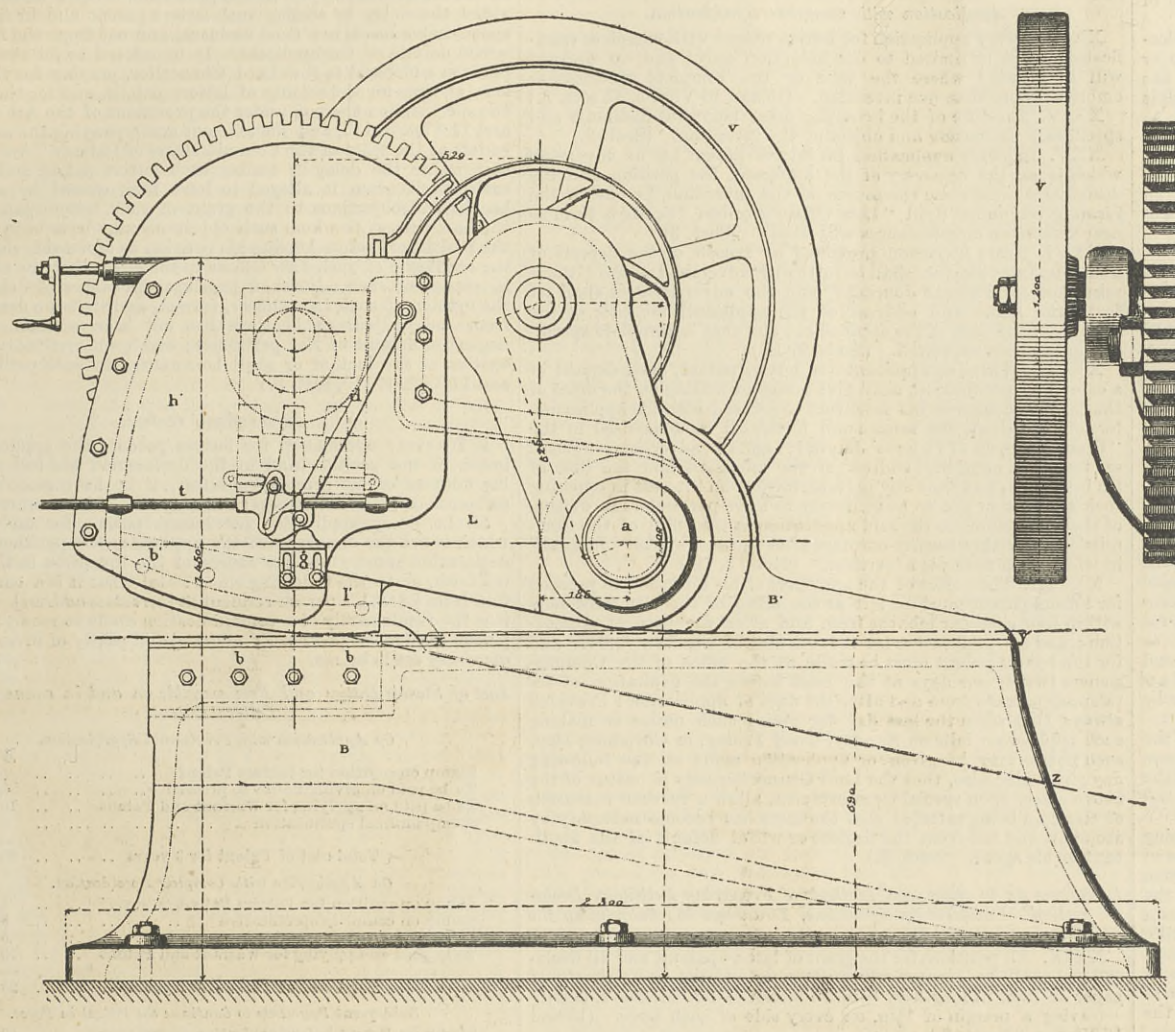


FIG 2

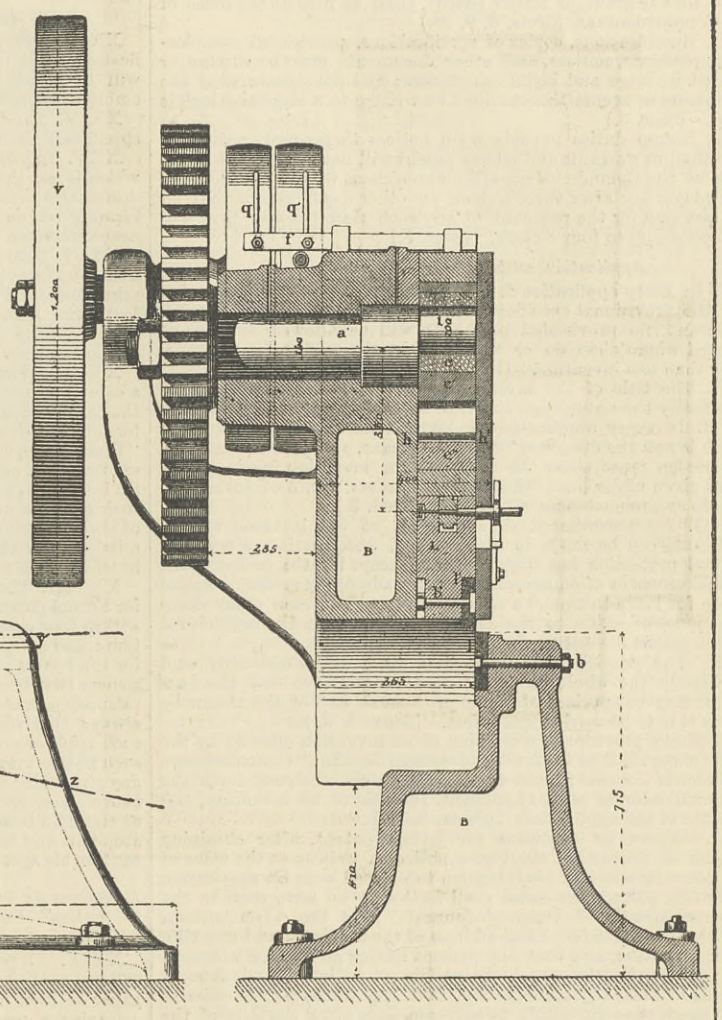


FIG 5

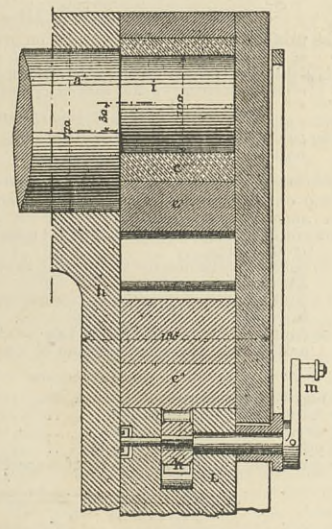
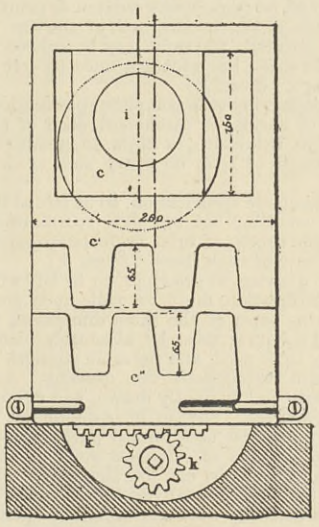


FIG 6.



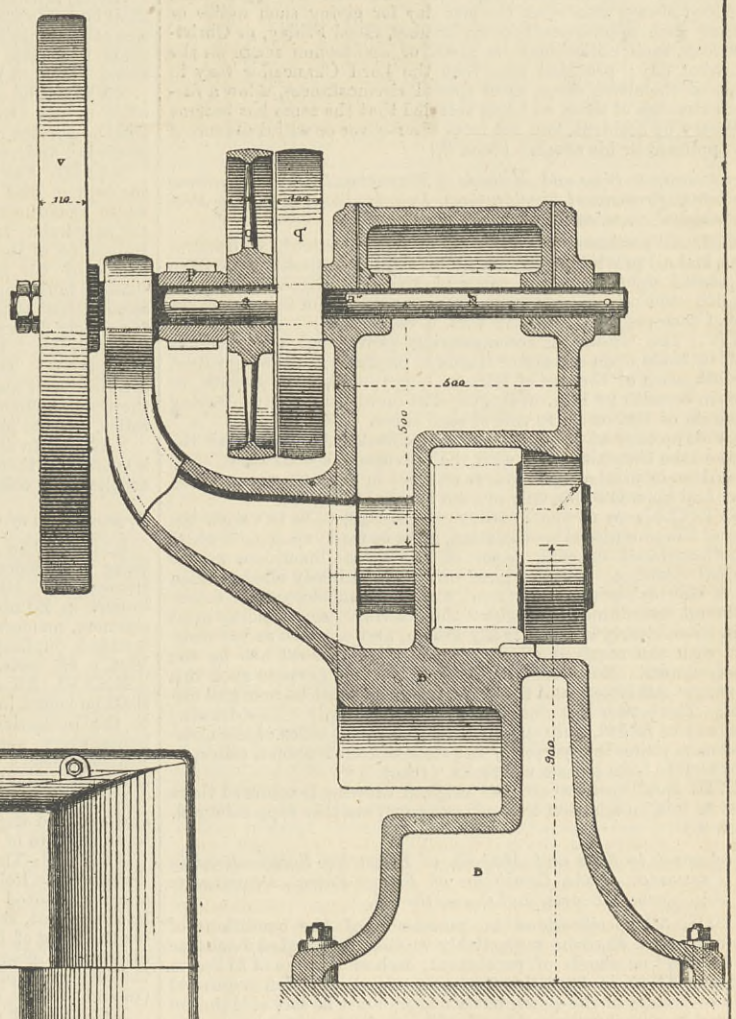
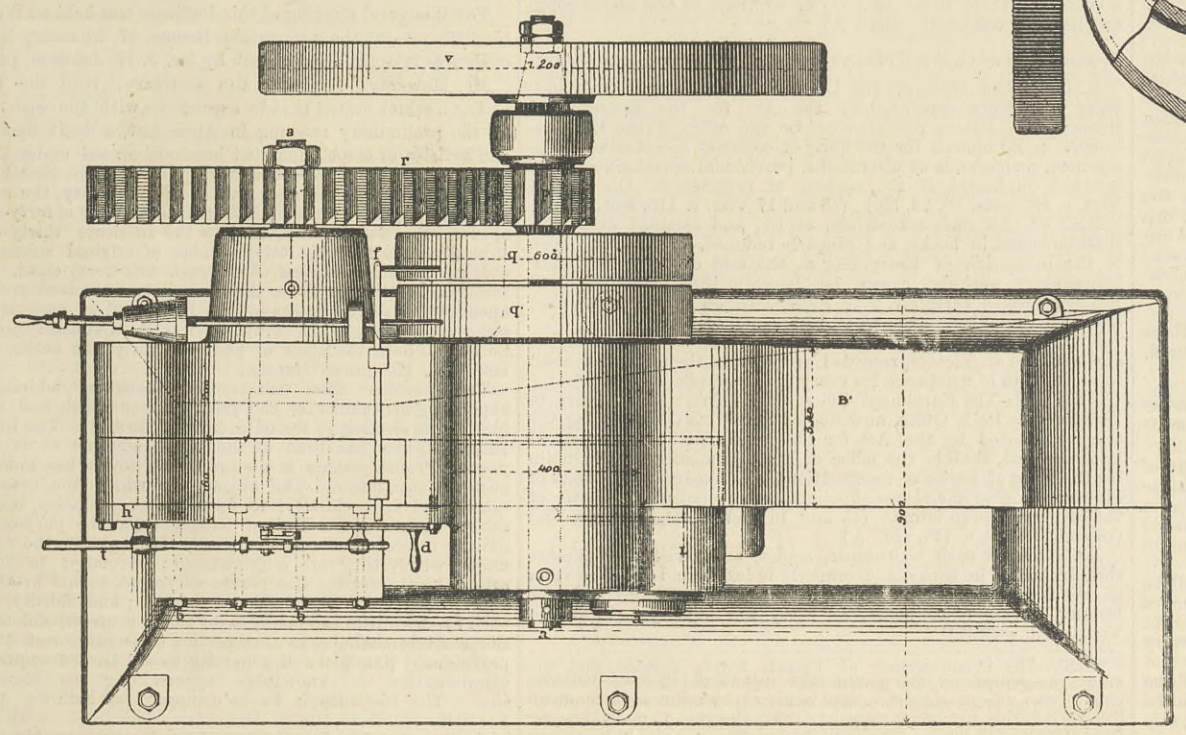


FIG 3.



JOHN SWAIN SC.

PATENT-OFFICE RULES.

The following "Rules, Regulations, and Orders for the Passing of Letters Patent for Inventions" have just been issued by the Commissioners of Patents.

General Rules.

I. The office of the Commissioners of Patents shall be open to the public every week-day, Christmas-day, and Good Friday excepted, from ten to four o'clock. (15 and 16 Vict. c. 83, sect. 3.)

II. All petitions for the grant of letters patent, declarations, and provisional specifications, shall be left at the office of the Commissioners; all specifications in pursuance of the conditions of letters patent, and all complete specifications accompanying petitions for the grant of letters patent, shall be filed at the office of the Commissioners. (Sects. 6, 9, 28.)

III. Specifications, copies of specifications, provisional specifications, petitions, notices, and other documents must be written or printed in large and legible characters; and the signatures of the petitioners or agents thereto must be written in a large and legible hand. (Sect. 3.)

IV. Stamp duties payable upon notices to proceed, notices of objection, or warrants and letters patent will not be received in the office of the Commissioners after two o'clock in the afternoon of Saturdays, nor after three o'clock on other days; except that on the last day for the payment of any such stamp duties they will be received up to four o'clock, (Sect. 3.)

Application with Provisonal Specification.

V. In every application for letters patent, the title of invention and the provisional specification must be limited to one invention only; and no provisional protection will be allowed or warrant granted where the title or the provisional specification embraces more than one invention. (15 and 16 Vict. c. 83, sects. 3, 8.)

VI. The title of the invention must point out distinctly and specifically the nature and object of the invention. (Sects. 3, 8.)

VII. In every application for letters patent for an invention which is not the discovery of the applicant, the petition and the declaration must state the source of the invention in one of the forms given under head "Law Officer's orders," or in a form as near thereto as circumstances will admit. (Sect. 3.)

VIII. No amendment or alteration, at the instance of the applicant, can be made in a provisional specification after provisional protection has been allowed, except for the correction of clerical errors or of omissions or errors made *per incuriam*. Application for leave to amend a provisional specification or other document must be made to the Law Officer to whom the petition for letters patent has been referred. (Sect. 3.)

IX. The provisional specification must state distinctly and intelligibly the whole nature of the invention, so that the Law Officer may be apprised of the improvement, and of the means by which it is to be carried into effect. (Sects. 3, 6, 8.)

X. Every provisional protection of an invention allowed by the Law Officer shall be forthwith advertised in the "Commissioners of Patents' Journal;" and the advertisement shall set forth the name and address of the applicant, the title of his invention, and the date of the application. (Sects. 3, 11.)

XI. Where an applicant for letters patent, after obtaining provisional protection, shall give notice in writing at the office of the Commissioners of his intention to proceed with his application for letters patent, the same shall forthwith be advertised in the "Commissioners of Patents' Journal;" and the advertisement shall set forth the name and address of the applicant and the title of his invention, and that any persons having an interest in opposing such application are to be at liberty to leave particulars in writing of their objections to the said application at the office of the Commissioners, within twenty-one days after the date of the "Journal" in which such notice is advertised. (Sects. 3, 12.)

XII. The notice of the applicant of his intention to proceed for letters patent must be left at the office of the Commissioners within four calendar months from and after the date of application; and the application for the warrant of the Law Officer and for the letters patent must be made at the office of the Commissioners twenty-one days at the least before the expiration of six calendar months from and after the date of application; Provided always that when the last day for giving such notice or making such application falls on Sunday, Good Friday, or Christmas Day, such notice may be given or application made on the following day; provided also, that the Lord Chancellor may in either of the above cases, upon special circumstances, allow a further extension of time, on being satisfied that the same has become necessary by accident, and not from the neglect or wilful default of the applicant or his agent. (Sect. 3.)

Directions as to Sizes and Methods of Preparing Petitions, Declarations, Provisional Specifications, Drawings to Accompany Provisional Specifications, and Copies thereof.

XIII. All petitions for the grant of letters patent, all declarations, and all provisional specifications, shall be respectively written or printed upon sheets of paper of 12in. in length by 8½in. in breadth—but on one side only—leaving a margin of 1½in. on every side of each page. (15 and 16 Vict. c. 83, sect. 3.)

XIV. The drawings accompanying provisional specifications shall be made upon a sheet or sheets of parchment, drawing paper, or cloth, each of the size of 12in. in length by 8½in. in breadth, or 12in. in breadth by 17in. in length—but on one side only—leaving a margin of 1in. on every side of each sheet. (Sect. 3.)

XV. The copy of the provisional specification, to be left at the office of the Commissioners with the provisional specification, shall be written or printed upon sheets of brief or foolscap paper, briefwise, and upon one side only of each sheet. (Sect. 3.)

XVI. The copy of the drawing or drawings, to be left with the copy of the provisional specification, must be made upon good white smooth-surfaced drawing paper of the same dimensions as the original drawing. All the lines must be absolutely black, Indian ink of the best quality to be used, and the same strength or colour of the ink maintained throughout the drawing. Any shading must be in lines, clearly and distinctly drawn, and as open as is consistent with the required effect. Section lines should not be too closely drawn. No colour must be used for any purpose upon this drawing. All letters and figures of reference must be bold and distinct. The border line should be one fine line only. The drawing must not be folded, but must be delivered at the office of the Commissioners either in a perfectly flat state or rolled upon a roller, so as to be free from creases or breaks. (Sect. 3.)

XVII. In all cases where the original drawing is coloured there must be left, in addition to the above copy, another copy coloured. (Sect. 3.)

Directions as to Sizes and Methods of Preparing Specifications in Pursuance of the Conditions of Letters Patent, Drawings to Accompany the same, and Copies thereof.

XVIII. All specifications in pursuance of the conditions of letters patent shall be respectively written or printed bookwise upon a sheet or sheets of parchment, each of the size of 21½in. in length by 14¾in. in breadth; the same may be written or printed upon both sides of the sheet, but a margin must be left of 1½in. on every side of each page. (15 and 16 Vict. c. 83. sect. 3.)

XIX. The drawings accompanying such specifications shall be made upon a sheet or sheets of parchment, each of the size of 21½in. in length by 14¾in. in breadth, or 21½in. in breadth by 29½in. in length (but on one side only), leaving a margin of 1½in. on every side of each sheet. (Sect. 3.)

XX. The copy of the specification to be left at the office of the Commissioners on filing the specification shall be written or printed upon sheets of brief or foolscap paper, briefwise, and upon one side only of each sheet. (Sect. 3.)

XXI. The copy of the drawing or drawings, to be left with the copy of the specification, must be made on good white smooth-surfaced drawing paper of the same dimensions as the parchment drawing. All the lines must be absolutely black, Indian ink of the best quality to be used, and the same strength or colour of the ink maintained throughout the drawing. Any shading must be in lines, clearly and distinctly drawn, and as open as is consistent with the required effect. Section lines should not be too closely drawn. No colour must be used for any purpose upon this drawing. All letters and figures of reference must be bold and distinct. The border line should be one fine line only. The drawing must not be folded, but must be delivered at the office of the Commissioners either in a perfectly flat state or rolled upon a roller, so as to be free from creases or breaks.* (Sect. 3.)

XXII. In all cases where the original drawing on parchment is coloured, there must be left, in addition to the above copy, another copy coloured. (Sect. 3.)

Application with Complete Specification.

XXIII. Every application for letters patent with complete specification must be limited to one invention only; and no warrant will be granted where the title or the complete specification embraces more than one invention. (15 and 16 Vict. c. 83 sect. 3.)

XXIV. The title of the invention must point out distinctly and specifically the nature and object of the invention. (Sect. 3.)

XXV. In every application for letters patent for an invention which is not the discovery of the applicant, the petition and the declaration must state the source of the invention, in one of the forms given under head "Law Officer's orders," or in a form as near thereto as circumstances will admit. (Sect. 3)

XXVI. Every invention protected by reason of the deposit of a complete specification shall be forthwith advertised in the "Commissioners of Patents' Journal;" and the advertisement shall set forth the name and address of the applicant, the title of the invention, the date of the application, and that a complete specification has been deposited. (Sects. 3, 11.)

XXVII. Where an applicant for letters patent, after deposit of a complete specification, shall give notice in writing at the office of the Commissioners of his intention to proceed with his application for letters patent, the same shall forthwith be advertised in the "Commissioners of Patents' Journal;" and the advertisement shall set forth the name and address of the applicant and the title of his invention, and that any persons having an interest in opposing such application are to be at liberty to leave particulars in writing of their objections to the said application at the office of the Commissioners, within twenty-one days after the date of the "Journal" in which such notice is advertised. (Sects. 3, 12.)

XXVIII. The notice of the applicant of his intention to proceed for letters patent must be left at the office of the Commissioners within four calendar months from and after the date of application; and the application for the warrant of the Law Officer and for the letters patent must be made at the office of the Commissioners twenty-one days at the least before the expiration of six calendar months from and after the date of application: Provided always, that when the last day for giving such notice or making such application falls on Sunday, Good Friday, or Christmas Day, such notice may be given or application made on the following day; provided also, that the Lord Chancellor may in either of the above cases, upon special circumstances, allow a further extension of time, on being satisfied that the same has become necessary by accident, and not from the neglect or wilful default of the applicant or his agent. (Sect. 3.)

Directions as to Sizes and Methods of Preparing Petitions, Declarations, Complete Specifications, Drawings to Accompany the same, and Copies thereof.

XXIX. All petitions for the grant of letters patent, and all declarations, shall be respectively written or printed upon sheets of paper of 12in. in length by 8½in. in breadth—but on one side only—leaving a margin of 1½in. on every side of each page. (15 and 16 Vict. c. 83 sect. 3.)

XXX. All complete specifications accompanying petitions for the grant of letters patent, shall be respectively written or printed bookwise upon a sheet or sheets of parchment, each of the size of 21½in. in length by 14¾in. in breadth; the same may be written or printed upon both sides of the sheet, but a margin must be left of 1½in. on every side of each page. (Sect. 3.)

XXXI. The drawings accompanying such complete specifications shall be made upon a sheet or sheets of parchment, each of the size of 21½in. in length by 14¾in. in breadth, or 21½in. in breadth by 29½in. in length, leaving a margin of 1½in. on every side of each sheet. (Sect. 3.)

XXXII. The copy of the complete specification, to be left at the office of the Commissioners on filing the complete specification, shall be written or printed upon sheets of brief or foolscap paper, briefwise, and upon one side only of each sheet. (Sect. 3.)

XXXIII. The copy of the drawing or drawings, to be left with the copy of the complete specification, must be made upon good white smooth-surfaced drawing paper of the same dimensions as the parchment drawing. All the lines must be absolutely black, Indian ink of the best quality to be used, and the same strength or colour of the ink maintained throughout the drawing. Any shading must be in lines, clearly and distinctly drawn, and as open as consistent with the required effect. Section lines should not be too closely drawn. No colour must be used for any purpose upon this drawing. All letters and figures of reference must be bold and distinct. The border line should be one fine line only. The drawing must not be folded, but must be delivered at the office of the Commissioners either in a perfectly flat state or rolled upon a roller, so as to be free from creases or breaks. (Sect. 3.)

XXXIV. In all cases where the original drawing on parchment is coloured, there must be left, in addition to the above copy, another copy coloured. (Sect. 3.)

Transmission of Copies, Transcripts, &c., to Edinburgh and Dublin.

XXXV. The office of the Director of Chancery in Scotland, being the office appointed by the Act for the recording of transcript of letters patent, shall be the office of the Commissioners in Edinburgh for the filing of copies of specifications, disclaimers, memoranda of alterations, provisional specifications, and certified duplicates of the register of proprietors. (15 and 16 Vict. c. 83, sects. 18, 29, 35.) (16 and 17 Vict. c. 115, sect. 5.)

XXXVI. All such transcripts, copies, and certified duplicates shall be bound in books, and properly indexed, and shall be open to the inspection of the public at the said office, during office hours, every week-day except 1st January, 10th February, Good Friday, Queen's Birthday, 20th June, 28th June, 9th November, and 25th December. (15 and 16 Vict. c. 83, sect. 3.)

XXXVII. The charge for office copies of such transcripts, copies, and certified duplicates, recorded and filed in the said office, shall be at the rate of twopence for every ninety words. (Sect. 3.)

XXXVIII. The Enrolment Office of the Court of Chancery in Dublin—late Rolls Office, now Record and Writ Office—being the office appointed by the Act for the enrolment of transcripts of letters patent, shall be the office of the Commissioners in Dublin for the filing of copies of specifications, disclaimers, memoranda of alterations, provisional specifications, and certified duplicates of the register of proprietors. (15 and 16 Vict. c. 83, sects. 29, 35.) (16 and 17 Vict. c. 115, sect. 5.)

XXXIX. All such transcripts, copies, and certified duplicates shall be bound in books, and properly indexed, and shall be open to the inspection of the public at the Public Record Office of Ireland, during office hours, on every working-day. (15 and 16 Vict. c. 83, sect. 3.)

* N.B.—The Commissioners of Patents having decided that the drawings accompanying the provisional, complete, and final specifications of 1876, and subsequent years, shall be copied by the process of photo-lithography, this regulation must be strictly observed, in order that correct copies may be made. Specifications and drawings filed in pursuance of letters patent should be left at the office of the Commissioners at least six days before the expiration of the time for filing the same, in order that the officers may examine the extra copy of the drawing, and ascertain that it has been prepared in conformity with the rules.

XL. The charge for office copies of such transcripts, copies, and certified duplicates, enrolled and filed as aforesaid, shall be at the rate of twopence for every ninety words. (Sect. 3.)

Applications to the Lord Chancellor.

I. Every application to the Lord Chancellor against or in relation to the sealing of letters patent shall be by notice, and such notice shall be left at the office of the Commissioners, and shall contain particulars in writing of the objections to the sealing of such letters patent.

II. Whereas by the Act 16 and 17 Vict. c. 115, the Lord Chancellor is empowered to extend the time for the sealing of letters patent for an invention, and for the filing of the specification thereon, limited to the period of one month after the expiration of the six months of provisional protection of such invention, provided the delay in sealing such letters patent and in filing such specification has arisen from accident, and not from the neglect or wilful default of the applicant. It is ordered as follows:—Every petition addressed to the Lord Chancellor, praying for the extension of time for the sealing of letters patent, and for the filing of the specification thereon under the provisions of the Act of the 16 and 17 Vict. c. 115, and the affidavit accompanying the same shall be left at the office of the Commissioners of Patents. And in every case where the delay in sealing such letters patent and in filing such specification is alleged to have been caused by adjourned hearings of objections to the grant of such letters patent before the Law Officer, to whom such objections may have been referred, the petitioner, before leaving his petition as aforesaid, shall obtain the certificate of such Law Officer to the effect that the allegations in respect of such adjourned hearings and causes of delay are, in the opinion of such Law Officer, correct, and that the delay arising from such adjourned hearings has not been occasioned by the neglect or default of the petitioner; and such certificate shall be written at the foot of or shall be annexed to such petition. (16 and 17 Vict. c. 115, sect. 6.)

Law Officers' Orders.

I. In every application for letters patent, the applicant must insert in the petition and in the declaration his full name and his address or his principal address, if he have more than one residence or place of business; but only one address must be given.

II. In every application for letters patent for an invention which is not the discovery of the applicant, the petition and the declaration must state the source of the invention in the following form, or to the following effect:—(*a*) That it is a communication from [*A.B.*], a person resident at [*here state address*]. (*b*) That it is the result partly of a communication made to me by [*A.B.*], a person resident at [*here state address*] and partly of invention and discovery made by me.

List of Stamp Duties and Fees payable on and in connection with Letters Patent.

On Application with Provisional Specification.

	£	s.	d.
Stamp on petition for Letters Patent	5	0	0
To be paid on giving notice to proceed	5	0	0
To be paid on applying for Warrant and Patent	10	0	0
Stamp on final specification	5	0	0
Total cost of Patent for 3 years	25	0	0

On Application with Complete Specification.

	£	s.	d.
Stamp on petition for Letters Patent	5	0	0
Stamp on complete specification	5	0	0
To be paid on giving notice to proceed	5	0	0
To be paid on applying for Warrant and Patent	10	0	0
Total cost of Patent for 3 years	25	0	0

Subsequent Payments to Continue the Patent in Force.

	£	s.	d.
Stamp on Patent before expiration of 3rd year	50	0	0
Ditto ditto 7th year	100	0	0
Total cost of Patent for 14 years	175	0	0

On Opposition to Grant of Letters Patent.

	£	s.	d.
To be paid by person opposing grant, on giving notice of objection	2	0	0
To be paid by petitioner—also by person opposing grant—on the hearing of the case of opposition—each	3	10	0

On Opposition to the Sealing of Letters Patent.

	£	s.	d.
To be paid by person opposing the sealing, on giving notice of objection	2	0	0

On Disclaimers, Memoranda of Alterations, and Oppositions thereto.

	£	s.	d.
Stamp on petition for leave to file a disclaimer or a memorandum of alteration	5	0	0
Stamp on caveat against a disclaimer or a memorandum of alteration	2	0	0
To be paid by petitioner for the hearing previous to the fiat of the Law Officer	3	5	0
To be paid by person opposing allowance, on the hearing of the case of opposition	3	5	0
To be paid by petitioner for fiat of Law Officer allowing a disclaimer or a memorandum of alteration	3	15	6

Other Payments.

	£	s.	d.
On registering assignment, licence, &c.	0	5	0
For duplicate of letters patent	5	0	0
For every search and inspection	0	1	0
For office copies—every 90 words	0	0	2
For certifying every printed copy of a specification	0	1	0

THE INSTITUTE OF PATENT AGENTS.

The inaugural meeting of this Institute was held on Wednesday, the 29th ult., at the Arbitration Rooms, 57, Chancery-lane. The chair was taken at eight o'clock by Mr. J. H. Johnson, president.

Mr. Howgrave Graham, the secretary, read the report of Council, which stated that in accordance with the wish expressed at the preliminary meeting in April last, a draft memorandum and articles of association had been elaborated under the advice of counsel and submitted for the approval of the Board of Trade, and licence having been granted by the authority, the association was incorporated on the 12th August last. Out of forty-six patent agents who were invited to join the Institute thirty-eight had subscribed, so that the total number of original subscribers, including the ten members of Council, was forty-eight. In the formation of the Institute the Council had received great assistance from Mr. Hardingham, who had acted as secretary, and as some slight recognition of his services, the Council suggested that he should hold the office of hon. secretary, the acting secretary being Mr. Howgrave Graham.

The President then delivered his inaugural address. After expressing his thanks for the great honour which had been done him by his election to the office he held, he said:—The Institute of Patent Agents has been in the minds of some of us for many years. Probably there is no profession which has more need of such an institution. The objects for which the association is established are:—Firstly, to form a representative body of the patent agents of the United Kingdom for the purpose of promoting improvements in the patent laws and in the regulations under which they are administered; secondly, to frame and establish rules for the observance of patent agents in all matters appertaining to their professional practice; and, thirdly, to extend their opportunities and facilities for meeting, correspondence, discussion and interchanging ideas respecting matters connected with their professional practice, and generally to aid in the acquisition and dissemination of knowledge appertaining to their profession. The Institute is to be composed of Fellows, Associates, Foreign Members, and Honorary Members, with a class of Graduates. The first Fellows of the Institute are the gentlemen who joined it on its formation; including, I think I may fairly say, all the prominent patent agents of the day, both in London and in the country. For the future, a Fellow must be more than

twenty-five years of age, and must come within one of the following conditions :—(*a*) He shall have practised on his own account in the United Kingdom for at least five years, and have acquired good repute in the profession of a patent agent; or, (*b*) he shall have been, for at least seven years, engaged as a pupil or assistant in the business of a Fellow of the Institute, and have acquired such knowledge as to qualify him to practise as a patent agent; or, (*c*) he shall have passed an examination in patent law and practice in mechanical drawing and in such technical or other subjects as the Council may deem requisite; such examination being conducted by the Council, or by examiners appointed by them. Associates are to be persons of more than twenty-five years of age who are not patent agents by profession, but who, by their connection with the law, science, or the arts, are, in the opinion of the Council of the Institute, qualified to advance the objects of the Institute, or shall be persons who have been Graduates of the Institute of three years' standing. Foreign Members shall be patent agents established in practice in foreign countries or the British Colonies, and neither having an office nor practising in the United Kingdom. Honorary Members are to be distinguished individuals who, from their position, are enabled to render assistance to the profession. Graduates are to be persons not under eighteen years of age, who are or have been pupils or assistants of Fellows of the Institute, and have the intention of becoming patent agents. Fellows are to pay an entrance fee of six guineas, and an annual subscription of four guineas. Associates, an entrance fee of three guineas, and an annual subscription of two guineas. Foreign Members, an entrance fee of two guineas, and an annual subscription of one guinea. Graduates, an entrance fee of one guinea, and an annual subscription of one guinea. The present list of the Council comprises the names of members of most of the principal London firms, and of one patent agent in Glasgow, and one residing in Birmingham. It is quite probable that some patent agents entitled to admission to the Institute have not been invited to assist in its formation. We wish it to be understood, as to any such gentlemen, that their non-inclusion in the first list of members is no slight on them, and that the Council do not profess to have invited the co-operation of all qualified practitioners, but only of those with whom some member of the Council was acquainted. They considered it necessary, in the first instance, to adopt this method of procedure, as no other means of selection appeared to be open to them. The Council could not undertake the personal responsibility of approving every name they heard of as that of a patent agent without knowing anything whatever of the position or qualifications of the person referred to. It was, therefore, deemed best to invite the assistance of a sufficient number to form a nucleus for electing applicants in accordance with the formalities prescribed by the regulations. The course they have followed has been prompted solely by regard for the interests of the Institute, and has not been in any sense attributable to a desire to exclude any patent agent who can be regarded as properly qualified for admission. On the contrary, they will be happy to receive applications for admission from gentlemen practising the profession who are not yet members. Our idea in forming the Institute of Patent Agents has been that it will be useful in making us better acquainted with each other on the ground of common interest, and in facilitating discussion on all questions of interest to patentees, and to ourselves. There are frequently questions arising of great moment to our clients upon which an individual agent can exert but little influence; and it is hoped that this Institute will be able to deal with such questions with an authority no individual member could hope to possess. Much good has been done by professional institutes founded, like ours, for the purpose of drawing together the members of the profession, and for extending their opportunities and facilities for meeting, correspondence, discussion, and for the interchanging of ideas connected with matters relating to their professional practice. The Law Institution—which has done so much to elevate the status of solicitors—the Institution of Civil Engineers, the Royal Institute of British Architects, the Institute of Surveyors, and the Institute of Chartered Accountants, number a great many more members than we do at present, or are likely to do; but the profession of a patent agent, properly carried on, relates to as important a class of interests, and requires the possession of as great a degree of trained skill and aptitude, as do the professions represented by the institutes to which I have referred. The Institute will, we trust, give us a greatly improved status; and we look forward to the time when our Institute will have as important an influence on our profession as the institutes referred to have in the professions to which they relate. The profession of a patent agent has not been carried on as a separate branch of business in this country for more than sixty years. Prior to the passing of the Patent Law Amendment Act, 1852, patent agents' business was of a comparatively limited character, the number of patents annually taken out in England at that time not amounting to more than 550; but the Patent Law Amendment Act was the precursor to an entirely new era in the profession. The number of patents was greatly increased, and there was also a very great increase in the number of patents applied for by British subjects in foreign countries. Prior to the Patent Law Amendment Act, the British patent covered our colonial possessions; but, as it was then decided that the British patent should not from that time extend to the British colonies, nearly every colony of importance has now passed a patent law of its own, and the number of colonial patents has vastly increased; this has greatly extended the sphere of operations of patent agents, and has necessitated the establishment of agencies in all the important colonies. Much has been said of late years with regard to the number of patents taken out in this country as compared with the number taken out in the United States. The fees in the United States are no doubt very much lower in amount than they are in this country; but it must be remembered that it is absolutely necessary, in the United States, for an inventor to take out separate patents for a number of heads of the invention, which may all be covered by one patent in this country; and that, when there are conflicting applicants for the same invention, the cost of the American patent is enormously increased.

On the whole, the Patent Law Amendment Act has worked very successfully for British inventors. Of course there are many points in it which might very well be amended, and I cannot help thinking that one great blot in our patent system consists in the fact that numerous patents are granted, upon mere application, for inventions which any man of intelligence must know to be perfectly old. It therefore appears to me that any Act to amend the Law of Patents should certainly contain some provision with respect to the examination of the applications, and that the applicant should, at least, have pointed out to him by the Patent-office the specifications of similar inventions which are already existing in that office. It is not possible, in the limited time at my command, to go into any details as to the mode in which such an examination should be conducted, or the principle upon which applications should be rejected. It is sufficient at present to draw your attention to the question—which is certain to be brought forward whenever Parliament can afford time to take up patent law reform. It may be well, therefore, that we should give the matter our serious consideration beforehand, so as to be prepared to deal with it at the proper time. Various Bills which have been brought before Parliament for the last ten or twelve years have all received the close attention of a Committee of Patent Agents sitting in London, and their recommendations have, from time to time, been brought before the gentlemen in charge of the several Bills, the law officers of the Crown, and the Lord Chancellor. It may not be irrelevant here to state that our suggestions have always been met with courtesy, and we have found many of these suggestions adopted in Bills of a later date. The Bill which appeared most likely to meet the views of inventors, and to be of most advantage to this country, was the one brought in by Sir John Holker in the year 1879; and the patent agents to whom I have before referred were in great hopes that the Bill, with some modifications, might pass, as it would have been a great advance on the present state of legislation on the subject. The Bill was, however, blocked in the House of Commons, and it is to be feared that inventors will find some difficulty in getting the Government again to look upon their interests with the same liberal view they did at that time. You are aware that the Government proposed to bring in a Bill for the amendment of the Patent Laws last year; but the state of business in Parliament clearly prevented their dealing with the subject. It is now understood that the Board of Trade have a Bill under their consideration, and that it is to be introduced as soon as there is any chance of its obtaining proper discussion. When that Bill is introduced it will be one of the chief duties of the Institute to keep the closest watch upon it, and upon all Bills that may come before Parliament on the subject; to do our best to point out where they are faulty, and how they may be improved. The Bills we have hitherto seen all contain provisions more or less crude, more or less impracticable, and more or less dangerous to the interests of inventors. For instance, I cannot help thinking that every plan for making licences compulsory is unworkable, that the patentees and the public should be left free to settle their business in their own way, and that any attempt to interfere with them will be entirely abortive, and will do more harm than good. As to these, and other questions relating to the same important subject, it must be manifest to all that the suggestions of our Institute, founded on the mature deliberations of the body of patent agents, will have much more weight than those of individuals. Here and there we meet with persons who preach the doctrine of "No patents," but I firmly believe that so long as the Government deems it just and expedient to give copyright to authors, it will extend patent right to inventors. It is intended to hold, at regular intervals, meetings of the Institute, at which papers will be read by members on subjects of interest to the profession. It is hoped that these meetings will afford the opportunity for discussing questions relating, not only to procedure and practice in this country, but in foreign countries and in the colonies, where the interests of patentees are now becoming of great importance. The Institute will also afford opportunities for prompt intercommunication of legal decisions in patent cases. It may probably be possible to arrange for the communication to the Institute of all legal decisions of importance, considerably in advance of the publication of such cases in the ordinary law reports, whilst decisions in matters of practice before the Law Officers—as to which there is often much obscurity—may also, with great benefit to the profession generally, be brought to the knowledge of the Institute by the members engaged. Patent agents are accustomed to be consulted by inventors, not only on the policy of securing their inventions by letters patent, but upon their commercial dealing with the inventions after they are protected; and our clients are entitled to expect from us the most honourable and straightforward advice. One part of our duty is to restrain them from rushing into litigation when their patents afford no fair grounds for such a course. We all know that the inventor has an extreme idea of the value of his own invention; and we can all repeat instances of clients who cannot understand that the consideration of their particular invention is not the most important subject of the moment. Patent agents are also very frequently in a position of much delicacy as regards the claims of rival inventors, through the feeling of jealousy which one inventor has of another. Where the patent agents employed are men of honour and position there is little ground for any jealousy of this kind. I have frequently found that the knowledge I possessed of rival inventions and rival inventors, which was confined to my own office, has been of great benefit by enabling me to warn subsequent inventors of dangers they might otherwise have rushed into. There has also been considerable difficulty at all times in the selection of proper scales of charges for procuring patents and for other services in relation to patents; but the members of an institute of this kind may, by communication with each other, agree on what should be fair to themselves and to their clients. This subject is a kindred one to that of the charges of solicitors, as to which there has also been much recent discussion, finally concluded by an Act of Parliament, in the preparation of which the Law Institution had no small part. It is our great wish to do everything that can be done to maintain the honourable position of patent agents, and to give them a place in the estimation of the public, which has scarcely yet been fully attained. If this Institute can attain the position of a central authority, we shall do much to effect the objects I have mentioned; it being our desire, on the one hand, to provide a check against all irregularities in professional practice, and, on the other hand, to secure to the members of the Institute that fair consideration from their clients to which they are entitled. The Council have power, by the Articles of Association, to exclude from membership of the Institute all persons convicted of any irregularity in the practice of patent agency. The members may rely upon it that no part of the duties of the Council will be more onerous or more unwillingly undertaken; and it is hoped that there will be few, if any, cases in which this authority has to be exercised. You will observe that we have taken power to admit as members of the Institute patent agents practising in the different foreign States. We shall be in constant communication with these agents; and much may be done to facilitate the labours of English agents by a well-arranged system of such correspondence. We look forward to the time when we may collect a library that shall be valuable to our members and all interested in patents in this country; but we may be some time in attaining this object, owing to the expense that must necessarily be incurred in the formation and preservation of such a library. The Council will be, at all times, willing and desirous to receive communications from agents upon all subjects connected with the objects of the Institute and the well-being of the profession; and as we shall meet at frequent intervals, all such communications will have our most careful consideration. Having put before you, gentlemen, the objects and interests of this Institution, it is only for me to say that our success can only be assured by the hearty co-operation of all its members; and this, I hope, we are already assured of, as the formation of an Institute of this kind seems in itself a proof that the members are desirous of effecting the objects I have pointed out.

Mr. Imray (vice-president), in moving the appointment of Mr. C. F. Kemp, of the firm of Kemp, Ford, and Co., as auditor, said he was very glad to find that a great number of patent agents in this country had come forward to get the benefits of co-operation by joining themselves together in an Institute, for there were thousands of little things in the practice of the Patent Laws which an Institute speaking with authority as a responsible body could compass, when no individual patent agent could do anything at all. They all knew, for instance, that there was a great deal of difficulty arising from the way in which certificates of allowance were issued from the offices of the Solicitor and Attorney-General, the order in which they were issued being something extremely like disorder. An Institute like theirs had for its business to try to rectify an abuse like that, and the Council at the present moment were wisely engaged in endeavouring to do so. (Hear, hear.) One of the prime objects would be to ensure what he was bound to call the respectability of the profession, and he hoped they would be able to exclude all persons guilty of dishonourable practices.

Mr. Carpmael seconded the motion, which was agreed to.

The President then proposed the appointment of Mr. Hardingham as Hon. Secretary, also thanking him for the great services he had already rendered to the Institute.

Mr. Abel seconded the motion, which was agreed to.

On the motion of Mr. Vincent Newton, seconded by Mr. Carpmael, and supported by Mr. Spence, a vote of thanks was passed to the President for his very able and judicious address.

The President said the Council would be happy to receive any papers from the members to be read and discussed at future meetings.

Mr. Jensen suggested as one subject for discussion the advisability, or otherwise, of having an examination of provisional and final specifications, and also the working of American and other patent laws.

Mr. Justice asked whether it would not be advisable that the Institute should be made known by the members using the titles to which they were entitled.

The President said the Council had already considered the question, but it was thought that they were not in a position at present to say anything authoritative on the subject. Each member was, of course, at perfect liberty to use the title if he chose.

Other questions for discussion were also suggested, such as the propriety of advertising charges and sending out circulars.

The President said the Council would consider the suggestions made.

The meeting then adjourned.

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty :—James Maling, engineer, to the Invincible, vice Rigler; and William M'Intyre, engineer, to the Asia, for service in the Mercury.

THE AMERICAN IRON TRADE.—The latest information which we have received from the United States confirms what we have said regarding the state of the American iron trade. The Joliet Iron and Steel Company has determined to close its works on or before December 1st, and other Western companies making Bessemer steel expect to follow suit speedily, thus throwing out of employment at least 20,000 skilled and unskilled workmen. Two reasons are assigned for this action. The Joliet Company gives as its reason for this step the fact that a majority of Congress hostile to the maintenance of the present tariff has been elected, and it proposes to take in sail while it has time and at a slack season. Another reason more potent than acknowledged is the recent decline in the price of steel rails. Within three months they have dropped from 50 dols. to 45 dols., at which the manufacturers say they cannot manufacture at a profit. Still the consideration that so many persons are dependent on the employment their mills furnish, would have inclined them to continue, even at a small loss, had not the Scranton Company, within a few days, further reduced the price to 42 dols. The recent decline has caused the North Chicago Rolling Mills and the St. Louis companies to take the same step. Mr. O. B. Potter, chairman of the North Chicago Company, attributes the closing to three causes—the decline in prices, disproportionate wages, and the probability that the tariff on steel rails will be reduced to 14 dols. per ton from 20 dols. as at present. The decline in prices, he said, had been due to the decreased demand, which, however, depended on the belief of railway constructors that they would be able to buy the rails at nearly their own figures by holding off a little while. Very little rail laying is going on now on that account. The Scranton Company's action in sending the prices 3 dols. lower had knocked the bottom out of the business. At 47 dols., he said, there would be a mere shaving of profit; at 45 dols. a considerable loss, and at 42 dols. a loss that the companies would not bear. Mr. Potter attributed the disposition of Congress to reduce the tariff to Mr. A. S. Hewitt's admission that the Harrisburgh Company, in which he is interested, made 79 per cent. on its capital last year. He says that the public do not understand that the same output at present prices would cause them a net loss of 3 dols. or more per ton. Most of the Western Bessemer companies became bankrupt between 1873 and 1879, in their losing effort to maintain their plants and furnish work for their *employés*. This time they prefer to look after the interests of their shareholders, and take in sail while they can do it without the loss of anything beyond interest on capital. He says the North Chicago Mill will probably shut down by Dec. 15th, while the Union Mill will keep open long enough to complete the orders on hand, which can be finished in less than sixty days. At this time last year they had orders on their books sufficient to keep them going for nine months.

DEATH OF PROFESSOR HENRY DRAPER.—Scientific men in this country will hear with regret that Professor Draper died suddenly in New York on the 20th ult. of pleurisy, contracted during a trip in the Rocky Mountains. Professor Draper was born in Prince Edward County, Va., March 7th, 1837. His father was the late Dr. John William Draper, celebrated as a chemist, physiologist, and publicist. After a course in the primary and preparatory schools, Henry Draper was admitted, at the age of fifteen, to the Academic Department of the University. The year 1857 he spent in Europe, visiting and studying places and instruments connected with great scientific investigation. An instrument which particularly attracted his attention was the 6ft. reflecting telescope of Lord Rosse, and to the interest excited in its examination and the field of enterprise which it suggested are largely attributable his subsequent efforts in the science of celestial photography. Upon his return to New York he was appointed a member of the medical staff attached to Bellevue Hospital, and for eighteen months he discharged the varied duties of his responsible position. His tastes lay in an altogether different direction, however, and he abandoned the practice of medicine, although he accepted, in 1860, the chair of Physiology in the Academic Department of the university from which he had been graduated, and retained it until last summer. Shortly after his return from Europe, Draper constructed a reflecting telescope of 15½in. diameter, with which he was enabled to procure a photograph of the moon 50in. in diameter, the largest ever made. He had his own workshop and his own tools at the Hastings Observatory, and his ingenuity suggested a number of important improvements in the making of astronomical instruments. His methods of grinding and polishing mirrors, as well as his system of testing them, attracted such attention that he felt warranted in embodying a description of them in an interesting memoir which was published by the Smithsonian Institution in 1864 in its "Contributions to Science." This work is regarded as the standard publication on the subject. Professor Draper was the first to demonstrate the superior value of chemically pure silver over all known substances in the construction of the speculum. This was the result of the experiments resorted to in the construction of his famous equatorial telescope, with its aperture of 28in., which was to prove of such value in photographing the spectra of the stars. In 1872 Professor Draper obtained a photograph of the diffraction spectrum which has never been excelled. It comprised the region from below G, wave length 4350, to O, wave length 3440, on one plate. Perhaps Professor Draper's most remarkable achievement was his discovery of oxygen in the sun. This was in 1877, after a long and costly investigation of the lines in the solar spectrum. It was a revelation to scientific men which created intense interest, provoked much discussion and some criticism. A trip to Europe by Professor Draper was one of its results. He laid his facts before the British Association and the French societies. The latter acknowledged the correctness of his views and applauded his discovery. There was a disposition to dissent from them among the English scientists, although the preponderance of opinion was in his favour. Subsequent investigations have tended to prove the soundness of his judgment. Professor Draper was not a prolific author. His time was too much occupied to permit him to do more than prepare occasional papers on the progress and results of his researches. Two works, however, have been contributed by him to scientific students—one, "On the Construction of a Silvered-glass Telescope;" the other, "A Text-book of Chemistry." These, with his other papers and contributions to scientific periodicals, comprise the bulk of his literary work. As a lecturer he was remarkably entertaining, and he combined the qualities of an excellent teacher and of an original investigator as well—a combination seldom found. He paid strict attention to his duties as a professor, and was eminently qualified to fill the chair of chemistry in the Academic Department of the University, to which he was called upon the death of his father in January last.

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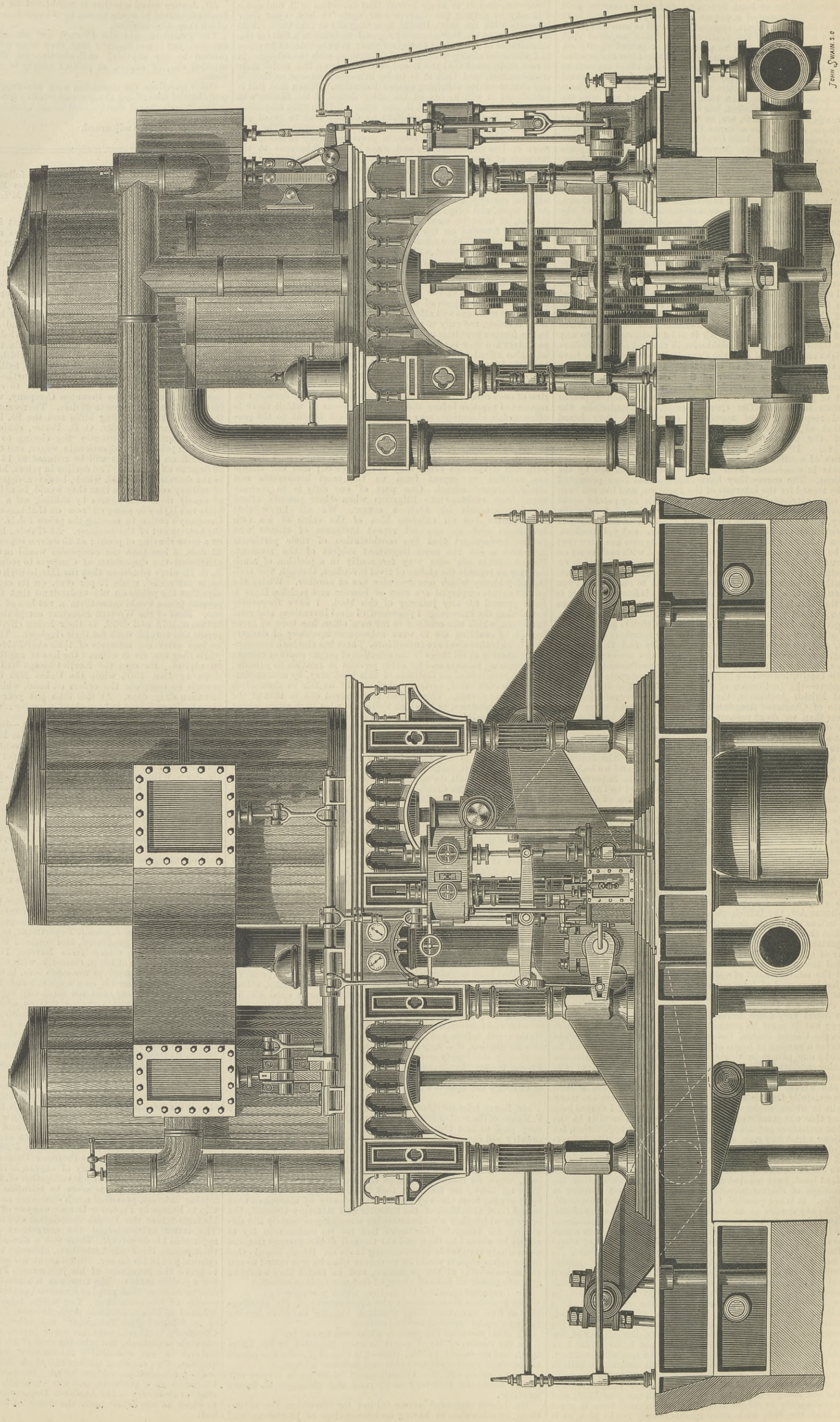

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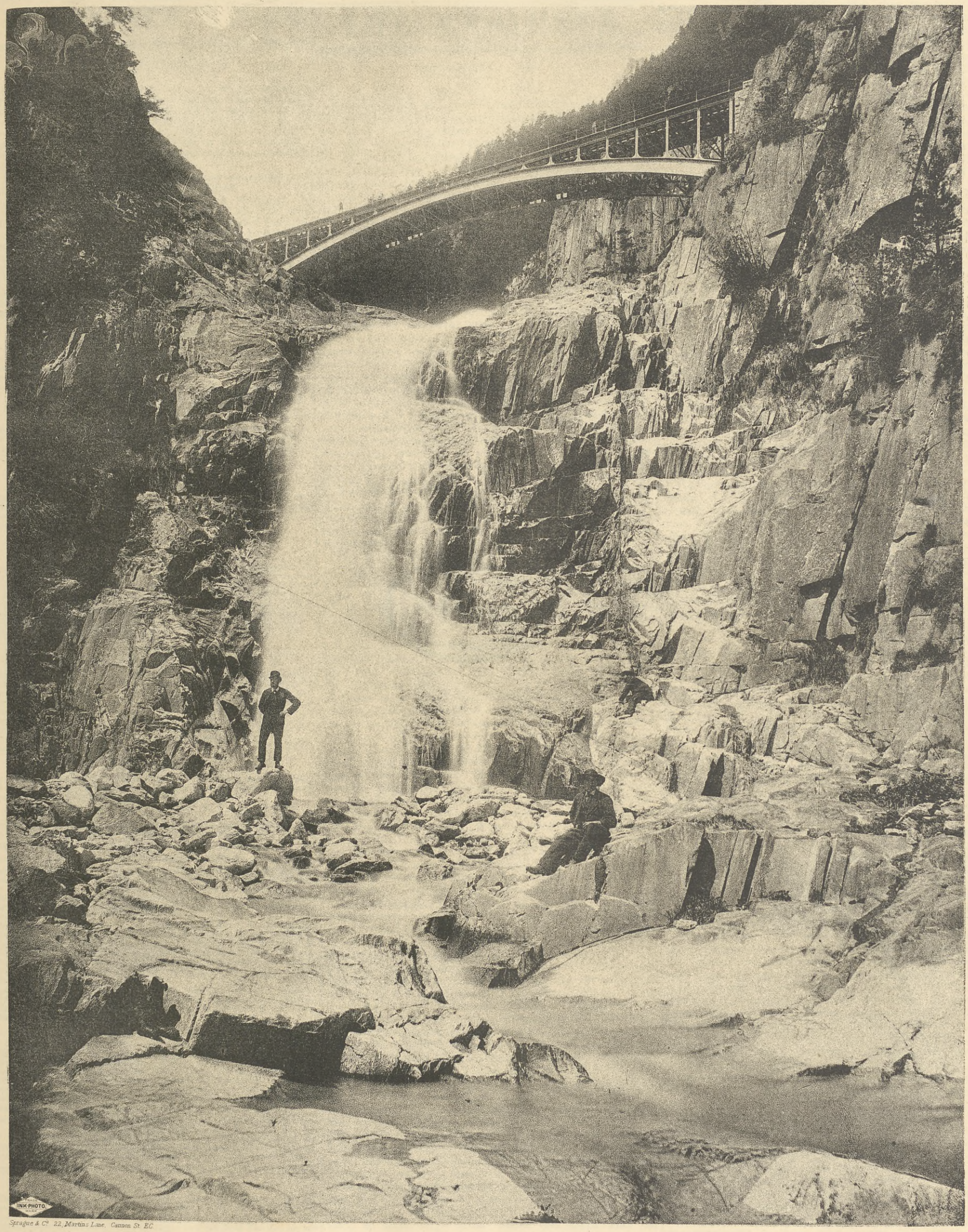

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TO CORRESPONDENTS.

*** *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.*

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G. JUNIOR.—*Enquire of Mr. Geo. Bower, St. Neots.*

AVERY HILL.—*The pressure on the bottom of a boiler is greater than that on the top by the weight of the water contained in the boiler.*

W. J. (Doncaster).—*A weight of* 2000 *lb. falling* 10*ft. would have* 20,000 *foot-pounds of work stored up in it—that is to say, it could push* 20,000 *lb. before it for one foot, or ten times as much through one-tenth of a foot, and so on.*

STRAW COVERS FOR BOTTLES.

(*To the Editor of The Engineer.*)

SIR,—There is a machine for stitching straw covers for bottles. Any reader would confer a great favour by letting me know name and address of the maker. C.

Glasgow, November 23rd.

HORSESHOE NAIL MACHINES.

(*To the Editor of The Engineer.*)

SIR,—I should feel much obliged if any of your readers could inform me where I can procure one of the above-mentioned machines, or give me any particulars connected therewith. ALPHA.

IMPOUNDING RESERVOIRS.

(*To the Editor of The Engineer.*)

SIR,—I shall be much obliged to any correspondent who will give me particulars of half a dozen of the largest impounding reservoirs in Great Britain, length, breadth, &c., and catchment area. HYDRAULIC.

November 27th.

WALTON'S WHEEL SCALE.

(*To the Editor of The Engineer.*)

SIR,—Will you allow me to ask if any of your readers are acquainted with Walton's wheel scale for setting out the teeth of wheels? I was for some time at a large works on the Continent, where it was in constant use for large and small work, and gave very satisfactory results, yet I cannot find that it is employed here, and after making repeated inquiries, I have been unable to learn where it may be obtained. Any information on this subject would greatly oblige, A CONSTANT READER.

November 27th.

ROPE GEARING.

(*To the Editor of The Engineer.*)

SIR,—Can any of your readers give me some reliable information concerning rope gearing? Is there any treatise on the subject? I should propose to apply it to drive a number of small machines requiring, say, from 3 to 30 indicated horse-power each, from the fly-wheel of an engine direct, and so avoid the expense of a countershaft and the inconveniences appertaining thereto. Would it be suitable for the purpose? The chief obstacle appears to be that loose pulleys cannot be applied. Is this objection removed by other means of stopping and starting the machine?

November 23rd. ENGINEER.

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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.*

MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, Dec. 5th, at 8 p.m.: Paper to be discussed, "American Practice in Heating Buildings by Steam," by the late Mr. Robert Briggs, M. Inst. C.E.; and, time permitting, paper to be read, "The Sinking of two Shafts at Marsden for the Whitburn Coal Company," by Mr. John Daglish, M. Inst. C.E.

SOCIETY OF ENGINEERS.—Monday, Dec. 4th, at 7.30 p.m., a paper will be read "On the Strength of Boiler Flues," by Mr. W. Martin, the leading features of which are as follows:—Introduction. Importance of the subject. Flue the weakest part of a boiler. Difficulty of discovering weakness by testing. Theoretical investigation of strength. Experimental determination of strength. Fairbairn's experiments, &c. Strength of, as affected by different methods of construction. Elliptical flues. Cross tubes. Flues of two diameters, &c.

SOCIETY OF ARTS.—Wednesday, Dec. 6th, at 8 p.m.: Fourth ordinary meeting, "The Artificial Drying of Crops," by Mr. William A. Gibbs.

CHEMICAL SOCIETY.—Thursday, Dec. 7th, at 8 p.m.: A ballot for the election of Fellows will be held, and the following papers read:—(1) "On the Condensation Product of Phenanthraquinone with Ethylic Acetoacetate," by Messrs. F. R. Japp and F. W. Streatfield. (2) "On the Condensation Products of Venanthol," Part I., by Mr. W. H. Perkin, jun. (3) "On the Condensation Products of Isobutylaldehide Obtained by Means of Alcoholic Potash," by Mr. W. H. Perkin, jun. (4) "On the Formula of Lophin," by Mr. H. E. Armstrong. (5) "On the Molecular Weight of Basic Ferric Sulphate," by Mr. S. U. Pickering. (6) "On Certain Brominate Compounds Obtained in the Manufacture of Bromine," by Mr. S. Dyson. (7) "The Chemistry of Hay and Ensilage," by Mr. F. Woodland Toms. (8) "Note on the Preparation of Diphenyleneketone Oxide," by Mr. W. H. Perkin.

DEATH.

On the 23rd ult., at his residence, Team Lodge, Saltwell, Gateshead-on-Tyne, in his 75th year, THOMAS LONGRIDGE GOOCH, M. Inst. C.E.

THE ENGINEER.

DECEMBER 1, 1882.

IRRIGATION IN INDIA.

THE opening of the great Sirhind Canal by the Viceroy of India is an event of great civil engineering interest as well as of vast importance to the Punjaub. During the past few years a number of influential men well versed in the economic and political affairs of India have shown by their publications that they take more than a passing interest in our great dependency. Sir Arthur Cotton has been a strenuous advocate of the extension of navigable and irrigation canals; Mr. E. C. G. Thomas, judge of Vizagapatam, has written two pregnant pamphlets on famines in India, urging the importance of the improvement of the harbour of Vizagapatam and the canal and railway communication therewith, all of which could be effected at a comparatively small outlay for the large area placed in intercommunication; Sir J. F. Stephen and Sir G. Campbell have done their best to excite some real interest in those public works in India which could be carried out by competent men at no great cost; Sir James Cairo, a member of the 1878-9 Finance Commission, and Major-General F. Applegath and others have done their best to show how very much could be done to prevent famines in India by irrigation works and the provision of the means of transport between provinces which are never at the same time visited by the causes of famine. Mr. Giffen, President of the Statistical Society, recently gave some valuable statistical information on the Indian population, which is increasing rapidly under our rule, owing to the removal or limitation of several of the checks on its growth, which were previously so active. At present the growth of the population is so rapid that its continuation at the same rate would make the problem of providing for it one of insurmountable difficulty, but fortunately the history of the world shows that the growth of populations, under the most favourable circumstances, is not so progressive.

The future historian of India will probably date the career of improvement through which India is now passing to the time of the great Sepoy mutiny. The turning point in the history of India is no doubt to be found about that date, when the national mind was first aroused to the vast field of enterprise and the great task of public works that had devolved upon us nationally, and it was not until after the great Orissa famine that the mind of England became thoroughly aroused to the fact that, as the rulers of India, we were responsible for preventing the recurrence—and the consequence to the inhabitants—of these famines, and that the well-directed work of the civil engineer presented the certain means everywhere for the mitigation of those consequences, and, except in a few districts, for their absolute prevention. According to Sir James Caird, the area under cultivated crops in India is equal to one acre per head of the population, and in an important communication to a daily contemporary, he says that the population increases at the rate of two millions a year, and may be provided for by two methods—either "by a progressive increase in the area of cultivated land, or by a gradually increasing produce from the land at present cultivated. The equivalents of the two methods are an extension of cultivation by two million acres annually, or an increased produce by one-tenth of a bushel annually from the present acreage. In a country like India, of ancient cultivation, the best and most available land has long been occupied. The cultivable area still untouched is stated to be abundantly extensive, but it will require much beyond the ordinary capital of an Indian cultivator to bring it into a state of production. We must, therefore, chiefly rely on the second method. One bushel of increase per acre gained gradually in ten years, from the present cultivated area, would meet the demand of a gradual increase in the same time of 20 millions of people. And, if a proportionate rate of increase could be attained in each decade, the increased population for a hundred years could be fed without much increase in area. The produce would then have gradually risen from 10 to 20 bushels an acre. Each acre, instead of maintaining one person, would thus have become capable of maintaining two. This is a great step, doubtless, but it is from a low point of production. And, considering the generally fertile nature of the soil, and that in most parts of India two crops can be got in the year, it would seem a very possible result. By these two methods, more or less combined, the increase of population may be safely met for a long time to come, and upon their wise development the success of the future Government of India must mainly depend."

Under two grand categories the means of prevention for Indian famines may be classed—equalise the rainfall, and provide ample and rapid means of communication, so that large areas where the crops may be scanty can be timely fed from those in which they are abundant; and facilitate the movement of the people from densely populated tracts. In some of the worst famines which have desolated Bengal and Central India, more grain existed in Tennasserim and Burmah than would have fed all the famine-stricken regions and left a superabundance for the natives of those provinces; but there was no sufficient means of transport possible between the distant regions, nor of distribution within reach of the starving crowds. Indeed, one of the most difficult circumstances to be dealt with in connection with these Indian famines is that the drought which destroys all hope of the grain crop for human food destroys also the provender for the cattle, who die by hunger and thirst, and with them ends the means of local transport. On the one hand, then, the construction of harbours, railways, roads, and navigable canals; on the other, the husbanding of water in tanks and reservoirs, and the production of works of irrigation upon a sufficient scale to equalise the rainfall, and in reality to make an artificial climate for India, which shall render its agriculture independent of those violent fluctuations of drought or deluge that must ever characterise the monsoons and the rainfall which they are naturally supposed to bring, are the chief requirements to be met. Upon this broad text there is an almost boundless field for remark when we come to examine it in detail. No portion of the vast Indian peninsula has been less favourably circumstanced by nature than the immense tract extending for more than 1500 miles along the East or Malabar Coast from Calcutta to the mean latitude of Ceylon. Eastward of this broad littoral tract lies the table land of Central India, a country larger and more populous than France, with a very varied and fertile soil, capable of producing grain crops in boundless abundance, and with great areas of black cotton soil to a great extent left waste because the local demand for cotton is limited to the supply of the native village loom, which still clothes many of the inhabitants whom Manchester calicoes cannot reach. The people are poor, barbarous, and ignorant as compared with the populations of Bengal and of Western India. A large proportion of the male population have no useful employment, and the produce exported annually is little more than nominal as compared with the natural capabilities of a vast country and immense population. The main cause for all this is, that, drawing an imaginary meridian line down the centre of the vast peninsula, all its eastern area is to a great degree cut off from intercourse with the rest of the world by the absence of ports fit for the reception of sea-going ships along its vast coast line from Calcutta to the mouth of the Godavery in about lat. 16 N. The coast, unlike the abrupt and sharply rising western one, everywhere slopes gradually down to the sea, with few headlands and no important inlets or indentations. There is one exception, however, to this generally harbourless coast, and it was the object of one of Mr. Thomas's pamphlets, to which we have referred, to point out with much force and perspicuity the natural advantages for the formation, at an insignificant expense, of an important harbour at Vizagapatam.

It is not our intention, however, to speak of the requirements of this part of India, but of the great work recently completed in the Punjaub. The Sirhind Canal is over five hundred miles in length, and has subsidiary channels of about two thousand miles in total length, distributing the waters of the Sutlej over three-quarters of a million of acres of thirsty soil. In requesting the Viceroy to open the Canal, Colonel Home delivered an address, giving an interesting account of its progress, and of the difficulties attending the construction of the canal from 1840, when the project was first suggested, up to the present time. The canal he described as one of the largest in the world, and the second large work of its kind undertaken in the Punjaub since the province had come under British rule. An important feature in Colonel Home's address was the assistance, which he warmly acknowledged, ungrudgingly given by all the chiefs through whose territories the canal passed, referring particularly to the late Maharajah of Patiala and the present Council of the Regency, the Chiefs of Jhind, Nabha, Fureedkote, and Maler Kotla. He explained that the management of the internal distribution of the water would be left to the village communities, Government interfering only to advise or to prevent wilful waste. The duties of the administrative staff would thus be lightened, and the people educated to a more intelligent appreciation of the benefits to be derived from canal irrigation. The total length of the canal, he said, was 502 statute miles, and when the works were completed 2500 miles of channel were to be maintained. The canal was designed to irrigate through branches 522,000 acres in British and 261,000 acres in the Native States of Sirhind and of Rajpootana. The total cost was estimated at 407 lakhs, of which 278 lakhs were being defrayed by the British Government, and 129 lakhs by the Native States.

The Sirhind Canal is an example of the great irrigation work which we have yet to perform in India, and which will contribute enormously to the welfare of the people, and must not only afford a great field of action for the civil engineer, but will co-operate with and increase the necessity for profitable railway enterprise. There are many economic and political questions which, brought about by the changes and innovations enforced by our rule, based upon Western modes of thought and habit, the statesman has yet to consider and settle; but the construction of navigation, irrigation, road, railway, and harbour works will do more to remove the poverty, to educate, and to ensure local independence, than any other reform can do without them.

In the official report on the East India Famine Commission issued last year, it is stated that the excess of mortality during the last famine in 1877-78 amounted to 5,280,000 human beings; food in abundance, but unavailable for want of means of transport, was often not more than fifty miles distant from the stricken district. To diminish the effect of such catastrophes, the Indian Government must either build canals, railways, and tramways on their own account, or give substantial encouragement to those who furnish the means. The want of these railways, which might not pay at first, is of course most felt in districts which do not produce food adequate to the consumption, and therefore require it brought to them, but the success of the railways already made shows that even these would ultimately pay.

BRIGHTON BEACH.

A RECENT visit paid to the works at Hove, on which we have from time to time commented, has revealed features

in connection with the deposit of beach there which are of great interest, as being likely to demonstrate the probable effects of groynes constructed at an angle with the shore line. We have been able to keep our readers fully informed of the action induced by these groynes while they have been under construction; and in our last article we stated our belief that they were likely to prove of practical effect in accumulating shingle. So they have been, certainly, but in so strange and unexpected a manner, that the engineer who designed them must feel as if he were a modern prototype of the Sisyphus of classical story. During the interval that has elapsed since our penultimate visit to these works, the groynes we then described as only partially finished have mainly been completed, and we fully expected, in spite of the storms which have raged since that date, to find shingle heavily piled against the west or windward sides of the groynes. It was, therefore, greatly to our astonishment that we found that in a considerable number of instances the beach lay instead thickly to the leeward of them, while the windward side was completely denuded, and the strong ties of rough tree stems, instead of fulfilling their designed function as ties, had had that function reversed, and were acting as struts. The groynes had, as is usual, been built with a batter towards the west to resist the expected pressure on that side, and the result now is that in the cases of the groynes referred to that batter has been injuriously increased by the reverse pressure to which they have to submit. This singular occurrence was so opposed to all the theories we have founded on our previous observations, that we sought for some time for a possible explanation before one occurred to us. Before entering upon this point, however, it may be as well to lay before our readers information given to us as to a somewhat similar phenomenon which occurred at Felixstowe on one occasion. The beach at that place is composed of very fine gravel with sand and small shells. Small groynes of wood are used to stop it from travelling. During a month's observation by our informant the beach was packed 2ft. to 3ft. high against the south side of the groynes, the wind during the period of observation having been constant from that quarter, and being practically an off shore wind. One night the wind changed round to the north-east, and, in one tide, the arrangement of beach was completely altered and all the groynes packed on the other side. The hypothesis submitted to us is that a similar shift of wind may have operated to produce the state of things we have remarked at Hove. But when endeavouring to realise the cause in the latter case, we observed that the reversal of accumulation became much more strikingly apparent as the angle of the groynes with the windward shore line became more obtuse—as, so to speak, they approached parallelism with it. In our earlier articles on this subject we referred to Mr. Ellice-Clark's proposal to adopt a series of trending groynes, each succeeding one approaching more nearly to that parallelism, and we received a letter from that gentleman giving a sketch illustrative of his design, which we published. Our readers will therefore be able, from that sketch, to understand our reference to this matter. We observed, as we have said, that the reversed action became more strongly apparent as the flatter groynes were reached, and that those which approached the rectangle were not subject to the same action. In fact, Mr. Ellice-Clark's plan has, in one sense, succeeded only too well. Designed to prevent the well-known scouring action induced along the leeward face of sea groynes, it has most effectually done it; but the weather face has become almost entirely bared of beach owing to the scour of the diverted current from the neighbouring groyne. It was observable that those groynes, constructed at the old-fashioned right-angle had secured a large deposit of shingle, piled some 10ft. high or more against their weather face, and actually travelling over the top of such groynes; but former experience was borne out by the fact that there was scarcely any counterpoise deposit on the leeward side. The two ultimate groynes, in fact, of the series were the exact opposites in their results to each other, and we saw, we thought, that it is between these two extremes that the happy and, probably, successful medium may be found. We were unprovided at the time of our visit with instruments to measure the angles of the several groynes, but at one of these, which appeared to vary about 15 deg. from the right-angle, we observed the accumulation of shingle to be about equal on both sides. In the cases where this angle was exceeded, the unexpected results we have described seemed to become developed in a ratio nearly corresponding to such excess. Hence our inference is that the angle of 15 deg., or thereabouts, seems to be that likely to afford the best chance of success.

It will be apparent that between this case at Hove and that we have cited as regards Felixstowe there is really no similarity, for in the latter instance the accumulation of beach was the same at every groyne, and that therefore the prevalence of wind from a particular quarter cannot in any way be assigned as a probable cause of what has occurred at Hove. It would seem that the action set up by the new groynes must have become apparent to Mr. Ellice-Clark not long after our former visit, for the last and most parallel groyne of his trending series was evidently stopped when about two-thirds completed, and the remaining third finished at a reversed angle to the previous line. What the effect of this will be is not yet apparent to a sufficient extent to enable us to judge as to the advisability of the course pursued. It may now, we think, be accepted as the fact that while a slight deviation from the old rectangular system of design produces decided improvement, the angle cannot be increased without setting up an action which mars the object had in view. We were glad to observe that the concrete groyne nearest to Brighton—in fact, marking almost the boundary line between the two parishes—has been run out at about the angle we have above named as appearing to us the most promising of success, viz., about 15 deg. from the perpendicular line. The end of this groyne, after leaving the normal beach line, has been somewhat sharply curved towards the east, and this appears to have added considerably to the effect produced by the slight angle of the groyne itself in arresting the denudation of beech on its eastward or leeward face.

In our earlier remarks on these works we strongly urged that in these and similar constructions too much should not be attempted. The principle we advanced was that the main object should be to secure what exists, without attempting by high groynes and large and unnecessary accumulations to defraud neighbouring sites. More especially we suggested the desirability of this course being pursued, as regards the groyne last noticed, that which we have designated for distinction the boundary groyne. Happily, as we think, Mr. Ellice-Clark has adopted this plan, and with an effect which fully justified our recommendation of it, for all the beach on either side of this groyne remains *in situ*, and there is none of that painfully one-sided accumulation so noticeable at some of the high groynes more to the westward, which can only have become lodged there by the defrauding of all the length of beach between them and those more to the eastward. It is on this topic that a correspondent, whose letter we recently published, addressed us, and our own observation proves how just his condemnation of high groynes has been. We receive from many quarters intimation of the interest with which Mr. Ellice-Clarke's experiment at Hove has been and is being watched. It is, in fact, one of great importance to engineers, and the partial failure which we have noticed will afford a useful lesson to those engaged on similar works. We do not pretend that as yet we can deduce a final conclusion from the works in their existing condition of incompleteness, nor until their results have been watched under more extended conditions of variance; but we believe we shall not ultimately be found to have been greatly out if we assume, on the basis of past observations, that the most economical and effective system of coast defence when the shore line is threatened will consist in concrete groynes at wide intervals built but very slightly above the existing shingle level, and having intermediate timber groynes should a number in excess of those to be constructed in concrete appear to be required to temporarily aid in accumulation. All these groynes, we hold, should be run out at the angle of 15 deg. or thereabouts, and should extend but very slightly beyond the normal beach line, and there terminate in a short curved head in the direction of the prevailing currents.

In cases where, as at certain points at Hove, the mischief has been too sudden and rapid to admit of the prevision required for such a course, the earth line should be at once protected along all its threatened length by a low wall of concrete, and an accumulation of shingle to guard against undermining ensured by a series of short and low groynes on the system above stated; but these should be only just sufficiently high to effect this purpose, and not of such a height as to arrest a large and needless quantity of the beach, and prevent the travel of the surplus to points further up the coast. For it will be remembered that it is to such unwarrantable accumulation to the westward of Hove by independent authorities that Mr. Ellice-Clark attributes the present trouble of his employers, the Hove Commissioners. Were imperial control of such matters established, such selfish and useless proceedings would in the future be impossible.

LATENT HEAT.

When steam is being made, it is known that after a certain temperature has been reached the water becomes no hotter. It then boils, and steam is formed. It is commonly stated that the heat poured into the water after ebullition commences ceases to be sensible, becoming "latent" or hidden in the steam. This word "latent" is misleading, because it gives the idea that the heat still exists as such, and very ingenious hypotheses have been framed and published to explain why a thermometer could not take cognisance of its existence. But no hypothesis of this kind is needed. The truth is that there is no such thing as latent heat. The words suffice, however, to indicate the nature of certain phenomena; and this being the case, we do not desire to see them expunged from the dictionary. But we do wish to see them used with an intelligent perception of what they mean. A pound of steam at a pressure, say, of 100 lb. on the square inch has that intensity of heat vibration corresponding to 328 deg. Fah., and it contains a quantity of heat equivalent in thermal units to $328 \times 772 = 253{,}216$ foot-pounds, and this is absolutely all the heat which exists in 1 lb. of such steam. But there has been imparted besides to it heat enough to do work on it equivalent to $883 \times 772 = 681{,}576$ foot-pounds. But this heat has no existence in the steam. It is not there, and consequently the thermometer cannot indicate its presence. So far from being latent or hidden, it has absolutely no existence at all. What, then, has become of this enormous amount of energy, equivalent to lifting a weight of 304 tons 1ft. high, or of lifting one ton to the top of the dome of St. Paul's?

Water is supposed to consist of a multitude of excessively minute spheres, retained in close propinquity to each other by some force, the precise nature of which no one knows anything definitely about. These spheres have two kinds of motion among themselves, first what may be termed mechanical motion, or currents, set up by external influences, or when a vessel containing water is shaken; and secondly, a motion due to the presence of heat—in other words, thermal motion. The precise nature of this motion is not understood. Those who are familiar with mathematical investigations and the works of such men as Rankine and Thomson need be told nothing on this subject; but we are not writing now for mathematicians, but for those who having no time for abstruse thought, nevertheless wish to acquire some accurate conceptions of the true nature of processes going on before their eyes daily. For these it will be enough to say that the heat motion of water is assumed under one hypothesis to be in the nature of a whirlpool; that is to say, the molecules are continuously rotating round centres among themselves. If there was no heat at all in water it would be a dense hard mass—an extemely solid ice in fact; and as soon as sufficient heat motion is taken out of it, we know that the whirling of the molecules among themselves to a great extent ceases, and we have ice. Now when steam is made, the whirling motion becomes more and more rapid and intense as the temperature of the water increases, and at last a point is reached when the force retaining the molecules in propinquity, to which we have referred above, is entirely overcome, and the molecules then fly apart. The result is steam; and the molecules of water in the shape of steam have then another kind of motion besides that of heat. They are assumed to move in straight lines, and coming continually in contact with the walls of the vessel in which the steam is confined, they rebound from them, and being multitudinous past all conception, this constant bombardment produces the effect known as pressure. Besides this longitudinal movement, however, the molecules also retain heat motion, which is capable of affecting a thermometer, which the other motion is not. Thus, then, we have in one pound of steam two sets of motion—one heat-motion, equivalent to 253,216 foot-pounds of work, and the other pressure-motion, equivalent to 681,576 foot-pounds. Thus, then, it will be seen that latent heat does not exist. It is not to be supposed that the statements we have made regarding the motions in water are more than theories. Nothing is, of course, certainly known on the subject; but the theories are generally regarded by competent authorities as in the main satisfactory. They have received developments and modifications, to which we need do no more than barely refer here. The broad fact, however, remains, that the heat said to be latent has really been converted into work, expended in overcoming the force which retained the molecules of water close to each other, and it is no more heat than is the journey performed by a train running from London to Liverpool. The engine fire has done work in two ways—it has produced steam, and it has conveyed a heavy train some 200 miles; but it would be just as correct to say that the heat of the fire had become latent in the train, as to say that is has become latent in the water.

The conversion of heat in this way into work is not peculiar to water. Thus, whenever any body, as ice or a metal, is melted, heat is said to become latent. In reality it is converted into work expended in overcoming the coherent force of the thing melted. Thus, the latent heat of ice is in round numbers 140 deg. Fah. That is to say, if we take a lump of ice, and having raised it to 32 deg., if we go on applying heat it will become no hotter, but it will begin to melt, and 1 lb. of it will require $140 \times 772 = 108{,}080$ foot-pounds for complete fusion. Mercury is solid at temperatures below — 39 deg. Fah.; its latent heat is only 2·82 deg. Centigrade; that of lead is 5·4, while that of silver is 14·25. Returning to steam, we may divide the work done on a pound of water in raising it from 32 deg. Fah. to 212 deg. Fah., and boiling it all away at that temperature in the following way: Increasing the temperature of the water from 32 deg. to 212 deg., and lessening the coherence of the molecules, 180·89 thermal units, equivalent to 139,653 foot-pounds, and representing about 15·77 per cent. of the whole work done on 1 lb. of water. The work of destroying the cohesion of the molecules—making steam, in fact—represents 893·66 thermal units, and 689,910 foot-pounds. Increasing the volume of the water from what it had as water to what it has as steam, 72 thermal units and 55,610 foot-pounds. The total is, omitting fractions, 1146 units and 885,000 foot-pounds. The distribution of the work done will vary as the pressure augments, less heat being converted into water as the pressure rises, because the molecules cannot be separated so far from each other; more heat therefore remains in the steam—in other words, its temperature rises with the pressure. At about 1200 deg. we should have no steam whatever formed. The pressure would be considerably over a ton on the square inch, and all the heat would be sensible. Jacob Perkins actually made water red hot in this way in the early part of the present century.

It may be said that the heat cannot be lost because it all reappears again when steam is condensed. That it reappears is quite true; but that is simply due to the fact that the work done on the molecules in separating them reappears as heat when they coalesce again; but there is one important fact to be taken into account—the heat never reappears of the same intensity. In order to obtain it, a surface colder than the temperature of the steam must be provided. If it is not colder, condensation will not take place. In other words, what Sir W. Thomson has called degradation of energy occurs, and this degradation, we may add, is going on constantly in the universe, the tendency being to the production of an average temperature throughout it. Thus, when we burn a pound of coal we get heat of a certain intensity; but there is no known process of nature by which this heat could be made to reappear in the same quantity and intensity. Thus, for example, we can burn coal and produce a heat of, say, 1800 deg. in a furnace, and we can employ an engine to drive a dynamo, and work arc lamps with a temperature of, let us say, 4000 deg. Here there is apparently an exaltation of energy; but it is only apparent, the quantity of heat produced by the arc lamp being quite trifling when compared with that expended by the engine. If we are asked why it is that steam in condensing returns in the shape of heat the work expended on it, we reply that we cannot tell; nor can anyone else. But we do know that if any portion of the pressure-motion to which we have referred be taken out of the steam by letting it do work in a cylinder on a piston, then the whole of the so-called latent heat will not reappear. The difference precisely represents the amount of work done by the engine, and this fact has been used as a means of determining the efficiency of an engine. This is done by ascertaining the weight of the steam used in the engine in any given time, and the weight of condensing water employed, and finding out how much the temperature of the latter is raised. If the steam did no work the whole of the heat put into it would reappear in the condensing water. It is clear that the greater the work done the less will be the heat found in the condenser. Thus, if of two

engines the one returns 90 per cent. of the whole heat to the condenser, and the other returns 82 per cent., the last is the more economical engine of the two. Unfortunately the difficulty met with in measuring the large quantity of water required for condensation is very great, which severely militates against the efficiency of this method of testing the performance of steam engines.

THE CONTINENTAL METAL INDUSTRIES.

THOUGH fairly provided with orders for immediate execution, the prospects of next year's trade are not considered by any means brilliant in some branches of the iron trade on the Continent. In an official report presented to the German Government the Silesian Miners' and Ironfounders' Association calls attention to the injurious effect on the industries it represents which is being exercised by the new Russian tariff of import duties. The establishments which have been started in Poland by means of German capital have, of course, prospects of a more flourishing character, and their united production will probably amount, during next year, to 38,000 tons of rolled iron, of a value of about £250,000. This output is equal to the normal annual exports from Upper Silesia to Russia, and represents the work of 2000 men. The imports of zinc and zinc plates will, it is stated by the *Metallarbeiter*, be rendered impossible by the new duties, which, on zinc, amount to one-third of the value. Lead and lead manufacturers will suffer in a like manner. The Rhenish-Westphalian districts have usually sent 50,000 tons of rolled iron and wire to Russia, and though the latter is at the moment allowed to enter free, the imposition of a prohibitive duty is considered so imminent as to affect in an appreciable manner the tone of the wire industry. The Westphalian small iron industry has been fortunate in getting its productions into the Dutch market in connection with the export trade. It is stated that an English firm recently had a delivery of 13,000 export hoes refused by the Dutch Government, and the order was then given out by the English house to a German firm. The delivery was made, it is said, with rapidity and to the satisfaction of the authorities, the hoes having been manufactured by a new patent process. The Dutch Government is said to have since placed some orders in the factory which had produced these hoes. The Austro-Hungarian iron industry has been, as yet, comparatively little affected by the general depression. The construction of the Galician Transversal Railway is expected to give an impetus to the iron manufacturing industry, as the important centres of Wadowice, Sayhisch, and Jordanow will be brought into direct communication with the coal districts, and the distribution of their manufactured products will also be facilitated by the new line.

THE LIME PROCESS OF GETTING COAL.

THE Midland Institute of Mining, Civil, and Mechanical Engineers met at the Victoria Hotel, Sheffield, on Tuesday, to consider the new process of getting coal by lime instead of gunpowder or wedging. Mr. T. Carrington, Kiveton Park Colliery, presided, and there was a large attendance of representatives of various collieries, with Mr. John Gerrard, Government Inspector of Mines in Yorkshire, and Major Moseley, and the gentlemen interested in the patent for the process. The latter gentleman, at the request of the chairman, gave some particulars of trials which had recently been made. At a trial in Belgium, with coal of a somewhat friable nature, and lying in an inclined position, three attempts were made. The first nine shots brought down 30 tons of coal, producing 73 per cent. of large; the second attempt, nine shots, brought down 28 tons, with 54 per cent. of large; the third time was practically the same as the first. The manager of the colliery stated that the pits had been worked since 1857, and they had never previously got more than 20 per cent. of large coal. In Austria experiments had been made at collieries belonging to Baron Rothschild, the State railways, and Count Lange. They were splendid coalfields, some of the seams being 15ft. thick. There again the results were equally satisfactory, the advantage over the coal got by powder being very marked. The chairman said that what was wanted in South Yorkshire was some method by which they could do away with powder, in consequence of the fiery nature of the Barnsley and Silkstone seams. Coalowners and managers would regard that as of far more importance than even the saving in small. Major Moseley said the system was absolutely safe. There were neither fire, nor flame, nor anything of that kind connected with it. The lime process could not possibly ignite gas. Mr. Rhodes said that the experiments at Aldwarke Main Colliery—Messrs. John Brown and Co.'s pits—had not been a success, owing probably to the coal in the Swallow Wood seam, where the trial was made, not being of a kind to give way to the expansion of the lime. Mr. A. M. Chambers said the trials at Thorncliffe Collieries had been very successful, and the men were desirous of continuing the use of the lime, which they were convinced conduced materially to their safety. The discussion was adjourned until various experiments now being conducted in the district have been concluded.

THE BASIC PROCESS.

MR. GILCHRIST read, on Saturday night, at Dudley, before the members of the Mill and Forge Managers' Association, a paper, the joint production of himself and Mr. Thomas, detailing the facts, brought down to the latest date, as to the progress of their system of making steel from phosphoric iron. Whilst the output in England is 572,604 tons a year, that upon the European Continent is 1,196,600 tons. Upon the Continent also twenty-five converters are now being built, with a monthly capacity of 36,000 tons; whereas in England the number is nine, and the monthly capacity 16,000 tons. That those who have had most experience here of the process are not abandoning it. Messrs. Thomas and Gilchrist would have it inferred from the statement that not a little of the larger make yet to take place in England will characterise the operations at the Eston Works of Messrs. Bolckow, Vaughan, and Co. Already the largest outturn by the process at any one works anywhere is at Eston, where the make in October was 9600 tons. Eston, we need hardly state, is as yet the only English works in operation; but in the same month 37,639 tons in all were made upon the Continent, at one works in France, one in Belgium, eight in Germany, three in Austria, and one in Russia. The largest weight turned out at any one foreign works in October was 7000 tons, which was made in two 9½-ton converters, at the works of the Dortmund Union. Adducing what had already been done with the common pigs of Staffordshire—where the ironworks managers admitted there had been plentiful success in rolling sheets—Mr. Gilchrist intimated that neither had he doubts as to the ultimate success of the process in the making of welding iron or boiler rings. Mr. Head and Mr. Charles Cochrane were amongst the ironmasters present at the Dudley meeting, and they expressed their confidence in the process. Touching the question of cost, Mr. Gilchrist still maintained that 74s. 11d. would be that of the puddled bar from Staffordshire common iron, the cost of the basic ingot from the like material being, on the contrary, 69s. 8d.

LITERATURE.

Memoirs of the Science Department, Tokio Daigaku (University of Tokio), No. 8. The Wave-Lengths of Some of the Principal Fraunhofer Lines of the Solar Spectrum. By T. C. MENDENHALL, Ph.D., Professor of Experimental Physics in Tokio Daigaku. Published by Tokio Daigaku, Tokio. 2541 (1881).

The length of light-waves of given colour has for several years ranked among the most accurately determined physical constants. In 1868 Angström published his results of the determinations of the wave-lengths of many hundreds of the dark lines—determinations made with such accuracy that they serve as a model of what scientific work should be. Ditscheiner's results, like those of others, such as Van der Willigen and Mascart, differed from those obtained by Angström, as can be seen by reference to "Watts's Index of Spectra," whilst those published by Ditscheiner at a later period differ still more from those of Angström. It seemed, therefore, desirable to the author to measure a number of these wave-lengths again, and explain the disparity in these results. He used a very good spectrometer, prepared by Messrs. Fauth and Co., of Washington, D.C., U.S.A., and a number of diffraction gratings, ruled by Mr. Chapman, upon Rutherford's machine. Three were upon metal and one on glass. The composition of the metal is of copper and tin, in the ratio of 17 parts of the former to 8 of the latter. The lines were nominally ruled at the rate of 17,296 to one English inch; and the finest of the three consisted of about 30,000 lines. It is a grating of great dispersive power, and was the one chiefly used. In his experiments neither the A nor the H lines were included in the measurements, as they could not be observed with sufficient satisfaction to make a measurement desirable. The corrections for temperature and barometric variation were made with the greatest care, and the value of the grating space—by far the most difficult quantity to determine with accuracy—was ascertained with great exactitude. The lines, the wave-lengths of which were carefully measured, were Fraunhofer's lines, B, C, D_1, D_2, E, b_1, b_2, b_3, b_4, F, and G, and his results accord so well with those given by Angström that they justify his assertion, that any other wave-length measurements that differ widely or irregularly from these, must be incorrect. An excellent photograph of the spectroscope accompanies the memoir.

Papers on Mechanical Subjects. By SIR JOSEPH WHITWORTH, F.R.S. Part I. True Planes, Screw-threads, and Standard Measures. London: E. and F. N. Spon. Manchester: T. J. Day. 1882.

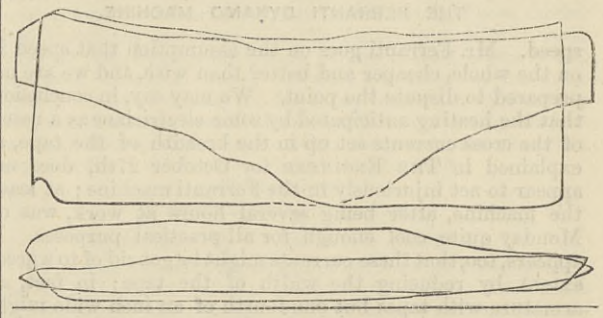
SIR JOSEPH WHITWORTH has at various times written many papers, some short, some long, but for the most part excellent in subject and method. These, or at least a good many of them, he is now collecting, with the object of publishing them for the benefit of students and working men in a very cheap and convenient form. The price of each part will be about one shilling, we believe, and it is impossible for the student or the fitter to spend a shilling better than in the purchase of the book before us. There are many points on which we do not quite agree with Sir Joseph. For example, as to the value of scraped surfaces for slide valves, and of the metrical system; but we none the less recognise the importance of what he has taught. In the present volume we have three short and excellent treatises on true planes, screw-threads, and standard measures—all subjects of the utmost interest to the engineer. We understand that the remaining parts, about three in number, we believe, will be published as soon as possible, one on rifled weapons of war early in the new year. We welcome this publication, and hope that it will meet with the attention and popularity it deserves.

THE FERRANTI DYNAMO.

ON Monday evening a number of gentlemen, including many well-known electricians, saw a Ferranti dynamo machine at work. So much has been said about this machine that the invitations sent out by Messrs. Hammond for Monday night were freely accepted. The machine was fitted in one of the arches under Cannon-street Railway station, close to Thames-street. Although we speak of it as a railway arch, it is, for practical purposes, a lofty hall with an arched roof, the ends being filled in and fitted with large windows. The walls and roof being whitewashed, all the conditions most favourable to lighting were present. In the centre of the building stood a compound engine by Messrs. Fowler, of Leeds, of the now well-known "Yorkshire" type. At one side of the engine was fixed the Ferranti machine; at the other side a very small Siemens machine used as an exciter. A counter shaft ran across one end of the arch. This was driven by a belt from the fly-wheel of the engine, and from it returned two other belts, one driving the Ferranti machine, and the other the exciter. All round the building about the level of the cornice, and round the windows at one end, were fitted Swan incandescent lamps arranged in series of three. In all there were 321 lamps alight. These were all of what is known as the A 1 pattern, with a nominal photometric value of eighteen candles. Each lamp, according to Mr. Swan's statement, requires 41 volts, E.M.F., and has a resistance of 53 ohms cold. Hot the resistance is about 32 ohms, and the 18-candle current is therefore 1·28 Ampères.

The Ferranti machine is illustrated by the accompanying engraving, as far as its external appearance is concerned. It is an exceedingly simple machine. It consists of a cast iron frame having two cheek plates, between which are arranged thirty-two bobbins with cores of soft iron. Each core is wound with four layers of wire one-seventh of an inch in diameter. The coils are connected up in series, and the resistance of the whole is 2·5 ohms. These are the field magnets, and are excited by the little Siemens machine to which we have already referred. This requires 1·7-horse power to drive it, giving a current of about 2·1 Ampères. The armature is the special feature of their invention, but Messrs. Ferranti and Thompson request that it should not be described in detail pending the completion of foreign patents. It must suffice to say that the current is produced by the passage of a copper tape through the magnetic fields of the two sets of electro-magnets before described. In THE ENGINEER for the 13th of October, page 271, we said, "We may add that it is stated Mr. Ferranti has included in a patent what has been called a disc armature, but is not one in the sense we have described, consisting instead of a waved copper strip revolving in the plane of the armature disc." This passage conveys an excellent idea of the construction of the armature. We believe that our engraving, taken with what we have just written, will make the construction of the machine tolerably intelligible to our readers without further explanation. Its total weight is 11¾ cwt. Its price is £250. Near it in the hall, for the sake of contrast, was placed the largest sized Brush machine made, costing £550. It is claimed that the Ferranti machine can do as much work, but the comparison is not fair, for the Brush machine shown is intended to drive forty arc lamps, giving 80,000-candles, while the Ferranti machine is intended for incandescent lighting only. It will be remembered that very extravagant statements have appeared in the pages of some of our contemporaries concerning the efficiency of the Ferranti machine, one writer going so far as to assert that it would do five times as much work as any other machine in the market. This was taken to mean that it had a five-fold efficiency per horse-power put through it. This was subsequently explained away, and the world was told that all that was meant was that, considering its weight and cost and dimensions, it was five times as efficient as any other machine. We are now in a position to say whether this statement is anywhere near the truth.

On Monday night Messrs. Thompson and Ferranti answered every question we asked, and permitted us to take diagrams from the engine; in so far everything was conducted in the most straightforward way. We append reduced copies of the four diagrams which we took. The engine, we may remark, ran very irregularly; the diagrams were taken with two Richard's indicators successively. The low-pressure cylinder was first indicated at both ends and then the high-pressure cylinder. No time was lost.

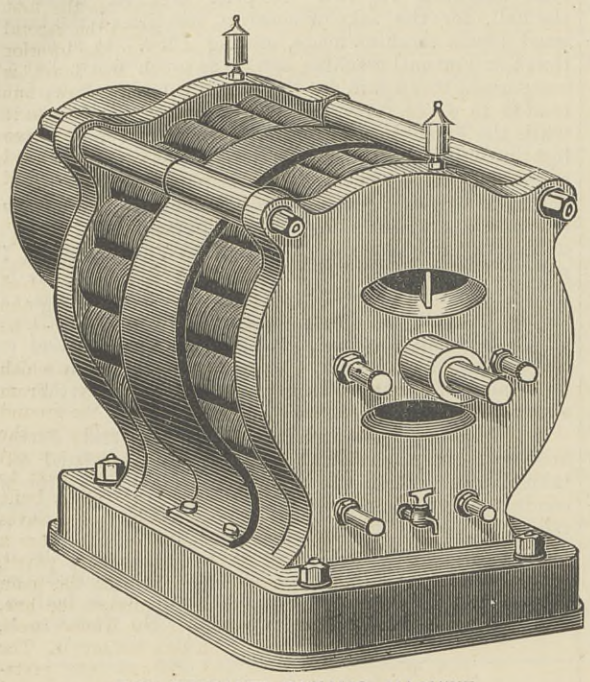


When the first diagram was taken the speed was 110 revolutions, when the second was taken it was 114. The first high-pressure diagram was taken at 116 revolutions, and the second at 110 revolutions. The engine ran fairly steadily in the sense that the rise and fall in speed was not effected by jerks; but its performance was, on the whole, bad, as will be seen from the diagrams. Although the boiler pressure was 85 lb., the cylinder pressure did not much exceed 60 lb. The high-pressure diagrams are fairly good, although deficient in lead; but the distribution of power between the two cylinders is very bad, and the back pressure in the low-pressure cylinder excessive. Messrs. Fowler ought to reorganise their valve gear. The average power indicated by the engine as a mean of the four diagrams was 26·7-horses. It is more than probable that nearly 5-horse power was expended in driving the belting, countershafting, and the exciter, leaving, say, 22 as the power put into the Ferranti dynamo machine.

On one of the walls was stencilled in black letters the words and figures, "160 Ampères, 125 volts;" and this, we were told, represented the performance of the machine. Now $\frac{160 \times 125}{746} = 25{\cdot}4$-horse power. But the engine was only indicating 26·7, and but 22-horse power were available for the machine; so that it is certain that, at the time we indicated the engine, the performance of the machine did not coincide with the statement on the wall. It is proper to add, however, that we understand that 400 lamps were driven for about two hours before our visit, and the statement might be true of this experiment. With this, however, we have nothing to do. We are dealing now only with what came under our own observation.

Turning now to the lamps, we have stated that they require an electro-motive force of 41 volts; and as the were in series of three, we have $41 \times 3 = 123$ volts; and allowing for circuit resistance, this corresponds accurately enough with the before-mentioned statement on the wall. But each lamp requires 1·28 Ampères of current, and $\frac{1{\cdot}28 \times 41}{746} = {\cdot}07$-horse power, or over fourteen lamps per horse power, or for 321 lamps as nearly as possible 23-horse power. But, as we have seen, there was not more than 22-horse power available. Furthermore, it must be remembered that if 90 per cent. of the power put into a dynamo machine comes out again, the result is very high, but this would leave less than 20-horse power available for current; consequently it is obvious that the lamps could not have been worked up to 18-candles each. Indeed, this was obvious on inspection. A great variation in brilliance was apparent; some of the lamps, it appeared, were giving more nearly 8-candles than 18-candles. Thus we are once more face to face with the old difficulty. As soon as we come to estimate the value of a dynamo in candle power, the want of any definite photometric standard turns up. We have no doubt that a large number of the lamps was working quite up to 18-candles, but a much larger number must have been considerably below it. Whatever uncertainty, however,

may exist on this point, it is at least clear that the Ferranti dynamo does no more work per horse-power than the Siemens, the Burgin, or any other good machine already in the market. Its advantages lie in the simplicity and cheapness of its construction, and its small size and weight. These advantages have been secured entirely by the adoption of a very high velocity for the armature. It ran at 1900 to 1950 revolutions during the time of our visit, and has been driven at 2000 revolutions. Velocities nearly as great have been got with the Siemens and Edison machines, but the armatures being much smaller in diameter, the angular velocity is less. Now it is well known that to a considerable extent speed may be made to take the place of wire; that is to say, we can augment the electro-motive force of a dynamo either by winding the armature with fine wire or by increasing the



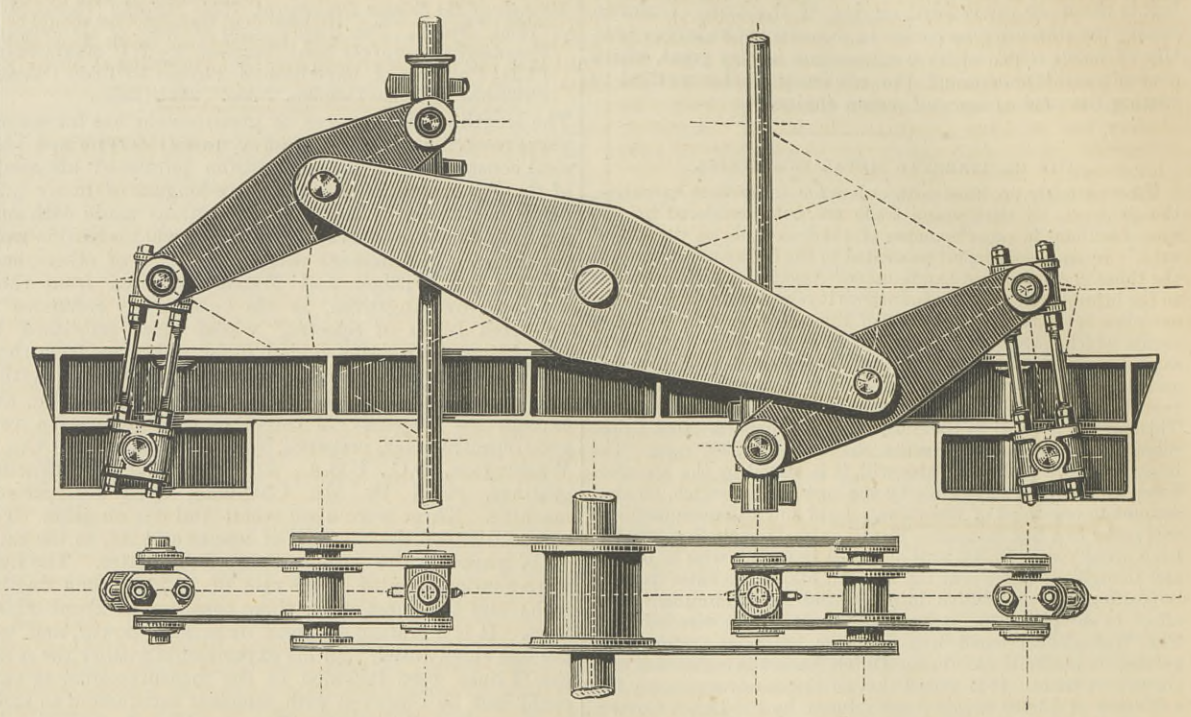
THE FERRANTI DYNAMO MACHINE.

speed. Mr. Ferranti goes on the assumption that speed is, on the whole, cheaper and better than wire, and we are not prepared to dispute the point. We may say, in conclusion, that the heating anticipated by some electricians as a result of the cross currents set up in the breadth of the tape, as explained in The Engineer for October 27th, does not appear to act injuriously in the Ferranti machine; at least, the machine, after being several hours at work, was on Monday quite cool enough for all practical purposes. It appears, too, that these currents might be got rid of to a great extent by reducing the width of the tape; in fact, an armature with tapes but one-fourth of an inch wide might be used if need be. It might also be found worth while to try the effect of doubling the copper on itself thus ⊃, so that both edges would be at one side.

Proposed Memorial to Trevithick.—A meeting was held on Wednesday, November 15th, in the rooms of the Society of Arts —Mr. Hyde Clarke in the chair—to consider the means to be taken for the purpose of commemorating next year, the fiftieth anniversary of the death of Richard Trevithick, the inventor of the high-pressure engine. It was resolved—"That, in the opinion of this meeting, next year being the fiftieth anniversary of the death of Richard Trevithick, it should be commemorated by some permanent memorial; and that the following gentlemen form the committee, with power to add to their number:—Messrs. Hyde Clarke, F. W. Webb, H. Chapman, W. Husband, H. Trueman Wood, Professor Pole, Captain John Davis, and Frank Harvey." Captain Davis was appointed honorary secretary.

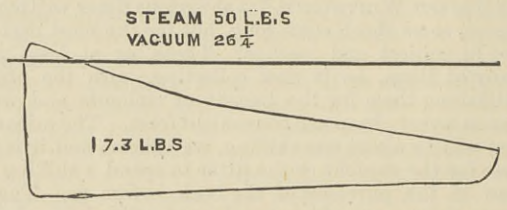
The Iron Trade.—We extract the following from Messrs. Bolling and Lowe's report on the iron trade:—"We cannot expect shipbuilding to be continued at the same rate as during the last twelve months, but sufficient orders for vessels are on hand to provide remunerative work for some time. Instead of vessels, we should rather have said steamers, for sailing vessels are now the exception, and the modern shipbuilding yard depends, for the construction of the day upon affiliated trades supplying it with iron, steel, forgings, tubes, &c., to such an extent that we may almost regard shipbuilding as a barometer of British trades, just as were formerly cotton mills. Bridge builders, locomotive makers, wagon builders, agricultural implement makers, engine and boiler makers, &c., are full of work, for home and foreign account, and at satisfactory prices. Manufacturers of rails, on the other hand, complain, and are endeavouring to form an alliance for improving their position. Since rail making became a leading industry in this country, the violent fluctuations in prices have always been caused through the demand from the United States, which are the great consumers of rails. They now possess 110,000 miles of railroad as against 108,000 miles in all Europe, and at the same time their production of finished rails has been rapidly increasing. Last year the United States turned out 2,150,000 tons of rails, this year's production will be about 3,110,000 tons, a sufficient quantity to satisfy wants of renewals, and equip the new lines which are being built. Consequently the continuance of orders coming to England is exceedingly remote, unless prices in the United States should rise considerably or a great change come over their fiscal policy, but we see no reason to expect either course. A few figures will show the exact position. Taking the cost of English steel rails, ordinary heavy section, including present low freight to New York, and insurance, at per ton, £6 5s. 6d.; import duty in United States per ton, £5 15s. 6d.; we have as the cost of imported rails, £12 1s. The present price of American rails at works is £8 5s., or £3 16s. per ton less than imported rails. Our 'cousins' have, therefore, a good margin to fall back upon if any alteration in the tariff should endanger their monopoly, but it is not likely that a reduction of duty of more than a few dollars at the outside will be settled upon, the protective party being still too strong and powerful for the free traders. In order to show to what extent our exports of rails to the United States vary, we mention that during August, September, and October, in 1877, they amounted to 12 tons, while during the same period of 1880 they were 48,558 tons, in 1881 they were 55,618 tons, in 1882 they were 44,341 tons. It is very likely that this period of prosperity may be followed by another depression, but the above data will show how the trade fluctuates. India and our Colonies, by their large demand, have helped to fill the gap caused by the decrease in orders from the United States; and we hope present prices may be maintained, as they give but a poor return on the capital invested."

DETAILS OF PUMPING ENGINE, LUTON WATERWORKS.

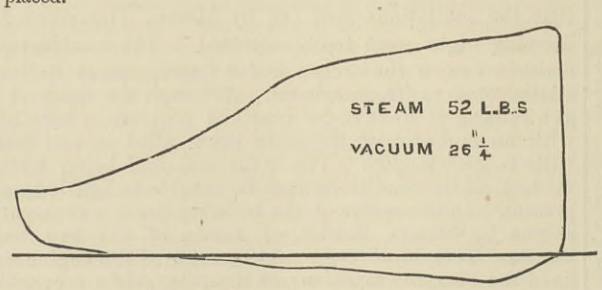


Through the courtesy of Mr. W. F. Phillips, the engineer of the Luton Water Company, we recently had an opportunity of inspecting its works, and are now enabled to publish on page 412, illustrations of the new engine recently erected by Messrs. Hathorn, Davey, and Co., of Leeds.

The water supply for Luton is obtained from a bore hole sunk into the chalk. The water from the bore hole rises into a suction well, from which it is pumped to a storage reservoir on an adjoining hill. The total lift from the surface of the water in the well to the reservoir is about 250ft. Until recently the water was pumped to the reservoir by means of a pair of beam engines with separate expansion valves, made by Messrs. Wheilden, Leckey, and Lucas, of London. The consumption of water having increased beyond the capacity of the old engines, the company determined on putting down new pumping plant, and selected an engine of similar design to that erected by Messrs. Hathorn, Davey, and Co., at the Chiltern Hills Waterworks, which is not far from Luton.



The new engine is an interesting example of a beautifully designed and highly-finished engine. It will be seen from our engravings that the entablature is of a highly ornamental character, and the general finish throughout is in keeping with it. The high and low pressure cylinders are mounted on an entablature directly over the pumps, the piston-rods being coupled direct to the pump plungers by an arrangement of wrought iron beams which constitute a parallel motion. This form of motion, as applied to pumping engines, was originated by Messrs. Hathorn, Davey, and Co., and has been applied to most of their recent waterworks' engines. We give an enlarged view of the beams above. The design is so carried out that the pressure on the whole of the bearings constituting the motion is never altered in direction, so that no knock occurs when the bearings are slack, and thereby a sweet and steady motion is insured. To effect this the pump plungers are loaded just as they are in a Cornish engine, and as one plunger makes the up stroke whilst the other is making the down, the two loads balance each other, so that the engine stands in equilibrium in any position in which it is placed.



The pumps are placed in a dry well under the engine-room floor, and the suction pipe is taken through a tunnel from the dry well to the pumping well. At present the engine has to lift the water to a great height on the suction side—from 22ft. to 26ft., varying with the water level in the well. There is also a considerable length of suction pipe between the dry well and the pumping well. It is intended, however, to supply the engine eventually from a new well, where the water will be brought nearer the pumps.

The engine is provided with a surface condenser, with an arrangement by which the water may be sent direct into the main without having to pass through the condenser, and the engine worked non-condensing. The air vessel is kept supplied with air by means of one of Wippermann and Lewis's air injectors. Both steam cylinders are steam jacketted, and the water from the jackets is discharged into the exhaust pipes by means of a self-acting water trap. It would have been much better, of course, if the steam jackets had been made to drain themselves direct into the boiler, but there may have been some difficulty in the arrangement of the necessary pipes. The valve gearing is made self-contained, and stands on the engine floor just in front of the engine, with the handles at a convenient height for the engine man. The gear is provided with a pausing cataract, and we are informed by Mr. Phillips that so constant is the number of strokes for any given adjustment of the cataract, that a clock worked from the engine would keep exceedingly good time.

In connection with the engine is a very ingenious and useful recorder, recently brought out by Messrs. Hathorn, Davey, and Co., illustrated already in our pages. The recorder is attached to the engine by a lever arrangement under the engine-room floor, and has a pointer working up and down on a scale indicating the stroke the engine is making, so that it can be seen at a glance whether the engine is making its full stroke or not, and whether it is in proper adjustment. There is also a second scale on the recorder showing the quantity of water pumped in a given time, calculated from the pump displacement. The index of this scale carries a pencil in contact with a revolving drum driven by an eight-day clock. The line traced on the paper of the drum gives a complete history of the working of the engine. It records stoppages and gives the rate of pumping at all times. With this recorder an engineer may have a permanent record of the working of his engine from year's end to year's end. There is also in connection with the suction well a well gauge, showing the fluctuations of the water level. In another part of the engine-room is placed an electric reservoir indicator, showing the water level in the reservoir. We observed on the sluice valves for shutting off the mains a very neat arrangement of indicator for showing the exact position of the sluice. We give indicator diagrams from the Luton engine and the leading dimensions.

Engine:—	
Diameter of high-pressure cylinder	28in.
Diameter of low-pressure cylinder	56in.
Length of stroke	6ft.
Boiler pressure	50 lb.
Ratio of expansion	9·5
Average pressure in high-pressure cylinder	29·6
Average pressure in low-pressure cylinder	7·3
Pumps:—	
Number of plungers	2
Diameter of plungers	19in.
Length of stroke	6ft.
Height of lift on suction side	25ft.
Height of lift on delivery side	225ft.
Length of suction pipe	90ft.
Condenser:—	
Type	surface.
Number of tubes	334
Diameter of tubes	1in.
Surface of tubes	540 sq. ft.
Vacuum	27in. to 28in.
Diameter of air pump	13
Length of stroke	6ft.

SHEARING MACHINE FOR LARGE SHEETS

When a piece of plate iron is placed in an ordinary shearing machine, the part of the cut plate resting on the lower cutter proceeds horizontally, while the part acted on by the upper cutter turns off in an angular direction. M. C. Donnay, of Paris, has designed shears, illustrations of which we take from the *Annales Industrielle*, in which the frame has two main parts cast in one piece, in such a form that the sheared part of a plate of any length passes free of the lower knife and support, the form of frame for this free action having been obtained by uniting the two parts of what may be looked upon as a large pair of shears. The movable knife l^1 is fixed by bolts b^1 to the lever L moving on pin a. The motion is communicated to the lever L by a cam on the spindle a^1, which is actuated by the spindle a^{11} carrying the pinion p gearing into the spur wheel r, and the fast and loose pulleys g g. The excentric pin i actuates the cutter by means of the cast iron slide c made in two parts, as seen in Figs. 2, 5, and 6, with large teeth which may be thrown opposite each other to put the shears in gear, or which may be moved by the pinion and rack k, so that the teeth pass between each other and so stop the movement of the cutter, the pinion k^1 being moved by the lever m and rod l. When the slide is out of gear, the lower part with the knife may be raised by the cam end to lever d to admit the free passage of a plate. The machine—see page 409—weighs 5½ tons, and cuts plates up to $\frac{7}{16}$in. in thickness.

Trial of Compound and Steel Plates in Russia.—The following statement will be read with interest in connection with the report we give from Spezzia of the competition between Cammell's, Brown's, and the Creusot plates:—"The trial of two 12in. armour-plates manufactured respectively at the Cammells' and Creusot Works, which took place to-day in the artillery ground, St. Petersburgh, resulted in a complete victory for the former. Although the plate fell from the target at the second shot, owing to the failure of the fastenings, the projectiles failed to penetrate it. Protection was perfect. The Creusot plate was split to pieces at the first shot. The third projectile passed through uninjured and was found 700 yards in the rear. The plate was altogether destroyed." Information to the same effect has, we understand, been received at Messrs. Cammells direct. The deficiency of bolts excepted, the results of this experiment contrasted strongly with those obtained at Spezzia. That Messrs. Cammells 12in. plate should for its thickness be better than the 18·9in. one in the present state of manufacture, is not surprising. It is much more difficult to explain why the smaller Creusot plate was worse than the larger one. Certainly the Spezzia Creusot plate was most excellent, though we consider competing at some advantage compared with its rivals

TESTS AT THE MUNICH EXHIBITION.

WE have spoken of the admirable arrangements for testing the apparatus exhibited at this Exhibition, as being of the greatest importance. The result of the tests may be expected shortly, and in the meantime it may be well to give a brief account of the arrangements. The whole apparatus was arranged and the method of procedure determined previous to the opening of the Exhibition. So far as we can gather, the arrangements were satisfactory, and no hitch occurred. The testing was exhaustively carried out by perfectly competent and unbiassed men. The full details of the testing arrangements will be published with the report, having been drawn up by Dr. Erasmus Kittler, Dr. Ernst Voit, Dr. Krüfs, and Professor Schröter. Professor Kittler has described the instruments and arrangements for the electro-technical measurements, Professors Voit and Krüfs those for the photometric measurements, and Professor Schröter those for the measuring the power. For the latter purpose the dynamometer of Hefner-Altenick was, we

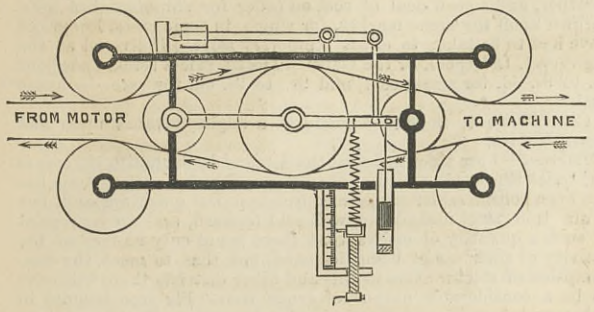


Fig. 1.

believe, used throughout these experiments. The accompanying Fig. 1 will help to explain its action. The driving band is arranged between the pulleys as shown, so that when at rest the whole is symmetrical. When the working commences the strain on the one band is increased and the middle movable pulley is pressed aside. The force necessary to bring it back into its normal position is proportional to the difference of tension between the bands. If this and the speed be observed at the same time the horse-power is easily obtained. The scale of the spiral spring used to bring back the pulley to its central position may be graduated so as to represent foot-pounds or metre-kilogrammes, or any other system of measurement adopted. The photometrical tests were the ordinary shadow tests, but under very stringent conditions. Five observers compared the results of their observations, and not only was the brilliancy of the light observed in a horizontal plane, but in direction 0 deg., 30 deg., 60 deg., and any special direction according to the desire of the manufacturer or exhibitor. Auxiliary to this it was intended to determine to light per unit area, but we have not heard that time permitted these experiments to be carried out.

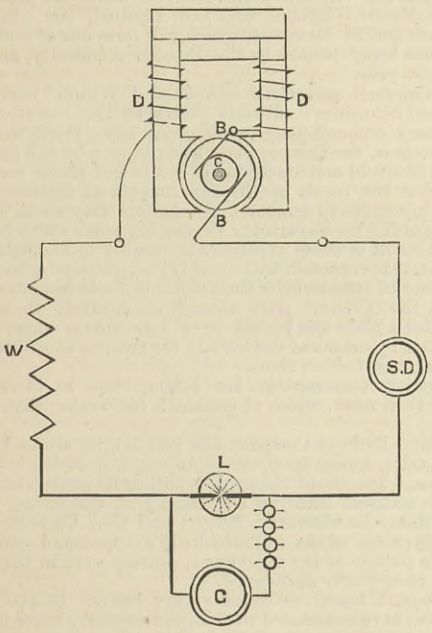


Fig. 2.

Unfortunately science is so cosmopolitan that every country adopts its own system of units, and thus when an English engineer wishes to hear about foot-pounds, English electricians reply in centimetre-grammes, and German electricians in metre-kilogrammes. No doubt the transposition of the one to the other is only a question of a constant factor, and a multiplication or division, but it is to be regretted that cosmopolitanism does not bring unification. The English indicated horse-power again is not the French horse-power, but so fond are our leading mathematical physicists of everything Frenchified, that it is merely a matter of time for them to adopt the French unit for this. When the results of the tests at Munich are obtained they will have to be transposed into our ordinary vernacular—not only from language to language, but also from nomenclature to nomenclature. Professor Kittler points out that the horse-power is obtained from the formula $\frac{C.E}{736}$. The formula as per the English system is $\frac{C.E}{746}$; C in both cases indicating current in Ampères, and E electro-motive force in volts.

Part of this work is absorbed in the heating of the machine, and the efficiency is expressed by the ratio between the effective and the total work. These measurements were made at Munich, and will form a very instructive part of the report. Besides these measurements, others, such as the power absorbed per lamp, the speed of armature coils, the heating of the machine, its resistance cold, its resistance hot, &c., were taken. The dynamometer measurements, the electrical and photometrical, were taken as nearly as possible at the same time. The photometrical being taken with one lamp stated to be in its normal condition by the exhibitor in the photometric room, while the other $n-1$ lamps were burning in the Exhibition. The tests were also taken when the $n-1$ lamps were replaced by equivalent wire resistance. Fig. 2 shows a diagram of the arrangement when the $n-1$ lamps were so replaced. B B are the brushes, D D the field magnet coils, C the commutator, W the wire resistance for $n-1$ lamps, L the lamps under test, S D Siemens's dynamometer, and G the galvanometer. The report will illustrate the whole of the arrangements in a similar manner. It will, we think, be seen that special pains have been taken to have these tests as accurate as the present state of science permits. The instruments used were of well-known type, and were very carefully adjusted and compared. The observations were mostly duplicated or triplicated, so that errors in this direction should be avoided. Thus we have briefly described the work done, and trust that the complete report may be forthcoming at an early date.

THROUGH THE ALPS BY LOCOMOTIVE.

AN ENGINEER'S TRIP OVER THE ST. GOTHARD.

(*Continued from page* 348.)

HAVING safely passed the great tunnel and halted a few minutes at the village of Airolo, where the traces of all the labour that was expended on the tunnel have disappeared yet more completely than at Göschenen, we pursued our way towards Italy down the valley of the Ticino. At first our course seemed easy and straightforward enough. The valley, flat at the bottom, trended in a gentle slope to the southward, the river wandered along it, and no lateral torrents of any size came down to bar our progress. One had time to mark how completely one had passed, in that short half-hour, from Switzerland into Italy—from a northern into a southern land. The vegetation was richer and deeper, and bore a more foreign aspect; the houses were clustered in villages, instead of being scattered hither and thither as on a Swiss mountain side; instead of the rich dark pine-wood of the chalet, with its carved front and overhanging eaves, they are almost all square tenements, with sash windows and flattish roofs, and white with recent stucco; whilst from the middle of each hamlet a tall white "campanile" or bell tower rises into the air. The very fences of the gardens and orchards, instead of wooden palings, are sharp slabs of gneiss or blocks of granite. Whilst noting these points, we have crossed the Ticino by a fine bridge of one span, passed through a short tunnel, thereby skirting the narrow gorge of Stalvedro, and are now holding our course down the right bank, on a terrace some little distance above the stream, with numerous side cuttings in "slaty crystalline" rocks, much distorted. But this easy-going fashion is not to last. Ahead the valley sides seem to close in upon each other at the gorge of Dazio, and the gradient steepens rapidly until we are fairly on the 1 in 40 incline once more, this time descending instead of ascending it. The steam is shut off, the pressure being allowed to fall to 8 atm., and the hand brakes are screwed firmly down; but no notice is taken of the air brake, which is not supposed to be used unless in case of emergency or where the rails are specially slippery. As a matter of fact, I only saw it used once, in pulling up rapidly in obedience to a signal, and this is quite in agreement with the exceptional use of the vacuum brakes on the Brenner and Semmering inclines. The braking of the train down these long and steep inclines is thus thrown almost entirely on the tender and on the brake vans, of which there are no less than four along the train; and the wear and tear on these must be proportionately severe. A system of continuous brake, which could be put on and off by the driver with as much certainty of action and ease of graduation as the hand brakes, would supersede the services of the brakesmen and control the train with far better effect. But certainly this problem does not seem to have been solved in these Alpine railways, where beyond all others its solution is desirable. Perhaps something readier, rougher, more mechanical, more resembling the old screw brake to which he has been accustomed, would suit the engine-driver, whether abroad or at home, better than the scientific intricacies of the various fluid-pressure systems.

Be this as it may, it is the hand brake on which we rely to pull up at the little stations of Piotta and Rodio, lying in the flat glacier-worn trough of the valley; and again to carry us safely through the celebrated gorge of Dazio, which we are now entering. Unfortunately the best road for the railway in such cases is very far from being the best for the purposes of the sight-seer. Thus, while the post road is carried along the gorge, mainly upon the arches, and so commands a full view of the precipitous crags, and the torrent roaring and eddying in its channel of gneiss, the railway, just before reaching the entrance, curves to the left, crosses to the left bank, and plunges into the Dazio tunnel, 380 yards long. Emerging from this, there is time for one glimpse down the gorge, with another stretch of the railway soon to be traversed showing at its far end, and at a much lower level; we next traverse the short tunnel of Artoito, and then, bending away from the river, we enter the spiral tunnel of Freggio. This tunnel is over 1700 yards long, and took us four and a-half minutes to traverse. We emerge from it almost exactly below the entrance to the Artoito tunnel, which we have just traversed, and in a direction nearly at right angles to it, which direction being continued, carries us once more to the right bank of the Ticino, and through the short Piottino tunnel. Curving slightly to the left to follow the winding of the stream we pass the Pardorea tunnel, and before leaving it commence a complete circle of above 500 yards diameter, the greater part of which lies within the second spiral tunnel of Prato. The mouth of this latter lies almost immediately below the mouth of the Pardorea tunnel, so that as we emerge from the latter we look down on a part of our future progress, lying as it were beneath our feet. The Prato tunnel is 1715 yards in length, and took us 3 min. 40 sec. to traverse. Coming out of it, we plunge almost at once into another short tunnel, emerge from it on to a magnificent bridge of one span that leads us back to the left bank of the river, and, traversing yet an eighth tunnel of 300 yards, leave the gorge behind us, and pull up at the station of Faido.

Faido is well known to all Mr. Ruskin's readers on account of the care and detail he expends on the description of a particular drawing by Turner, representing the scene as it used to appear in the old days of diligences. He specially dwells on the vast waste of stones, and on the gathering in of the mountains above the ravine of Giornico—the "Gate of the Hills"—but I confess to being unable to trace anything in the real scene to account for so much enthusiasm, either in painter or critic. The fact is that in the days when all that was ever seen of the Alps was from the post roads, the beauties of those main valleys were almost as widely exaggerated as their terrors. Chesnut trees have now begun to dot the slopes around the railway; below, the Ticino runs in a deeply cut ravine, whose precipitous sides show marks of glacier carvings almost down to the bed of the stream; above, the mountain drops into the valley by abrupt cliffs, down one of which thunders the noble cascade of Livorgo. As we stop here another express train passes us—no less than sixteen carriages, with a six-coupled tank engine in front and a six-coupled tender engine behind it, forming a total weight of 200 to 220 tons to be hauled up the steep incline we have left behind us.

But one more pass—in some respects the most striking of all—is yet before us, as we draw away from Livorgo and enter the gorge of Biaschina. Here the line, as seen on plan, describes almost exactly a figure of 8, in order to follow the rapid descent of the river, which at the entrance of the gorge is already a great distance below us. We are at first on the left bank, and our experiences begin with a tunnel about 480 yards long, which takes the line behind a torrent called La Lune, so dangerous in flood time as to make a wide berth specially desirable. In the middle of this tunnel we curve to the left, and so commence a great circle of about 660 yards diameter, forming the upper loop of our figure of 8. As we come out of the tunnel we see the mouth of another tunnel close below us, making the intersection of this loop. We are now upon a lofty viaduct of masonry, which shortly ends in a girder bridge of four spans, and about 350ft. total length, which crosses at a great elevation the Piano Tondo stream. The further end of this viaduct lands us in the mouth of the Piano Tondo spiral tunnel, about 1660 yards in length, and bending through an angle of 280 deg. Emerging from this, we pass below the post road in another short tunnel, cross the Piano Tondo again, but at a level some 130ft. lower than on the first occasion, and then, curving again to the left, begin the second loop of the 8, which speedily leads us once more into the interior mountain. This fourth and last spiral tunnel, the Travi, is 1700 yards long, and sweeps through about 280 deg. as before; but the last part is nearly straight, and at right angles to the course of the valley. Consequently as we emerge we find that we have just passed underneath the post road, which, since we last crossed it, has descended by a series of zigzags through the hamlet of Biaschina, and directly afterwards we come full upon the river, and cross it by a bridge of about 220ft. span. A rapid curve to the left brings us up to the station of Giornico. Here, looking back, we get a singular view of the gorge, embracing three different levels of line, and six mouths of tunnels, and leaving a confused impression as if two or three separate railways, traversing the country at different levels, had chosen this particular spot to tunnel under and over each other.

The rapid fall to Giornico is the last step, as it were, by which the Ticino descends from its mountain source into Italy. From henceforward the slope is gentle, the curves easy, and the ground around us takes all the characteristics of a main valley to the south of the Alps. Engineering difficulties, however, are not altogether over. After leaving Bodio, the station next to Giornico, we find ourselves on a long embankment, solidly built in rubble stone. On one side are the cream-white racing waves of the Ticino—now a considerable river—and on the other a species of backwater, or wide artificial channel, roughly paved, and communicating here and there by conduits with the main river. These expensive works are necessary to protect the line, at seasons of flood, from the joint attacks of the Ticino itself, and of a lateral torrent, the Vallone, which here fall into it. The reason for thus bringing the river and railway into juxtaposition was the sufficient one that if the latter had been carried close under the mountain side, the danger from falls of rock, owing to the treacherous nature of the ground above, would have been excessive. Soon, however, the river curves away towards the other side of the flat valley bottom; a wide railway yard, full of sidings, opens before us, and we run gently into the station of Biasca, which may be held to terminate the mountain section of the main line from Switzerland to Italy.

(*To be continued.*)

ROHRBACH FALL AND BRIDGE.

WE publish this week the second of our series of views illustrating the St. Gothard Railway. It represents a striking scene where the line crosses the Rohrback torrent, about midway between the great zigzag at Wasen and the entrance to the great tunnel at Göschenen. The bridge is remarkable, from the fact that it is the only iron arch on the line, all the other iron bridges being of the lattice girder type. The object of adopting this form was to do away with piers, and so give the freest possible passage underneath for avalanches, which, in winter, are apt to sweep down the bed of the torrent. The span is 60 m. (197ft.), and the rise of the arch is one-tenth of this, or 19·7ft. There are four arched ribs of wrought iron, with plate webs, the depth being about 4ft. They are braced together horizontally by a double system of diagonal wind-ties; but the spandrils are filled up with simple uprights. The rails are carried on longitudinals, laid at an incline of 1 in 40. The total weight of ironwork is 224 tons. The bridge is made more remarkable by the fact that just below it the stream falls in a fine cascade, forming a gulf, into which the eye naturally plunges during the few moments occupied by the train in crossing the bridge.

LEGAL INTELLIGENCE.

QUEEN'S BENCH DIVISION.

(*Before* MR. JUSTICE CAVE *and a Common Jury.*)

November 27th.

DURHAM AND OTHERS *v.* GRINDLEY AND CO.

Mr. Jelf, Q.C., and Mr. Kisch were the counsel for the plaintiffs; Mr. Bowen Rowlands, Q.C., and Mr. Douglas Walker appeared for the defendants.

The plaintiffs are ironfounders, carrying on business at 205, Bow-road; the defendants are varnish manufacturers, of Upper North-street, Poplar. The action was brought for the value of an iron resin-still supplied to the defendants by the plaintiffs. The still in question was taken to the defendants' works on the 10th of February last on a trolley, and in course of being removed to the ground it fell over against the wheel of the trolley, and was so injured as to render it useless for the defendants' business. Mr. Durham, one of the plaintiffs, alleged that he had fulfilled his contract when he had taken the still on the trolley to the defendants' works, and that it was a well-known custom in the iron trade for the buyers to unload goods that came from foundries. In cross-examination, the witness denied that he had, in fact, superintended the unloading of the still. The case for the defendants was that there was no such custom as had been set up by the plaintiffs, and also that Mr. Durham had personally supervised and directed the operations of the men engaged in unloading the still.

The learned JUDGE, in summing up, said that the evidence seemed very strong that in these cases the buyers were by usage to unload the trolleys. If, however, Mr. Durham, in spite of the usage, undertook to superintend the unloading, he would render himself liable for any negligence. The evidence was contradictory, and it was for the jury to decide.

The jury found a verdict for the plaintiffs for £110, the amount claimed.

TORPEDO BOAT FOR THE DUTCH GOVERNMENT.—On Saturday last the official trial took place of a large sea-going torpedo boat, built by Messrs. Yarrow and Co. for the Dutch Government. The boat is 100ft. in length by 12ft. 6in. beam, and attained a speed of over twenty-one knots an hour. The Dutch Government was represented by Captain Bogaert, the chief of the Torpedo Department, and Captain Hudig, of the ministry of marine, the contractors being represented by Mr. Crohn. After the trial the Dutch authorities expressed their perfect satisfaction with the performance of the boat as well as the working of her machinery.

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

(*From our own Correspondent.*)

The iron markets either, in Birmingham this afternoon or in Wolverhampton yesterday, did not show additional strength in actual business. The supply was in excess of the demand, and buyers took care to remind sellers of the fact. Especially do merchants from a distance—London, Liverpool, and Manchester—harp upon this chord in the negotiations which they are now conducting. They state that numerous vendors are calling upon them offering to accept contracts at something like their—buyers'—own terms. But makers would not this afternoon by any means let buyers have it all their own way. There are still plenty of unexecuted contracts on the books, and this is their strong point. Besides, they reminded buyers that with the beginning of the new year they will have to pay higher wages.

Plate makers reported a moderate demand for qualities needed by the constructive engineers, and for these and for tank-plates their price was £8 10s. Boiler sorts were firm at £9 to £9 10s.

Sheet makers quoted £8 for merchant singles, £8 10s. for galvanisers' singles, £9 5s. to £9 10s. for doubles, and £10 5s. to £10 10s. for lattens. It was not without difficulty, however, that these prices could be got.

Thin sheet—stamping—makers reported a steady call alike on home and export account. Messrs. E. P. and W. Baldwin's quotations for sheets of this description were :—"Severn" singles at works, £12 ; Baldwin-Wilden, B., £13 ; B.B., £14 ; B.B.B., £15 ; Baldwin-Wilden charcoal, £17 10s.; best charcoal, £20 10s.; and E. best charcoal, £22 10s.

In the bar trade it is noticeable that common bars on the basis of £6 10s. are relatively stronger than marked bars on the basis of £7 10s. to £8. And more business is doing by those firms whose price is £7 and £6 15s. and £6 10s., according to quality, than by those who will have £7 10s., yet one or two of these latter are doing a good colonial business, Australia being a particularly prominent buyer.

Hoop makers this afternoon generally quoted £7. But the demand is not very brisk, and there were makers who openly admitted that they were accepting £6 10s. per ton ; £6 10s. was also the price of these same makers for strip iron suitable for the manufacture of gas tubes and other purposes. Hurdle bars were obtainable at as low as £6 5s.

The Australian news is an improvement on the week, and the demand from these markets is a little better for all the leading requirements usually taken from this district. The galvanisers and makers of fencing wire in particular are benefitted. Some of the former have so much work in hand that needs prompt execution—for dispatch to the colonies and to South America—that they are running their sheet departments actively throughout the night as well as on day turns. Prices of galvanised sheets are—22 to 24 w.g. £14 10s. to £15 per ton, delivered Liverpool or London in bundles ; 26 w.g., £16 10s.; and 28 w.g., £18 10s.

Arrangements are being perfected for the laying down of the plant for the manufacture of steel upon the Thomas-Gilchrist process by the new company formed in this district. It transpired on 'Change on Wednesday that Mr. Fitzmaurice, late of the Cwmavon Tin-plate Works, South Wales, has been appointed manager and secretary to the company. This intimation is accompanied by the announcement that the company do not purpose beginning upon a very large scale.

In the pig trade one or two native makers are pressed for supplies, and can hardly satisfy buyers' requirements with the needed promptitude. Such makers are therefore asking rather more money this week for second and third-class sorts. Bradley's Caponfield mine pigs were quoted to-day at 57s. 6d., and their second quality at 47s. 6d. Common native pigs were quoted 42s. 6d., but were to be had at the level 40s. At this last price there have this week been some sales in 500 ton lots. Turley's best native all-mine pigs were quoted 67s. 6d.

Agents of foreign pig makers were unable to report many new sales, but a few of them—representatives of Derbyshire and Northampton producers—stated that their principals were almost at a loss to know how to supply customers' present demands under old contracts with the required regularity. That, therefore, looks well. Derbyshire pigs were generally quoted 50s.; Lincolnshires, 52s. 6d. to 55s. delivered ; and the Thorncliffe—South Yorkshire—brand, 62s. 6d.

Hematites were dull at for Blaina sorts 64s. 6d., and for West Coast and best Welsh brands 67s. 6d. to 70s. nominally.

The award of Alderman Avery, arbitrator to the Mill and Forge Wages Board, has created some dissatisfaction amongst the masters. They state that its terms are certainly not warranted by the falling market which now rules. Its terms are that on December 31st puddlers shall receive a rise of 3d. per ton, and millmen of 2½ per cent. From that date until certainly the end of March puddlers' wages are to be 8s. 3d. per ton. This rate, under the conditions of the award, may be terminated by either the masters or men by a month's notice. Alderman Avery expresses a very strong opinion in favour of the re-establishment of the sliding scale to regulate wages. He believes that the best interests of the trade would be promoted by the adoption of such a course. And if the Board should be unable to agree among themselves upon the new scale, the arbitrator invites them to by-and-by meet before him and attempt to come to an arrangement.

The structural engineers are still in the receipt of good inquiries, and the yards generally keep pretty full of work in the execution of contracts booked some while ago.

Agricultural machinery of the description needed for the preparing of food for winter stock raising is in very active manufacture. One or two firms, indeed, state that the combined home and export demand is unprecedented. Chaff-cutters are in special demand.

Steam pumps for hydraulic purposes are in great demand, and Messrs. John Onions and Sons, Bilston, who also are brisk just now upon orders for engineering work needed at the ironworks of the district, are this week increasing their manufacturing capacity by removing to the Globe Foundry, which is three times the size of their old premises.

The operations of the Pelsall Iron and Coal Company during the past six months have been chiefly directed to repairing the damage of the inundation in their pits, which occurred early this year, and all the collieries are now completely restored. Besides this a blast furnace has been relined, and the ironworks machinery kept in good order ; so that, although a net profit has been made on the six months of £4500, the directors do not propose any *interim* dividend.

The arbitrators under the South Staffordshire Mines' Drainage Acts have made their draft awards for mines' drainage rates, to endure a year, in the Old Hill and Kingswinford districts. A rate of 3d. per ton on fire-clay and limestone, and 6d. per ton on ironstone, coal, and slack, is required for the Old Hill district, and 2d. per ton on all minerals in the Kingswinford district. No graduation is allowed in the Kingswinford district, but in the Old Hill district the Saltwells and Dudley Wood Collieries of Lord Dudley are assessed at one-third of the rate, part of his lordship's Warrens Hall Colliery, along with the Yew Tree Colliery of Messrs. Cochrane and Co., at two-thirds, and the Withymoor Colliery of Messrs. George and John Dunn at five-sixths of the rate. Further appeals against these awards can be made.

The tin-plate workers, braziers, and blacksmiths employed in the Bilston district have organised a trade union similar to the one in operation at Birmingham.

The nut and bolt operatives of Darlaston have been agitating for the abolition of female labour in their trade, and to test the probable success of a proposal for parliamentary legislation, have obtained the opinion of several members of Parliament; these were read at a public meeting in Darlaston on Wednesday night. Replies in favour of such a measure had been received from Messrs. Thomas Burt, H. T. Davenport, Francis Moncton, E. A. H. Lechmere, J. Corbett, and T. R. Hill.

Mr. Muntz reminds the trade that "the question of interfering with women's work is a very wide and serious one. If the Legislature undertakes to limit women's labour it must extend the limit to the other sex, and men should be prevented from doing the work of shop-girls, &c. When the State, he concludes, interfered with women's work in the collieries it was on the ground of immorality."

The manufactured iron trade of North Staffordshire is less active than a fortnight or three weeks ago, and as the orders which are being worked off the books are not replaced by new orders of the same extent, it is thought that a curtailment of the output will presently be necessary. Merchants' orders on home account are small, but shipping orders keep fairly numerous. Engineering descriptions of iron are in about as good demand as any. Bars are selling steadily, but hoops and plates are quiet. "Crown" bars remain at £7 per ton and upwards, and common bars at £6 10s. New sales of pig iron are not of large extent, but prices keep pretty firm.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The iron market seems to be gradually approaching a point when either makers will have to seek business at lower prices than they are now asking, or consumers will have to renew their contracts to keep up their supplies. Present indications do not seem to encourage the belief that makers can maintain their position ; the unsettled condition of other iron-making centres, and the collapse of the American iron trade, are naturally tending to weaken the market here, and although makers have still a line of defence in the fair amount of work yet on their books, this is fast disappearing. To avert the threatened breakdown in values makers seem determined to work on with their contracts as long as possible before pressing sales, but there is more disposition, especially in the finished iron trade, to entertain offers ; buyers, however, who are looking forward confidently to lower prices, are giving out orders only as they are absolutely compelled.

There were neither inquiries nor orders of any importance stirring at the Manchester market on Tuesday. Pig iron workers, however, did not press sales, and quotations were nominally unchanged from last week. Lancashire makers who have still large deliveries to complete against contracts, and are sending away the whole of their output, were firm at 49s. for No. 4 forge, and 50s. for No. 3 foundry, less 2½ per cent., delivered equal to Manchester; for Lincolnshire iron quotations also remained on about the same basis as local brands, with about 1s. per ton more asked for Derbyshire, but beyond one or two small sales of foundry, there has been comparatively little or no business doing. Some of the Yorkshire brands of pig iron have been offered on the market at 1s. to 1s. 6d. per ton under late rates.

In the finished iron trade more disposition was shown to give way than in pig iron. Forge proprietors have in most cases orders to keep them going for the present, but their contracts are running out, and new work is not coming in, whilst the check given to American shipments is seriously affecting one or two of the large firms in the district, owing to the difficulty now experienced in getting specifications for iron already sold. Although there is no actually great pressure to sell at low figures, if good specifications were offered they would in many cases be readily booked at under current rates. For delivery into the Manchester district the average prices are about £6 10s. to £6 12s. 6d. for bars, £7 to £7 5s. for hoops, and £8 10s. to £8 12s. 6d. for sheets.

In some of the engineering branches of trade I hear many complaints of decreasing activity; that whilst old orders are being run off new ones are not coming in, and there seems at present to be very little general engineering work going out. I do not, however, find that this applies either to locomotive building or to the machine tool-making trade. I have previously referred to the activity prevailing in the locomotive building shops, and personal inquiries generally, and visits I have made to some of the principal machine-tool shops in the district, justify the conclusion that work in this branch of the engineering trade is anything but scarce, many large firms having quite as much as they can get out for some time to come. As an illustration, it may be interesting to sketch briefly what I found going on in one of the local works—Messrs. Craven Bros., of Manchester—over which I have been during the week. The firm were chiefly engaged in tools for locomotive-building plant, and their shops throughout were fully occupied with work, both for home and abroad. The orders in hand included a complete equipment of machine tools for the Canadian and Pacific Railway Company and for a Franco-Belgian works, for turning out in each case fifty engines per annum ; locomotive tools for the North-Eastern and Great Western Railway Companies, and for the Scinde, Punjaub, and Delhi Railway Company; whilst the firm have just completed a large order for the workshops of the Chicago, Milwaukie, and St. Paul's Railway Company, U.S. The orders in hand included a number of tools of special construction, which I can at present only very briefly refer to, leaving any details which may be of interest for subsequent notice. Amongst the tools were a great variety of lathes for turning and boring cranks, excentrics, and general motion work, for turning axles at both ends at the same time, crank axle lathes, and quartering machines for boring crank pin holes in the wheel boss when on the axle; a machine for boring connecting rods and coupling rods at both ends at the same time, drilling machines for tube plates, and for drilling and tapping the stay holes in the locomotive fire-box frames, a special planing machine for connecting and coupling rods, and another for planing two locomotive cylinders at the same time; a crank axle planing machine for planing the side of the crank sweeps with three tools, a crank axle grooving machine for grooving both key-beds at the same time, a horizontal face plate tire and wheel-boring machine, several wheel lathes of large size up to 8ft., machines for sawing iron cold, a profile milling machine for locomotive motion work, and amongst slotting machines were several with special arrangements for slotting the steam ports of cylinders, with a special machine for slotting the arms of the reversing shafts. Messrs. Craven have also in hand a couple of gun-boring machines for the Government similar in construction to those made by the firm five years ago, of which at the time I gave a description in The Engineer. Since then, however, an increased length of ordnance has been introduced, and the boring machines the Government have now ordered have necessarily to be constructed to meet present requirements. The present machines will be the largest of the kind yet made, each weighing 150 tons, and able to bore of 30in. diameter and 40ft. long. The manufacture of overhead travelling cranes has become an important branch of engineering at Messrs. Craven's works. The special features introduced into the cranes I have already noticed in connection with a previous visit, and I need only here add that the firm, who have facilities for turning out one large crane per week, have at present no less than twenty-eight in hand. These include two 30-ton overhead travelling cranes for the United States, four cranes of 30 tons, three of 16 tons, one of 8 tons, and four 4-ton travelling jib cranes for the Canadian and Pacific Railway and the Franco-Belgian works already referred to, and two 5-ton overhead travelling cranes for Messrs. Crossley Bros.' new gas engine works, where six similar cranes have already been supplied.

Messrs. Emmerson and Murgatroyd, of Stockport, have in hand a contract for the machinery and plant for a manufactory of pure block ice, which is being erected in Manchester by Messrs. Muirhead and Son.

The plans and sections of the proposed Manchester Ship Canal for deposit in Parliament have been prepared by Messrs. Geo. Falkner, of this city, and have been open to inspection during the past week. In connection with the plans, a book of reference has been prepared under the superintendence of Mr. H. E. Price, of the engineers' department, Metropolitan Board of Works. This volume, which extends to nearly 300 pages, contains a description of all the property affected by the proposed works, together with the names of last owner, lessee, and occupier.

Although the coal trade continues generally quiet, with stocks of house fire classes of fuel still accumulating and most of the pits on short time, some of them not running more than four days a week, a slight change for the better has been noticeable during the week. Orders for house fire coal have been coming in rather more freely, and consumers of fuel for manufacturing purposes seem now to be gradually getting through the stocks laid in prior to the last advance in prices, which will shortly bring into the market an accession of orders for the lower qualities of fuel. Concessions are still being made in many cases to secure orders, but there is no further general giving way in prices, and quotations seem likely to be maintained upon about their present basis. At the pit mouth the average prices are about 10s. to 10s. 6d. for best coals ; 8s. to 8s. 9d. for seconds ; 7s. to 7s. 6d. for common house coal ; 6s. 6d. to 7s. for steam and forge coals ; 5s. to 5s. 3d. for burgy ; 4s. to 4s. 3d. for best slack ; and 3s. 3d. to 3s. 6d. for common sorts.

Although there are a fair quantity of orders in hand for shipment, but very little coal has been sent away during the past week owing to the scarcity of vessels, as the result of the recent stormy weather, and a good deal of coal on order for shipment has been thrown upon the home market, for which, in some cases, low prices have had to be taken to effect temporary sales. Delivered at the high level, Liverpool, or the Garston Docks, prices remain at about 8s. to 8s. 6d. for steam coal, and 9s. to 9s. 6d. for seconds house coal.

Coke continues in good demand at a slight advance upon last month's rates.

Barrow.—I am informed that the demand for hematite pig iron is but quiet this week, and that the business which has been done has not been considerable. Bessemer iron is in but quiet demand, but I am told steel makers are well sold forward, and are in receipt of such a quantity of orders that there is not only no fear of the activity at their works being lessened, but that to meet the consumption of steel makers in this and other districts there will have to be a considerable output of crude iron. Pig iron is quiet in value, and shows no symptoms of an improvement. Bessemer mixed parcels are quoted at 56s. per ton at makers' works, and 54s. for No. 3 forge. Easier prices have, I understand, been accepted for second-hand parcels, but makers are firm in their demanded prices for forward deliveries, as they are sanguine of an early improvement. It is not, I am told, expected that a change for the better will take place this year, but better things are looked to early in 1883, as the demands which are made from various quarters are some warrant of a better trade at that time. Steel makers have experienced no change in their business on the week, there being a capital demand for railway material ; and a fair business is doing in merchant qualities. Shipbuilders are well employed, and there is a prospect of further activity. The demand for iron ore is steady at 13s. to 14s. per ton, and there is a good demand for coal and coke.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

I understand that Messrs. John Brown and Co., Limited, Atlas Steel and Ironworks, have just secured an important order from the Russian Government. It is for compound plates of the "Ellis" type, for a new war-ship, to be called the Dmitri Domskoy, a sister ship to the Vlidimir Monomach, for which the plates were supplied by Messrs. Cammell and Co., Limited, last year. The plates for the Dmitri Domskoy, which will form one of a new fleet of war vessels being formed by the Russian Admiralty, are to be delivered next year.

Messrs. Cammell and Co.'s compound "Wilson" plates were tried against Schneider's all-steel plates at St. Petersburg last Friday. The compound plates, which were 12in. thick, were completely victorious, the Creusot plate being broken by the first shot.

Both the Sheffield manufacturers of compound plates seem very confident that the result of the experiments at Spezzia will be favourable to compound armour, and therefore they are in expectation of the order for the armour for the Lepanto, which has been waiting the result of these experiments, coming to Sheffield. The experiments, it is expected, will cause the adoption of a very much larger number of armour bolts than it has hitherto been customary to use, as the Creuzot plate showed conclusively that it was possible, after a plate was broken by a tremendous blow, to keep itself together by means of the bolts in the rear, so as still to afford protection against further shots.

The Austrian Government are taking steps to increase the strength of their navy, which at present is far weaker than that of Italy.

The Midland Railway Company has just let its stores tender—files, tires, axles, spring steel, &c. As usual, it is divided among various firms. The Great Northern is issuing its tenders for stores.

A serious accident occurred on Monday at the rolling mill of Messrs. Wilson, Hawksworth, Ellison and Co., Carlisle Works. The large fly-wheel of the mill suddenly snapped and smashed a considerable portion of the machinery, causing work in the department to be temporarily abandoned.

The colliers, I hear, are working very badly. In the case of collieries who have contracted with large consumers there is barely sufficient brought to bank to fulfil their contracts, and the owners are therefore unable to get the benefit of the rise in dealing with the general public. I am told that nowhere, owing to contracts being still running at old rates, is any colliery getting the advantage of the recent advance in value on more than 25 per cent. of the coal raised.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

The Cleveland iron market held at Middlesbrough on Tuesday last was well attended, but only a very small amount of business was transacted. The dulness of trade at Glasgow, and the comparatively light shipments for this month, have tended to weaken the market, though perhaps not to the extent that might have been expected. The principal producers have sufficient orders in hand to last till the end of January. They are, therefore, not inclined to book fresh ones unless they can obtain the prices they have been quoting during the last few weeks, viz., 44s. 6d. to 45s. per ton for No. 3, g.m.b. Those makers who have held aloof from the combination asked on Tuesday 44s. for No. 3, whilst merchants offered the same quality in small lots at 43s. 6d. per ton, f.o.b. There were, however, very few purchasers even at the latter figure.

Messrs. Connal and Co. had on Monday night 100,861 tons of Cleveland pig iron in their Middlesbrough store, being a reduction of 705 tons since last report.

Only very small quantities of pig iron have been shipped during the past week. Up to Monday the total for the month had only reached 61,076 tons. The manufactured iron shipped in the same period amounted to 24,921 tons.

There is no improvement noticeable in the manufactured iron trade, and prices are unaltered. Ship-plates are £6 12s. 6d. to £6 17s. 6d. per ton; angles, £6; common bars, £6 5s.; and iron rails, £5 2s. 6d. to £5 7s. 6d. free on trucks at makers' works, cash 10th less 2½ per cent. discount. Puddled bars are £4 2s. 6d. per ton net.

Messrs. H. S. Edwards and Sons, ship repairers, of the South Shields graving docks, have leased some land at Howdon, belonging to the Duke of Northumberland, and intend to start an iron shipbuilding yard there. The ground extends from the Tyne Commissioners' works at Howdon to the staithes of the Cramlington Coal Company, and will have excellent access by road and railway. There will be room for seven or eight slipways, with a good river frontage. Arrangements have already been made for the erection

of the necessary buildings, and it is expected that operations will be begun early in the new year.

It is expected that a commencement will be made next month at the Duisdale Steel and Wire Works, at Fighting Cocks near Darlington. The works of the North-Eastern Steel Company are now in a forward state, and it is thought that the first blow will take place early in the new year.

Mr. Robert Wyllie, who has been with Messrs. John Elder and Co. for a considerable length of time, has been engaged by Messrs. T. Richardson and Sons to take charge of their marine engine works at Hartlepool, and he will shortly enter upon his duties.

The award of Sir J. W. Pease, M.P., in the northern finished iron trade, was received at the offices of the Board of Arbitration on the 23rd ult., and was as follows:—"That as regards the operatives' claim for an advance of 9d. per ton on puddling, and 7½ per cent. in other forge and mill wages, as set forth in their notice of September 4th, 1882, no advance is due to them." "That as regards the employers' claim for a reduction of 9d. per ton on puddling and 7½ per cent. in other forge and mill wages, as set forth in their notices of August 3rd and September 12th, 1882, a reduction is due to the employers of 6d. per ton on puddling and 5 per cent. in other forge and mill wages." "That such reduction shall take effect from and after Saturday next, the 25th inst., and shall continue till the last Saturday in February, 1883, subject to one month's notice of change from either side, to terminate on or after the expiration of such period."

The award was accompanied by a letter, in which the arbitrator again expressed a hope that a sliding scale might be adopted before long. He also dealt at some length with the facts which had been put before him at the last two arbitrations. These show conclusively that the employers' case was a very strong one, and that they were fully entitled to the reduction which has been awarded. The men have so far accepted the award with admirable spirit, and it does not seem likely that there will be any further trouble at present.

The council of the Cleveland Institution of Engineers have issued an appeal to the members asking them to consent to pay a double subscription for the current season, in order to provide means to pay off the debt which has for some time been encumbering their operations. A considerable number of members have already responded in the affirmative, and it is to be hoped that all will agree, and so place this active and valuable institution in a sound financial position. The alternative is that the subscriptions, now only one guinea per annum for members and associates and half-a-guinea for graduates, will have to be permanently increased. The debt has arisen through inability to recover a large number of subscriptions during the recent bad times. It is not much to the credit of the defaulters that they have made use of the various privileges of membership and repudiated the liabilities thereby incurred.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THE Glasgow pig iron market has been suffering from the effects of the failure of two brokers, which took place towards the end of last week. But the depression is not so great as it was a few days ago, and the market has apparently assumed a steadier phase, with little change in prices, and not much business doing. Hitherto the foreign demand for Scotch pigs has continued remarkably good, and the prospects at present are not discouraging, even making full allowance for the backward condition of the American market. This week the stocks in Connal's stores show a reduction, not merely as compared with those of the preceding week, but with those of the corresponding week of last year, having fallen upwards of 20,000 tons since June last. Makers' special brands are also well sold out, and but for the existence of a heavy "bear" account in the market, the probability is that prices of warrants would at this moment be considerably higher. The arrivals of Middlesbrough pigs at Grangemouth this week are much larger than usual, but they are to a considerable extent made up of consignments which were kept back by stormy weather in the preceding week.

Business was done on Friday forenoon at from 48s. 7d. to 48s. 11d. cash, and from 49s. to 49s. 2d. one month, the afternoon quotations being 48s. 10½d. to 49s. cash, and 49s. 2d. one month. On Monday business was done at 49s. to 48s. 7½d. cash. Tuesday's forenoon market was steady, with transactions at 48s. 10d. to 48s. 11½d. cash, and 49s. 3d. one month, the afternoon figures being 48s. 11d. to 49s. cash. The tone was quiet on Wednesday at 49s. to 48s. 10d. cash. To-day —Thursday—business was done at 48s. 8d. to 48s. 9d. cash, and 48s. to 49s. 1d. one month

Some of the makers' brands are a shade lower, the quotations being:—Gartsherrie, No. 1, 64s. 6d.; No. 3, 54s.; Coltness, 68s. 6d. and 56s.; Langloan, 68s. and 56s. 3d.; Summerlee, 64s. and 54s.; Calder, 63s. and 52s. 6d.; Carnbroe, 57s. and 52s.; Clyde, 54s. and 52s.; Monkland, 50s. 9d. and 49s.; Quarter and Govan, each 50s. 9d. and 49s.; Shotts, at Leith, 66s. and 56s. 6d.; Carron, at Grangemouth, 53s.—specially selected, 57s. 6d. —and 52s.; Kinneil, at Bo'ness, 50s. and 49s.; Glengarnock, at Ardrossan, 57s. and 51s. 6d.; Eglinton, 51s. 6d. and 49s. 6d.; Dalmellington, 52s. and 50s.

The feeling in the malleable trade is rather quieter. Common iron bars are quoted at £6 7s. 6d.; angles, £6 5s. to £6 15s.; ship plates, £7 10s.; boiler plates, £7 15s.; steel angles, £9; ship plates, £10; boiler plates, £11 10s.

At Glasgow the coal trade is very good. The severe weather has quickened the inquiry for domestic use, and the shipments of the past week have been heavy. Orders now under execution are large. There is more inquiry for dross, and splint has likewise improved in demand. Prices in the West are good and well maintained. At the Fife ports shipping orders have fallen off considerably, and quotations are lower, the f.o.b. figures at Burntisland being 7s. to 7s. 6d. per ton. About 5000 tons of coals were shipped at Leith in the course of the week, including a cargo of 2000 tons per the ship Blair Athole, of Glasgow, for Rangoon.

Powers are to be sought in next session of Parliament to construct a railway from North Alloa to Kirkcaldy. It has much support from the coalmasters in the district, who anticipate that it would effect a saving of 6d. to 1s. per ton in the rates of carriage.

The miners are working quietly in nearly all parts of the country at present. In Fife the reduction in the price of coals appears to convince them that there is little chance of their obtaining the additional 5 per cent. of wages they have for some time been claiming. The men have abandoned their policy of restriction of output just at the moment that the Baltic trade is practically over for the season; it is not unlikely that coals may be stored at some of the collieries.

Mr. John M'Culloch, of the Kilsyth Coal Company, has been appointed general manager of the Monkland Iron and Coal Company, Limited, in place of Mr. Ferrie, resigned. Mr. Ferrie retains a seat at the board of directors, with an annual allowance of £500, so that his practical knowledge of the business may be available for the benefit of the management.

Messrs. Von Ligertwood and Co., of the Speedwell Engineering Works, Coatbridge, have acquired 22 acres of ground on the Clyde, below Glasgow, at Dalmuir, where they contemplate the erection of extensive works for the production of sugar-making plant. The advantage of the site is that it will have both railway and water communication.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

THE coal trade of Wales is not quite so brisk as it was, principally owing to the necessary tonnage not coming into port. Storms have helped materially in this hindrance, and reports are to hand of several shipping disasters to Cardiff vessels. A French vessel laden with coal from Cardiff went down this week off Lundy Island.

Exports from all Wales show a decline of 40,000 tons, an important difference, yet one that may be made up easily in the coming week. The Royal Mail Company's contracts have been given to the Powell Duffryn Company, Locket and Judkins, and the London and South Wales. It is a noticeable fact that the Locket referred to is a descendant of one of the same name who first, in connection with Mary Church, of Cardiff, opened the coal trade of that port.

Still another steamship company is announced —the Abermaed, with a capital of £20,000.

The Ynyshir lamp, which is now threatening to be a formidable rival to the Clanny, has been brought under the notice of the Mines Commissioners. The inventor was this week introduced to them by Mr. W. T. Lewis, in London, and having heard his explanation, they expressed themselves most favourably on the merits of the invention.

The Newbridge Rhondda Colliery, which is favourably placed for Taff Vale traffic, being even better off in this respect than the Great Western Colliery, has now, it is understood, passed into the ownership of Crawshay Brothers. Apart from the local importance to the Rhondda there is a good deal of encouragement in the report, as it is evidently the intention of the Brothers Crawshay by this purchase, the extension of their own collieries, and renewal of the steel works at Cyfarthfa, to take up a very forward position again in the iron and coal world.

There was a general delegate meeting of colliers on Monday at Aberdare, and the result was looked forward to with some degree of anxiety, as it was decided at this meeting to bring forward the overtures of Leeds for co-operation in restricting the output. The result was that it was decided not even to be represented at the Leeds meeting. Another proposition carried was to limit the working hours to nine daily.

Work has been resumed at the Dinas 6ft. seam. This was the scene of the explosion four years ago, and even now I hear there are twenty-eight bodies in the pit.

The iron trade continues satisfactory, and good work for some months to come is secured. At present orders are rather slow in coming in, but as substantial ones are on the books this is not felt.

Best steel rails are in demand, prices rather low; pig iron quiet. A slight change for the better is to be noted at some of the tin-plate works. I hear of negotiations on foot for resuming work at one or two that have been closed. If this took place in the spring when tin-plate begins to look up, I should not be surprised. As it is, the movement has a sort of healthy character about it.

To meet the great demand for coal, I hear that experiments have been made at the Harris Navigation Colliery to raise four trams at a time. The experiment did not succeed.

Initiatory steps have been taken during the last few days to form a sliding scale for the Llanelly Collieries in the western district of Wales, and Mr. Abraham, the principal of the Colliers' Amalgamation in South Wales, has taken a prominent part. An important meeting of colliery owners and colliers' representatives has been held in the Forest of Dean, when it was decided to form a board of conciliation. An application for an advance of 5 per cent. was declared.

The Great Western Electric Light Company, Cardiff, is announced.

The Taff Vale Co. has it in contemplation to carry out several important changes next year, and a considerable alteration of passenger traffic is likely.

The house colliers have just had a meeting, and decided to adopt the same course as the steam coal men *in re* Leeds.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Nov. 25th, 1882:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 9028; mercantile marine, Indian section, and other collections, 2829. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 4 p.m., Museum, 1447; mercantile marine, Indian section, and other collections, 292. Total, 13,596.

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.

21st November, 1882.

5520. AFFIXING FLEXIBLE TUBING TO COUPLINGS, J. Hunt and T. E. Mitton, Birmingham.
5521. SEWING MACHINES, W. H. Beck, London.
5522. TAPS for BOTTLES, P. Yates, Oldham.
5523. SOLUTIONS of METALLIC SALTS for the REMOVAL of IRON IMPURITIES THEREFROM, C. D. Abel.—(*F. C. Glaser, Berlin.*)
5524. LAWN POOL, A. J. Adams, London.
5525. MANUFACTURING SUGAR, H. H. Lake.—(*La Société Lebaudy Frères, Paris.*)
5526. METALLIC FASTENERS for ATTACHING BUTTONS, &c., A. J. Boult.—(*F. A. Smith, jun., U.S.*)
5527. GAS ENGINES, E. Dyson, Milnsbridge.
5528. REMOVING the SUPERFLUOUS GLAZE off ENAMELLED BRICKS, &c., E. B. Brooke, Huddersfield.
5529. WINDING APPARATUS, J. Farrar, Halifax.
5530. TENTS, &c., H. E. Newton.—(*J. G. C. van Döcker, Copenhagen.*)
5531. MANUFACTURING MATERIAL IMITATING LEATHER FABRICS, &c., H. Loewenberg, Wiesbaden.
5532. LITHOGRAPHIC PRESSES, H. J. Haddan.—(*E. Lapeyre, Paris.*)
5533. WIRE for FENCES, W. Friedlaender.—(*H. Honour and M. Friedlaender, Ashburton.*)
5534. DISTRIBUTING STEAM in MOTOR ENGINES, J. W. Jordan and J. T. Brockliss, Norwich.
5535. METALLIC PACKINGS, A. M. Clark.—(*L. Katzenstein, New York, U.S.*)
5536. PURIFYING TOWN SEWAGE, P. Jensen.—(*H. Betche, Magdeburg.*)
5537. DRYING GRAIN, W. R. Lake.—(*F. W. Wiesebrock, New York, U.S.*)
5538. WHEELS for VEHICLES, W. R. Lake.—(*U. A. Chanveau and P. C. A. Laglenne, Paris.*)
5539. MEASURING LIQUIDS, H. H. Lake.—(*P. J. Carmien, Issy.*)
5540. PROPELLING VEHICLES, E. Edwards.—(*C. Laburthe, St. Pierre.*)
5541. ROTARY ENGINES, A. M. Clark.—(*G. W. Wade and J. M. Wardell, Cadillac.*)
5542. URINAL and WASHSTAND, A. Albutt.—(*F. Müller, Stuttgart.*)

22nd November, 1882.

5543. VALVES for AIR COMPRESSORS, C. Pilkington and J. Forrest, Haydock.
5544. TRAVELLING GRATES for FURNACES, G. and E. Ashworth, Manchester.
5545. UTILISING BY-PRODUCTS of SODA, &c., J. Mactear, Glasgow, N.B.
5546. COOLING APPARATUS, S. P. Wilding.—(*G. Stollwerck, Cologne.*)
5547. MOVABLE PARALLELOGRAMIC SUPPORT, A. Zwierzchowski, Paris.
5548. IMPROVING INFERIOR QUALITIES of DIAMONDS, &c., J. C. Mewburn.—(*G. H. Durkès, Paris.*)
5549. HANDLE for SAUCEPANS, &c., E. Baldwin, Stourport.
5550. CENTRE VALVES, R. Dempster, jun., Elland.
5551. SHAMPOOING, &c., A. G. Klugh, London.
5552. VOLTAIC BATTERIES, L. Hartmann, London.
5553. GOVERNORS for STEAM ENGINES, W. M. Musgrave, Bolton.
5554. DERIVATIVES, C. Lowe, Reddish.
5555. BOILER FLUES, &c., G. W. Dyson, Bolton.
5556. BREECH-LOADING GUNS, W. R. Lake.—(*W. Gardner, Hartford, U.S.*)
5557. TRIMMING, &c., the SOLES and HEELS of BOOTS, &c., J. Keats, Bagnal.
5558. FOUNTAIN PENHOLDERS, A. Osborn, Birmingham.
5559. ORDNANCE, J. Vavasseur, London.
5560. APPARATUS for CUTTING PAPER, W. C. Kritch and J. Garland, Leeds.
5561. COUPLING APPARATUS, A. S. Mildred, Middlesbrough-on-Tees.
5562. LAMPS, &c., H. Salsbury, London.
5563. PROPULSION of ROW BOATS, W. Sage, Walworth.
5564. WHEELS, &c., A. Clark.—(*B. N. Shelley, U.S.*)
5565. EXTRACTS of MEAT, F. S. Barff, London, and A. P. Wire, Leytonstone.
5566. EXHAUSTING the BULBS of INCANDESCENT ELECTRIC LAMPS, N. K. Cherrill, Paris.
5567. HARVESTING MACHINERY, A. C. Bamlett, Thirsk.
5568. APPLYING MOTIVE POWER to TRAM-CARS, W. H. Hindle, Blackburn.

23rd November, 1882.

5569. RIBBED PILE FABRICS, J. R. Hutchinson, Bury.
5570. CHAINS and BUCKETS for DREDGERS, W. R. Kinipple, Greenock.
5571. PROTECTING SHIPS, W. Beverley, Aberdeen, and G. A. MacLanerty, Glasgow.
5572. ANTISEPTICS, &c., C. T. Kingzett and M. Zingler, London.
5573. DRAIN PLOUGHS, S. Pitt.—(*J. C. White, U.S.*)
5574. PURSES, G. Macaulay-Cruikshank.—(*F. W. Schwarz, Offenbach-on-the-Main.*)
5575. EXTRACTION of TALLOW, C. D. Abel.—(*H. Lissagaray and H. Leplay, Paris.*)
5576. BREECH-LOADING ORDNANCE, &c., S. H. Berry, London.
5577. PRINTING, &c., STAMP, G. K. Cooke, Paris.
5578. BOBBINS, &c., L. Heppenstall, jun., Milnsbridge.
5579. CARTS, &c., A. Bettger, London.
5580. CARBONS, &c., W. Cunliffe, London.
5581. WOOD BLOCK PAVEMENTS, E. Hughes, Liverpool.
5582. NAVES of WHEELS, S. Andrews, Cardiff.
5583. MEASURING MEN, &c., E. P. Wilford, Bristol.
5584. ELECTRIC BELL, W. R. Lake.—(*C. F. de Redon, Paris.*)
5585. ATTACHING LAMPS to CARRIAGES, R. J. Dobbs and F. Davies, Birmingham.
5586. UNDERGROUND CONDUCTORS, R. Gülcher, London.

24th November, 1882.

5587. RAILWAY SWITCHES, E. N. Molesworth-Hepworth, Manchester.
5588. KEYS for FIXING RAILS, E. W. Swan and T. G. Massicks, Middlesbrough.
5589. SEWING SILK, W. Trafford, Leek.
5590. METALLIC BEDSTEADS, &c., T. Kendrick, Birmingham.
5591. TREATING VEGETABLE, &c., MATTER, G. and J. E. Tolson, Dewsbury.
5592. CRICKET-BAT HANDLES, H. J. Haddan.—(*J. C. Brodie, Port Augusta.*)
5593. STAMPED, &c., PLATES, J. F. Smyth, Belfast.
5594. DYNAMO ELECTRIC MACHINES, C. D. Abel.—(*B. Abdank-Abakanowicz and C. Roosevelt, Paris.*)
5595. CANDLE MOULDING MACHINES, E. Cowles, London.
5596. FACILITATING the RAISING, &c., of the HEADS of CARRIAGES, S. C. L. Fuller, Bath.
5597. STEEL TUBES, S. Walker, Birmingham.
5598. STOVES, F. Greatrex, London.
5599. TRICYCLES, H. J. Hissett, Plymouth.
5600. WATER HEATER, E. Vermeiren, Brussels.
5601. SECONDARY BATTERIES, A. Tribe, London.
5602. COMPOSITION for UNITING SHEETS of PAPER, C. Bond.—(*W. Doughtie, Cleveland, U.S.*)

25th November, 1882.

5603. TENTERING, &c., MACHINES, J. Ashworth, Rochdale.
5604. BENZOL, &c., S. Mellor, Patricroft.
5605. NAILS, S. Watkins.—(*W. Taylor, Pittsburg, U.S.*)
5606. TAKING SOUNDINGS, F. Sutcliffe, Liverpool.
5607. TREATING MIXED SOLUTIONS of CHLORIDE of COPPER, &c., W. Weldon, Burstow.
5608. LOOMS for WEAVING, G. Keighley, Burnley.
5609. CUTTING UP SUGAR-CANE, C. D. Abel.—(*A. Perret France.*)
5610. BLOCK SIGNALLING, F. Swift, London, and A. J. M. Reade, Slough.
5611. REGULATING LIQUIDS, P. J. Catterall and E. Birch, Manchester.
5612. STANDS for BOTTLES, C. Pembrook and J. Dingley, Birmingham.
5613. TIP VANS, E. Hora, London.
5614. PERMANENT WAY, W. T. Garnett, Bradford.
5615. PAPER BAGS, J. Johnson.—(*F. E. Bilon, Paris.*)
5616. EXHAUSTING, &c., FLUIDS, H. Stewart, London.
5617. SHARPENING SAWS, W. R. Lake.—(*L. Martinier, France.*)
5618. FERMENTING LIQUIDS, N. Lubbock.—(*F. I. Scard, Demerara.*)

27th November, 1882.

5619. FILLING BOTTLES, J. Phillips, London.
5620. SPINDLES, D. Skeoch, Stewarton.
5621. PREVENTING INJURIES to STEAM BOILERS, A. J. Smith, London.
5622. TUBULAR STEAM GENERATORS, C. D. Abel.—(*L. C. Uhler, Paris.*)
5623. AERIAL RAILWAY, E. P. Alexander.—(*P. M. T. Imbaud, Paris.*)
5624. OBTAINING ELASTIC FORCE, J. Graddon, Forest Hill.
5625. TELEPHONIC APPARATUS, J. B. Spence, London, and J. E. Chaster, Southport.
5626. METAL CISTERNS, H. Sutcliffe, Halifax.
5627. PORTABLE RAILWAY, H. A. Spalding, Jahnkow.
5628. STEAM ENGINES, W. Hornsby and R. Edwards, Grantham.
5629. BICYCLES, &c., J. Hix, London.
5630. PILED FABRICS, J. Holt, Bolton.
5631. DYNAMO-ELECTRIC MACHINES, C. A. McEvoy and J. Mathieson, London.
5632. SURGICAL TRUSS, E. Edwards.—(*P. C. B. Horlique, France.*)
5633. TELEPHONIC APPARATUS, H. H. Lake.—(*J. H. Rogers, Washington, U.S.*)
5634. TOYS, H. H. Lake.—(*J. N. Gifford, jun., U.S.*)
5635. SHEARS, H. H. Lake.—(*G. S. V. Pelt, U.S.*)
5636. SEWER GAS TRAP, T. Carder, Bideford.
5637. FRET SAW MACHINES, R. D. Sanders, Acton.
5638. CULTIVATING LAND, W. Fisken, Stamfordham, and S. S. Robson, Sunderland.
5639. COUPLING RAILWAY VEHICLES, W. and L. Younghusband and T. Hudson, Darlington.
5640. PRODUCING DESIGNS, &c., A. M. Clark.—(*H. Beau, Paris.*)
5641. STAYS, W. Rosenthal.—(*H. Rosenthal, Germany.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

5486. RENDERING ANIMAL, &c., FIBRES WATER REPELLENT, C. B. Warner, London.—18*th November*, 1882.
5517. ORNAMENTAL NAILS, &c., A. J. Boult, London.—A communication from C. E. Bailey and W. R. Talbot, Providence, U.S.—20*th November*, 1882.
5526. METALLIC FASTENERS for ATTACHING BUTTONS, A. J. Boult, London.—A communication from F. A. Smith, jun., Providence, U.S.—21*st November*, 1882.
5535. METALLIC PACKINGS, A. M. Clark, London.—A communication from L. Katzenstein, New York, U.S.—21*st November*, 1882.
5550. CENTRE VALVES, R. Dempster, jun., Elland.—22*nd November*, 1882.
5564. WHEELS and AXLES, A. M. Clark, London.—A communication from B. N. Shelley, Anderson, U.S. —22*nd November*, 1882.

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

4729. PACKING CASES, T. Cockcroft, Birkenhead.—20*th November*, 1879.
4721. WEIGHING APPARATUS, J. Parnall, Bristol.—20*th November*, 1879.
4733. PROPELLING VESSELS, G. Wilson, London.—20*th November*, 1879.
4840. SPIDER WHEELS, H. J. Brookes, Smethwick.—26*th November*, 1879.
5056. SUPPLYING PLASTIC COMPOUNDS to MOULDING, M. Gray, London.—10*th December*, 1879.
4739. RECORDING LEVEL, A. M. Rymer-Jones, London. —21*st November*, 1879.
4752. BOILER, &c., FIREPLACES, J. M. Stanley, Rhyl. —21*st November*, 1879.
4757. WARP FABRICS, T. Coltman, Leicester, and J. A. Frerichs, Bradford.—22*nd November*, 1879.
4761. SUGAR, &c., SYRUPS, D. MacEachran, Greenock. —22*nd November*, 1879.
4762. COLOURING MATTERS, J. A. Dixon, Glasgow.—22*nd November*, 1879.
4767. SEWING MACHINES, G. Benson, Belfast.—22*nd November*, 1879.
4768. PRIVIES, R. Pease and T. Lupton, Bradford.—22*nd November*, 1879.
4878. TORPEDO BOATS, W. R. Lake, London.—28*th November*, 1879.
5127. ELECTRIC LAMPS, T. A. Edison, Menlo Park, U.S.—15*th December*, 1879.
33. DEVELOPING ELECTRIC CURRENTS, T. A. Edison, Menlo Park, U.S.—3*rd January*, 1880.
4793. MANUFACTURING BUTTONS, H. E. Newton, London.—24*th November*, 1879.
4808. ROLLING MILLS, F. C. Glaser, Berlin.—25*th November*, 1879.
4870. FURNACES, J. Mactear, Glasgow.—28*th November*, 1879.
4982. RAISING, &c., CASKS, C. Hewitt, Swanscombe.—5*th December*, 1879.
5118. FLOOR CLOTHS, &c., F. Walton, London.—13*th December*, 1879.
4781. ARTIFICIAL MANURES, F. J. Bolton and J. A. Wanklyn, London.—24*th November*, 1879.
4783. CUTTING, &c., WOOD, C. H. Pickles, S. Smithson, and T. Pickles, Ravensthorpe.—24*th November*, 1879.
4820. GAS MOTOR, E. Edmonds, London.—25*th November*, 1879.
4977. REGULATING the SUPPLY of STEAM, J. D. Churchill, London.—5*th December*, 1879.
5039. WATER-CLOSETS, E. G. Banner, London.—9*th December*, 1879.
4861. FILLING MATCH BOXES, W. P. Thompson, Liverpool.—27*th November*, 1879.
4864. REGISTERING APPARATUS, H. J. Fieldus, Brighton.—27*th November*, 1879.
4888. INDICATORS, E. T. Darke, London.—28*th November*, 1879.
4907. PRINTING MACHINERY, A. Sauvée, London.—1*st December*, 1879.
4823. EXTENDING TABLES, A. M. Clark, London.—25*th November*, 1879.
4855. REAPING MACHINES, T. Culpin, London.—27*th November*, 1879.

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

4039. FEEDING FUEL into FURNACES, J. M. Holmes and B. P. Walker, Birmingham.—20*th November*, 1875.
4047. LATHES, W. F. Smith and A. Coventry, Salford. —22*nd November*, 1875.
4178. PINS, &c., T. R. and T. W. Harding, Leeds.—2*nd December*, 1875.
4116. KNEADING MACHINES, P. Pfleiderer, Norwood.—26*th November*, 1875.
4146. SEWING MACHINES, W. Webster, San Francisco. —30*th November*, 1875.
4159. WAREHOUSE HOISTS, J., J., and T. Barker, Oldham—1*st December*, 1875.
4115. SUBMARINE TELEGRAPHIC CABLES, W. T. Henley, Plaistow.—26*th November*, 1875.
4125. SPEED INDICATORS, J. M. Napier, Lambeth.—27*th November*, 1875.

4220. Magazine Fire-arms, W. Morgan-Brown, London.—6*th December*, 1875.
4310. Buffer, &c., Apparatus, G. Turton, Sheffield.—11*th December*, 1875.
4400. Discharging Mud from Dredgers, &c., F. E. Duckham, London.—18*th December*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 15*th December*, 1882.

3400. Perambulators, J. Aylward, Birmingham.—18*th July*, 1882.
3402. Machinery for Spinning Fibrous Substances, F. W. Fox, Burley-in-Wharfedale, and T. Coulthard, Preston.—18*th July*, 1882.
3421. Railway Carriages, W. P. Thompson London.—A com. from A. H. Munro.—18*th July*, 1882.
3427. Rotary Steam Engine, J. Pinchbeck, London.—19*th July*, 1882.
3428. Horseshoes, A. Laird and T. Wilson, London.—19*th July*, 1882.
3432. Screw Propellers, E. G. Brewer, London.—A communication from G. Hoper.—19*th July*, 1882.
3451. Life-saving and Swimming Apparatus, A. I. Ratn, Manchester.—20*th July*, 1882.
3453. Improved Beverage, J. Lane, Liverpool.—20*th July*, 1882.
3469. Saddle Bar, W. Macleod, Teignmouth.—21*st July*, 1882.
3475. Brake Gear, J. M. Haime, Cardiff.—21*st July*, 1882.
3476. Receptacles for Electrical Apparatus, W. A. Barlow, London.—A communication from L. Encausse.—21*st July*, 1882.
3482. Locks, J. H. Black, London.—21*st July*, 1882.
3490. Machinery for Cutting, &c., Fire-wood, J. Rowley and H. Vulliamy, London.—22*nd July*, 1882.
3496. Suspension for Carriages, &c., E. M. Desprez, Paris.—22*nd July*, 1882.
3511. Flush Cisterns, W. Wright, Plymouth.—24*th July*, 1882.
3522. Producing Metallic Wolfram, C. J. L. Leffler, Sheffield.—25*th July*, 1882.
3536. Coupling for Pipes and Tubes, W. H. Beck, London.—A communication from J. L. B. Bodel and J. L. F. Brauer.—25*th July*, 1882.
3552. Apparatus for Separating Grain, W. R. Lake, London.—A com. from C. McNeal.—26*th July*, 1882.
3556. Boat-lowering Appliances, C. Grayson, Liverpool.—27*th July*, 1882.
3567. Pocket Cases for Containing Cigars, &c., P. Everitt, London.—27*th July*, 1882.
3578. Apparatus for Impregnating Wood, W. P. Thompson, London.—A communication from L. L. de Paradis.—27*th July*, 1882.
3624. Ships' Sleeping Berths, E. Lawson, Birmingham, and E. W. de Rusett, Anerley.—31*st July*, 1882.
3654. Saw-filing Apparatus, A. M. Clark, London.—A communication from C. M. Elkins and W. M. Weston.—1*st August*, 1882.
3684. Fire-arm, W. R. Lake, London.—A communication from A. Coroni.—2*nd August*, 1882.
3737. Ceramic Composition, B. J. B. Mills, London.—A communication from F. Gillett.—5*th August*, 1882.
3806. Vacuum Brake Apparatus, S. Carlton, Swindon.—10*th August*, 1882.
3820. Magneto-electrical Apparatus for Signalling, J. H. Johnson, London.—A communication from T. and J. Ducousso, and the Société Anonyme Maison Breguet.—10*th August*, 1882.
3848. Steam Engines, I. Beck, Sheffield.—12*th August*, 1882.
3849. Parallel Vices, W. M. MacBriar, Sheffield.—12*th August*, 1882.
4055. Constructing Engines, T. Charlton and J. Wright, London.—24*th August*, 1882.
4358. Apparatus for Coupling Railway Trucks, G. Fenwick, Gateshead-on-Tyne.—13*th September*, 1882.
4362. Distributing Electricity for the Production of Light and Power, L. Gaulard and J. D. Gibbs, London.—13*th September*, 1882.
4623. Preparations of Animal Vaccine, E. T. Darke, London.—A communication from E. Warlomont.—28*th September*, 1882.
4798. Machine for Opening Horsehair, &c., M. G. Daughters, London.—9*th October*, 1882.
4915. Switches for Electric Lamps, T. W. Cowan, Rotherham.—16*th October*, 1882.
5005. Rope Tramways, H. H. M. Smith, London.—A com. from A. S. Halliday.—20*th October*, 1882.
5119. Cable Traction Railways, &c., J. Wright, London.—A com. from C. F. Findlay.—27*th October*, 1882.
5166. Circuits for Telephonic Communication, H. Alabaster and T. E. Gatehouse, London.—30*th October*, 1882.
5192. Apparatus for Measuring Water, J. A. Muller, London.—31*st October*, 1882.
5201. Apparatus used for Manufacturing Paper, F. Wrigley & J. Robertson, Bury.—1*st November*, 1882.
5225. Axles, &c., for Vehicles, H. Weatherill, Manchester.—2*nd November*, 1882.
5486. Compound for Rendering Fabrics, &c., Water Repellent, C. Warner, London.—18*th November*, 1882.

(*Last day for filing opposition*, 19*th December*, 1882.)

3447. Valves of Hydraulic Rams, J. Blake, Accrington.—20*th July*, 1882.
3487. Apparatus to Prevent Chimneys Smoking, E. Edwards, London.—A communication from A. Marques.—22*nd July*, 1882.
3497. Treating Sewage, T. H. Cobley, Dunstable.—22*nd July*, 1882.
3498. Metallising Cloth, &c., A. J. Boult, London.—A com. from J. Hautrive.—22*nd July*, 1882.
3508. Electric Lamps, A. M. Clark, London.—A com. from H. J. Müller and A. Levett.—24*th July*, 1882.
3516. Surgical Splints, H. Hides, Surbiton.—A communication from E. Porteus.—25*th July*, 1882.
3532. Secondary Batteries, G. L. Winch, London.—25*th July*, 1882.
3559. Locking Devices, H. J. Haddan, London.—A com. from J. Fondu-Bloemendal.—27*th July*, 1882.
3563. Regenerative Furnaces, A. Beard, Swansea.—27*th July*, 1882.
3566. Looms for Weaving, T. Singleton, Darwen.—27*th July*, 1822.
3595. Electric Telegraphy, J. H. Johnson, London.—A communication from E. Estienne.—29*th July*, 1882.
3621. Uniting Small Pieces of Amber, W. Morgan-Brown, London.—A communication from B. Borowsky.—31*st July*, 1882.
3631. Amber Varnish, W. Morgan-Brown, London.—A com. from B. Borowsky.—31*st July*, 1882.
3649. Screw Propellers, H. Hardy, Edinburgh.—1*st August*, 1882.
3658. Steam Pumps, W. W. Beaumont, London.—1*st August*, 1882.
3661. Apparatus for Use in Telephonic Circuits, J. W. Fletcher, Stockport.—2*nd August*, 1882.
3667. Apparatus for Indicating Position of Railway Switches, H. J. Haddan, London.—A communication from G. Otte.—2*nd August*, 1882.
3700. Secondary Batteries, E. G. Brewer, London.—A communication from O. Schulz.—3*rd August*, 1882.
3711. Bridges of Furnaces C. Hill, Blaydon-on-Tyne.—4*th August*, 1882.
3770. Preparing Lead for Use in Cells of Secondary Batteries, L. Epstein, London.—8*th August*, 1882.
3824. Meters for Electric Light, A. M. Clark, London.—A communication from L. Hours-Humbert and J. de B. de Liman.—10*th August*, 1882.
3874. Apparatus for Bending, &c., Metal, C. Scriven, Leeds.—14*th August*, 1882.
3876. Apparatus for Clearing Tramway Rails of Dirt, S. Shields, Liverpool.—14*th August*, 1882.
3892. Compound Applicable as a Substitute for Butter, H. J. Haddan, London.—A communication from S. H. Cochran.—15*th August*, 1882.
4314. Manufacture of Shot, T. Spence, Gateshead-on-Tyne.—11*th September*, 1882.
4375. Hydraulic Lifts, J. S. Stevens and C. G. Major, London.—14*th September*, 1882.
4553. Injectors, H. J. Haddan, London.—A com. from W. Macdonald & J. Morrison.—25*th September*, 1882.
4591. Machine for Pasting Labels on Bottles, &c., F. Foster, London.—27*th September*, 1882.
4850. Apparatus for Ventilating Purposes. W. Teague, Illogan.—12*th October*, 1882.
4856. Producing Lint from Flax Fibres, G. W. von Nawrocki, Berlin.—A communication from M. Salomonson.—12*th October*, 1882.
4909. Screw-neck Bottles, F. Foster, London.—16*th October*, 1882.
4996. Compound Armour Plates, T. D. Clare, Handsworth.—A com. from F. Yates.—20*th October*, 1882.
5075. Manufacturing Cokes, P. Jensen, London.—A communication from Messrs. Beatus, Petersen, and Co.—24*th October*, 1882.
5089. Manholes of Boilers, A. Watkins, Greenwich.—25*th October*, 1882.
5125. Door Checks, A. J. Boult, London.—A communication from the Elliott Pneumatic Door Check Company.—27*th October*, 1882.
5128. Machines for Crushing Stones, G. Dalton, Leeds.—A com. from S. Marsden.—27*th October*, 1882.
5136. Watchman's Time Detectors, J. Wetter, London.—A com. from G Ransom.—28*th October*, 1882.
5168. Steam Boilers, S. P. Wilding, London.—A com. from Stollwerck Brothers.—30*th October*, 1882.
5183. Secondary Voltaic Batteries, B. H. Woodley and H. F. Joel, London.—31*st October*, 1882.
5194. Fastenings for Bracelets, &c. E., Jones, London.—31*st October*, 1882.
5285. Manufacturing Artificial Dung, S. Walter, Berlin.—6*th November*. 1882.
5307. Velocipedes, R. E. Phillips, Anerley.—7*th November*, 1882.
5332. Production of Light, E. P. Chaimsonovitz, Leytonstone.—8*th November*, 1882.
5365. Producing Fibres for Spinning, &c., J. A. Graham, London.—10*th November*, 1882.
5367. Coating Iron with Lead, J. A. Graham, London.—10*th November*, 1882.
5407. Filters, J. Wetter, London.—A communication from J. Grant.—13*th November*, 1882.
5526. Metallic Fasteners, A. J. Boult, London.—A com. from F. A. Smith, jun.—21*st November*, 1882.
5535. Metallic Packings, A. M. Clark, London.—A com. from L. Katzenstein.—21*st November*, 1882.
5564. Wheels for Vehicles, A. M. Clark, London.—A com. from B. N. Shelley.—22*nd November*, 1882.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 24th November*, 1882.)

2192. Bridges for Incandescent Electric Lamps, C. J. Allport, London.—10*th May*, 1882.
2484. Metallic Alloys, G. A. Dick, London.—25*th May*, 1882.
2486. Apparatus for Supporting the Net Employed in Lawn-tennis, J. M. Croisdale, Manchester.—25*th May*, 1882.
2500. Heels for Boots and Shoes, E. A. Brydges, Upton.—26*th May*, 1882.
2501. Electrical Insulator, B. Bhodes and G. Binswanger, London.—26*th May*, 1882.
2520. Machines for Breaking Coke, H. J. H. Thomas and J. Somerville, London.—27*th May*, 1882.
2527. Apparatus for Producing Inflammable Gas, H. Davey, Leeds.—27*th May*, 1882.
2550. Machine for Sifting Various Materials, M. Shearer, sen., and M. Shearer, jun., London.—30*th May*, 1882.
2586. Sugar-cane Mills, E. Hunt, Glasgow.—1*st June*, 1882.
2591. Water Gauges, W. R. Lake, London.—1*st June*, 1882.
2601. Appendages for Attaching Purses to Gloves, S. Cooke, London.—2*nd June*, 1882.
2605. Implements for Cultivating Land, G. P. Blake, Exeter.—2*nd June*, 1882.
2631. Elastic Wedges, A. E. Séné, Paris.—5*th June*, 1882.
2648. Bathing Machines, H. Westman, Birmingham.—6*th June*, 1882.
2678. Railway Rails, F. C. Winby, London.—7*th June*, 1882.
2689. Mail Elevators, W. E. Gedge, London.—8*th June*, 1882.
2697. Propelling Velocipedes, C. H. Brooks, London.—8*th June*, 1882.
2708. Treating Celestine for Producing Caustic Strontia, F. J. Bolton, London.—9*th June*, 1882.
2778. Apparatus for Compressing, &c., Explosive Material, E. Hesketh, Dartford.—13*th June*, 1882.
2834. Water-closets, A. M. Clark, London.—15*th June*, 1882.
2839. Apparatus for Retaining Air in Feeding-bottles, C. P. D. Chittenden, Lee.—16*th June*, 1882.
2846. Railway Brake Apparatus, E. Foakes, Cardiff.—16*th June*, 1882.
2886. Printing Machines, J. H. Johnson, London.—19*th June*, 1882.
2897. Railway Brakes, W. R. Lake, London.—19*th June*, 1882.
2987. Steam Engines, R. Duncan, Glasgow.—23*rd June*, 1882.
3018. Sheep Shears, C. Burgon, Sheffield.—26*th June*, 1882.
3070. Electric Arc Lamps, E. de Pass, London.—29*th June*, 1882.
3085. Excavating Earth for Sinking Tubing, W. E. Gedge, London.—30*th June*, 1882.
3087. Looms for Weaving Fabrics, J. Dodd, Oldham, and W. Adam, Kidderminster.—30*th June*, 1882.
3528. Secondary Batteries, C. E. Buell, New Haven, U.S.—25*th July*, 1882.
3640. Distilling Tar, W. Maxwell, Gartsherrie.—1*st August*, 1882.
3738. Holder for Chalk, C. E. Bryant, London.—5*th August*, 1882.
3786. Furnaces, J. Imray, London.—9*th August*, 1882.
3870. Steam Boilers, J. Imray, London.—14*th August*, 1882.
3913. Baking Ovens, J. R. Chibnall, Hammersmith.—16*th August*, 1882.
3926. Spring Mattresses, W. R. Lake, London.—16*th August*, 1882.
3975. Secondary Batteries, J. E. T. Woods, London.—19*th August*, 1882.
3978. Furnaces for Reducing Ores, J. Imray, London.—19*th August*, 1882.
3992. Rotary Engines, J. M. X. Terlinden, Brussels.—19*th August*, 1882.
4010. Constructing Cannon, R. H. Brandon, Paris.—21*st August*, 1882.
4054. Gas Furnaces, C. D. Abel, London.—24*th August*, 1882.
4271. Automatic Brakes, J. C. Peache, Crewe.—8*th September*, 1882.
4348. Wheels for Railway Vehicles, W. R. Lake, London.—12*th September*, 1882.
4405. White Lead, A. J. Smith, West Brompton.—15*th September*, 1882.
4428. Artificial Leather, E. Fischer, Kaltwasser.—18*th September*, 1882.
4442. Apparatus for Manufacturing Air Gas, H. J. Haddan, London.—19*th September*, 1882.
4455. Feed Cups for Lubricants, R. Baird, Glasgow.—19*th September*, 1882.
4688. Nut-locks, A. J. Boult, London.—2*nd October*, 1882.

(*List of Letters Patent which passed the Great Seal on the 28th November*, 1882.)

1642. Incandescent Electric Lamps, W. H. Akester, Glasgow.—5*th April*, 1882.
2553. Hinges, A. J. Boult, London.—30*th May*, 1882.
2558. Generating, &c., Electricity, J. S. Williams, London.—30*th May*, 1882.
2560. Electric Lamps, S. Hallett, London.—31*st May*, 1882.
2562. Imparting a Rotary Motion to Brushes, R. F. Heney, London.—31*st May*, 1882.
2566. Weaving Cloth for Tapestry, D. A. Guille, London.—31*st May*, 1882.
2567. Heating by Electricity, O. Rose, Manchester.—31*st May*, 1882.
2571. Making the Insulating Bodies of Electric-light Conducting Wires Non-inflammable, W. A. Phillips, Homerton, and S. E. Phillips, Charlton.—31*st May*, 1882.
2573. Dynamo-electric Machine, S. Hallett, London.—31*st May*, 1882.
2578. Telephonic Instruments, S. P. Thompson, Bristol.—31*st May*, 1882.
2585. Apparatus for Separating Soluble Matters from Gases, G. Beilby, Mid Calder.—1*st June*, 1882.
2590. Glazing, T. H. P. Dennis, Chelmsford.—1*st June*, 1882.
2592. Quick Adjusting Parallel Screw Vices, P. Lawrence, London.—1*st June*, 1882.
2593. Wrenches, P. Lawrence, London.—1*st June*, 1882.
2597. Stoppering Bottles, G. Falconnier, Nyon, Switzerland.—1*st June*, 1882.
2599, Moulds for Casting Steel, A. Patrick, Glasgow.—2*nd June*, 1882.
2600. Actuating Dabbing Brushes, J. Haigh, W. Dean, & T. W. Mitchell, Bradford.—2*nd June*, 1882.
2602. Secondary Batteries, C. T. Bright, London.—2*nd June*, 1882.
2620. Machinery for Paring the Curls of Hat Brims, J. T. Grimshaw, Stockport.—3*rd June*, 1882.
2621. Machinery for Making Horseshoe Nails, H. P. Fenby, Leeds.—3*rd June*, 1882.
2647. Metal Tubes, J. Robertson, Govan.—6*th June*, 1882.
2669. Antiseptic Preservative, &c., Compounds, J. Jeyes, Plaistow.—7*th June*, 1882.
2670. Plugs for Water, &c., Mains, C. J. T. Hanssen, Flensburg.—7*th June*, 1882.
2676. Preparing Electrodes for Secondary Batteries, A. M. Clark, London.—7*th June*, 1882.
2692. Stopping Ends of Boiler Tubes, D. McMillan, Govan.—8*th June*, 1882.
2702. Apparatus for Levelling Molehills, T. Morgan, London.—8*th June*, 1882.
2795. Looms for Weaving, T. Knowles, Blackburn.—14*th June*, 1882.
5802. Type Printing Presses, J. Miller, Springburn.—14*th June*, 1882.
2816. Filter Press, J. Simpson and E. W. Parnell, Liverpool.—15*th June*, 1882.
2847. Printing Machines, J. H. Johnson, London.—16*th June*, 1882.
2875. Gas Batteries, B. J. Gülcher, London.—17*th June*, 1882.
2900. Promoting Combustion in Furnaces, A. M. Clark, London.—19*th June*, 1882.
3137. Sporting Cartridge Cases, C. D. Abel, London.—3*rd July*, 1882.
3248. Cranes, M. J. Brooks, Sunnyside, and J. H. Spencer, Crawshaw Booth.—8*th July*, 1882.
3256. Rolling Mills, C. A. Snow, Washington, U.S.—10*th July*, 1882.
3702. Manufacture of Cement, L. Roth, Wetzlar.—3*rd August*, 1882.
3973. Churns, W. McCausland, Belfast.—19*th August*, 1882.
4014. Hydrocarbon Furnaces, J. Mundell and W. J. Gordon, Philadelphia.—22*nd August*, 1882.
4283. Treating Coal to Obtain Coke, R. de Soldenhoff, Louvain.—8*th September*, 1882.
4357. Constructing Oil Stoves, J. H. Stiles, South Norwood.—13*th September*, 1882.
4481. Decorating Ceramic Ware, A. Wenger, Hanley.—20*th September*, 1882.
4498. Registering Padlocks, W. R. Lake, London.—20*th September*, 1882.
4523. Malted Farinaceous Food, J. Schweitzer, Brixton.—22*nd September*, 1882.

List of Specifications published during the week ending November 25th, 1882.

2408*, 4d.; 1458, 4d.; 1691, 6d.; 1724, 2d.; 1735, 6d.; 1740, 6d.; 1773, 2d.; 1787, 2d.; 1794, 10d.; 1806, 4d.; 1807, 2d.; 1809, 2d.; 1818, 2d.; 1822, 6d.; 1823, 2d.; 1838, 6d.; 1841, 6d.; 1845, 6d.; 1846, 2d.; 1850, 2d.; 1852, 6d.; 1853, 8d.; 1854, 6d.; 1855, 4d.; 1856, 2d.; 1859, 6d.; 1860, 8d.; 1861, 2d.; 1863, 6d.; 1864, 6d.; 1866, 4d.; 1867, 6d.; 1869, 2d.; 1871, 2d.; 1872, 6d.; 1873, 2d.; 1874, 1s. 3d.; 1875, 6d.; 1876, 2d.; 1877, 6d.; 1878, 6d.; 1880, 6d.; 1882, 6d.; 1883, 1s. 6d.; 1884, 4d.; 1888, 1s.; 1889, 2d.; 1890, 4d.; 1892, 4d.; 1893, 6d.; 1894, 6d.; 1895, 6d.; 1896, 6d.; 1899, 2d.; 1900, 2d.; 1901, 4d.; 1902, 4d.; 1903, 4d.; 1904, 2d; 1905, 2d.; 1906, 2d.; 1907, 2d.; 1909, 4d.; 1910, 2d.; 1911, 2d.; 1912, 6d.; 1913, 8d.; 1915, 6d.; 1916, 4d.; 1917, 6d.; 1918, 6d.; 1919, 6d.; 1920, 6d.; 1921, 2d.; 1922, 2d.; 1923, 2d.; 1924, 8d.; 1925, 2d.; 1926, 2d.; 1927, 6d.; 1928, 4d.; 1930, 6d.; 1934, 2d.; 1935, 6d.; 1936, 6d.; 1937, 2d.; 1938, 6d.; 1939, 2d.; 1940, 6d.; 1941, 4d.; 1942, 6d.; 1943, 2d.; 1944, 6d.; 1945, 8d.; 1946, 6d.; 1947, 6d.; 1948, 4d.; 1951, 6d.; 1952, 4d.; 1956, 8d.; 1960, 6d.; 1961, 2d.; 1962, 4d.; 1963, 2d.; 1965, 4d.; 1966, 6d.; 1967, 6d.; 1968, 6d.; 1969, 4d.; 1972, 6d.; 1973, 6d.; 1974, 8d.; 1975, 6d.; 1976, 2d.; 1979, 8d.; 1982, 6d.; 1983, 2d.; 1984, 6d.; 1987, 2d.; 1988, 6d.; 1990, 2d.; 1993, 6d.; 1995, 6d.; 1996, 2d.; 1997, 2d.; 1998, 6d.; 1999, 6d.; 2001, 2d.; 2003, 2d.; 2004, 2d.; 2006, 2d.; 2007, 6d.; 2011, 6d.; 2014, 4d.; 2016, 4d.; 2017, 4d.; 2018, 6d.; 2020, 2d.; 2021, 6d.; 2022, 2d.; 2034, 6d.; 2038, 6d.; 2041, 6d.; 2043, 2d.; 2048, 4d.; 2049, 6d.; 2057, 8d.; 2058, 6d.; 2216, 6d.; 2269, 6d.; 2429, 4d.; 2811, 6d.; 3048, 6d.; 3795, 6d.; 3905, 2d.; 3967, 4d.; 4039, 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.*

1458. Composition for Rendering Combustible Materials Uninflammable, *L. A. Groth, London.*—27*th March*, 1882.—(*A communication from H. R. P. Hosemann, Berlin.*) 4*d.*

This consists in the composition of an uninflammable starching, dressing, or painting material from chlorides, soluble glass, sulphate of soda, sulphate of ammonia, soapstone powder, and potato starch; or from chloride of calcium and soluble glass with starch.

1691. Connecting and Mounting Tobacco Pipes, &c., *W. Rest, London.*—6*th April*, 1882. 6*d.*

This relates to the employment of a hinge and spring catch to fasten the parts together.

1724. Colouring Matters for Dyeing, &c., *J. Erskine, Glasgow.*—12*th April*, 1882.—(*A communication from the Farbwerke vorm. Meister, Lucius, and Bruning, Hoechst-am-Main, Germany.*—(*Void.*) 2*d.*

This relates to the manufacture of colouring matters suitable for dyeing and printing from the acetylised aromatic amido acids or mixtures, which yield them by heating the said acids or mixtures with dehydrating agents.

1740. Stove, *A. Browne, London.*—12*th April*, 1882.—(*A communication from L. Bregha, Dresden.*) 6*d.*

The stove consists of three cylindrical chambers placed one within the other. The two inner chambers are in communication with each other for the passage of the heated gases from the fire.

1640. An Improved Dynamo-electric Machine, *R. Kennedy, Glasgow.*—4*th April*, 1882. 6*d.*

In Fig. 1, A A and B B are fixed magnets. The armature is formed of an inner ring, Fig. 2, of soft iron wire C wound continuously in one direction, and an outer coil D wound in a direction at right angles to that in which the inner coil is wound. D, although forming a continuous conductor, is constructed of short lengths, the ends of which are led off at intervals to the insulated segments of commutator, Fig. 1. The

1640

FIG. 1

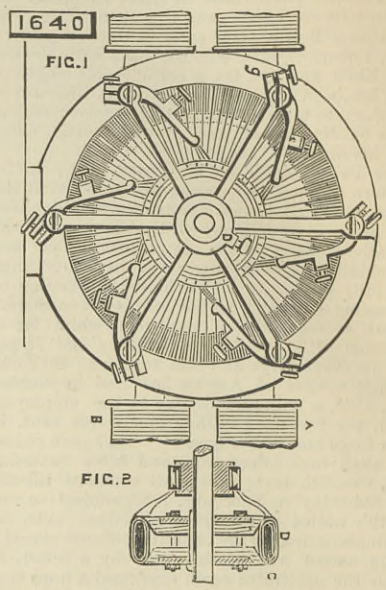


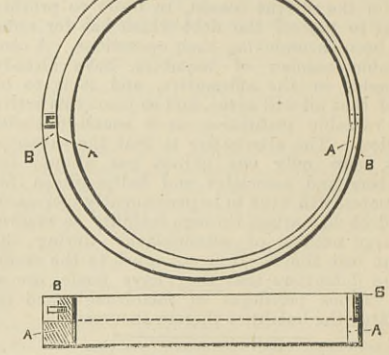
FIG. 2

inventor claims the arranging of the poles in equal numbers of pairs, so that the pairs above the armature are alike, and those below are alike, whereby, in the case of a dynamo similar to that illustrated, six poles are produced in the armature.

1735. Piston Packing Rings, &c., *A. A. Rickaby, Sunderland.*—12*th April*, 1882. 6*d.*

The drawings show a plan and section of a pair of packing rings made according to one method. A is an L-shaped ring having its outer diameter excentric to its inner diameter cut open at its thinnest part;

1735



B is a rectangular-shaped ring having its outer diameter excentric to its inner diameter resting on the ledge of the L-shaped ring A, cut open at its thickest part, and prevented from turning (except together) by a stud screwed into the ring A.

1773. Colouring Matters for Dyeing and Printing, *J. Erskine, Glasgow.*—14*th April*, 1882.—(*A communication from C. Rumpff, near Elberfeld, Germany.*)—(*Not proceeded with.*) 2*d.*

The nature of this invention consists in manufacturing colouring matters suitable for dyeing and printing by the reaction of the sulpho acids of diazo and diazo azo—or tetrazo—derivatives of the aromatic hydrocarbons, preferably in the form of the sodium salts or compounds of the sulpho acids on napthylamine alpha or beta in acid solution.

1787. Improvements in Dynamo-electric and Electro-dynamic Machines, *B. H. Antill, Lambeth.*—14*th April*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the generation of currents by the movement of coils of wire through magnetic fields without change of polarity or by the movement of magnetic fields of constant polarity relatively to coils of wire.

1794. Improvements in the Means or Apparatus for Generating Currents of Electricity, *E. L. Voice, Torrington-square.*—14*th April*, 1882. 10*d.*

This relates to the construction of dynamo or magneto-electric machines. The inventor claims: (1) the construction of ring armatures so as to form part of permanent or electro-magnets whose polarity is of opposite sign to the field magnets before which the armatures revolve; (2) causing such armatures to be under the direct inductive influence of such magnets; and (3) the combination of permanent or electro-magnets with annular grooved ring armatures, &c.

1806. Casing for Ships, Torpedo Boats, &c., *A. L. S. Leighs, Southwark.*—15*th April*, 1882. 4*d.*

The essential characteristics of this invention are the reducing or removing of the steel, or of the steel and iron, by grinding or otherwise, to expose the weld or the steel adjacent thereto, and the subsequent polishing and hardening of the surface.

1807. Preparing Fabrics for Bleaching and Dyeing, *S. Fulda, Bow.*—15*th April*, 1882. 2*d.*

The inventor claims, First, the method and means of effecting the first boil; Secondly, the method and means of fixing aniline and other colouring matters; Thirdly, the method and means of neutralising the chlorine gas without the aid of acids.

1809. Cooling and Preserving Food, *W. Keates, Lutton.*—15*th April*, 1882.—(*Not proceeded with.*) 2*d.*

The apparatus is divided into three chambers: First, for food; Secondly, for mixture of ice and salt; and, Thirdly, for sawdust, india-rubber, or other non-conducting substances.

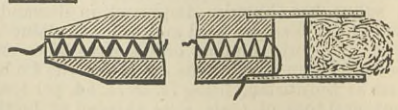
1818. Purifying Water for Steam Boilers, *L. Swift, Westminster.*—17*th April*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the employment of an apparatus which acts both as an injector and an ejector.

1822. Improvements in Electric Lamps, *A. S. Church, San Francisco, California.*—17*th April*, 1882.—(*A communication from J. B. King, Brooklyn, New York.*) 6*d.*

The object of the invention is to keep carbons clean when burning. The inventor combines with a hollow

1822



carbon a piece of moist sponge, through which atmospheric air may pass to the arc, and an electric conductor passing through the carbon, as shown in the figure

1823. REPEATING FIRE-ARMS, *S. P. Wilding, London.* 17*th April*, 1882. —(*A communication from F. Drevensted, Germany.*)—(*Not proceeded with.*) 2*d.*
The object is to effect, First, a form of revolving magazine to allow of a larger number of chambers and greater ease of withdrawal or change of the magazine; Secondly, a longer line of sight than is usually attained, and a fixed back sight as well as front sight; Thirdly, rotation of the magazine after firing, and not by its operation.

1838. PACKING FOR STEAM ENGINES, &c., *J. Bell, Liverpool, and R. Harper, London.*—18*th April*, 1882. 6*d.*
This consists in a mode of applying asbestos in combination with vulcanised india-rubber and suitable woven fibrous material.

1841. STRETCHERS FOR TROUSERS, &c., *T. H. Harris, London.*—18*th April*, 1882. 6*d.*
This consists essentially of a central rod screwed at one part, and provided with a suitable handle or equivalent to turn it by, preferably in the form of a loop so as to serve as a hanger.

1845. CONVEYING STEAM OR HOT WATER UNDERGROUND, *W. T. Whiteman, London.*—18*th April*, 1882.—(*A communication from the American Heating and Power Company, New York.*) 6*d.*
The object is to provide mains which may be tapped at any point, such points generally not being secured, so as to be immovable, or nearly so.

846. PLASTIC COMPOUNDS, *H. J. Haddan, London.*—18*th April*, 1882.—(*A communication from G. S. Evans, New York.*)—(*Not proceeded with.*) 2*d.*
The invention consists in treating caoutchouc and gum, such as gum kauri and gum manilla, with palm oil, cocoa-nut oil, or other non-siccative oil, and vulcanising the product.

1850. IMPROVEMENTS IN DESTROYING THE EFFECTS OF INDUCED CURRENTS, &c., *R. D. Smillie, Glasgow.*—18*th April*, 1882.—(*Not proceeded with.*) 2*d.*
The invention consists of a pair of coils surrounding an iron core applied at each end of a telephonic circuit, said coils being insulated from each other and the cores. A metallic circuit is used.

1852. PRESERVATION OF MEAT, *E. G. Brewer, London.*—18*th April*, 1882.—(*A communication from A. Lee, J. A. Wallace, and R. W. Knox, Victoria.*)—(*Complete.*) 6*d.*
This relates to improvements on the "Davies" process.

1853. IMPROVEMENTS IN TRANSMITTING AND RECEIVING APPARATUS FOR PRINTING TELEGRAPHS, *W. J. Burnside, Lower Norwood.*—18*th April*, 1882. 8*d.*
This relates to improvements on the ordinary step-by-step type wheel printing telegraphs, the step-by-step movements being controlled by a series of electrical pulsations, alternately of opposite polarity, transmitted from a sending station.

1854. DIRECT-ACTING RAM HYDRAULIC LIFTS, *J. S. Stevens and C. G. Major, Battersea.*—18*th April*, 1882. 6*d.*
The object is to dispense with all counterbalances, chains, weights, wheels, and overhead gear, and everything in a condition of suspension, and to balance the weight of cage and ram by hydraulic pressure, and subsequently to return the water so used for balancing purposes into the main or tank or accumulator.

1855. AUTOMATIC RAILWAY BRAKES, *F. C. Glaser, Berlin.*—18*th April*, 1882.—(*A communication from A. Klose, Switzerland.*—(*Not proceeded with.*) 4*d.*
This relates to a construction of automatic brakes for railways, whereby, First, the weight of the vehicle is caused to effect the application of the brakes; and Secondly, whereby the train in its normal condition, when standing or moving slowly, always has the brakes more or less applied.

1856. ADJUSTABLE CHAIRS OR SEATS, *H. J. Mohan and E. A. Girvin, San Francisco.*—18*th April*, 1882. —(*Not proceeded with.*) 2*d.*
The object is to provide seats which may fold automatically when not in use.

1859. VELOCIPEDES, *H. E. Newton, London.*—18*th April*, 1882.—(*A communication from A. Winkler, Paris.*) 6*d.*
This relates to a velocipede in which the driving power is obtained partly from the positions assumed by the rider, and partly from the rider touching the ground with his feet.

1860. APPARATUS FOR DRYING PIECE GOODS, *J. Worrall, Salford, and J. Kershaw, Halifax.*—18*th April*, 1882. 8*d.*
The inventors claim, First, the means for putting an elastic lateral tension upon travelling piece goods, and for removing the tension therefrom. Secondly, mounting the tenter pins of travelling chains upon transverse rods in such manner as to provide for the chains receiving a double load of fabrics, or fabrics on opposite sides of the transverse rods.

1861. PICKING ARMS AND PICKERS FOR LOOMS, *W. B. Birkby, Liversedge.*—18*th April*, 1882.—(*Not proceeded with.*) 2*d.*
This consists, First, in introducing one or more lengths of spring steel under a piece or between folds of buffalo hide or ordinary leather; and Secondly, in the construction of metal pickers.

1863. POCKET FILTER, *A. M. Clark, London.*—18*th April*, 1882.—(*A communication from L. L. T. F. d'Autemarche, Paris.*) 6*d.*
This relates to a filter which can be readily taken to pieces.

1864. TRANSMITTING MOTION, *A. M. Clark, London.*—18*th April*, 1882.—(*A communication from A. Samper, Paris.*) 6*d.*
This consists in the arrangement of an apparatus called an "adhesion device," and the mode of applying the same for the transmission of motion by means of cords and belts running on ordinary pulleys.

1866. PURIFICATION AND REFINING OF RAW SPIRITS, &c., *F. M. Lyte, London.*—19*th April*, 1882. 4*d.*
This relates to the employment of the peroxides of hydrogen, lead, barium, strontium, and calcium, for the refining, deflegmation, or purification of alcohols.

1867. IMPROVEMENTS IN ELECTRIC ARC LAMPS, *A. B. Brown, Edinburgh.*—19*th April*, 1882 6*d.*
The feed movement of the carbons is effected by the weight of a piston working in a cylinder and pressing on a liquid with controlled egress, as per patent No. 5272 (2nd Dec., 1881), granted to W. F. King and A. B Brown. The piston carries the upper carbon in a tubular holder, in which it (the carbon) is held by a gripping device, which only acts when being raised. When the current is passing all right this device is held up by the core of a solenoid, but when the carbons become too far apart the gripping device is released, and allows the upper carbon to descend into contact with the lower.

1869. STEAM BOILERS, *J. Fox, Dewsbury.*—19*th April*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to the use of a coiled or curved pipe for upplying heated air to the furnace.

1871. FOUNTAIN PEN-HOLDERS, *H. J. Haddan, Kensington*—19*th April*, 1882.—(*A communication from H. Burckas, Leipzig.*)—(*Not proceeded with.*) 2*d.*
This relates partly to the use of an air valve.

1873. APPARATUS FOR SWEEPING CHIMNEYS AND FLUES, *H. Fokes, Pimlico.*—19*th April*, 1882.—(*Not proceeded with.*) 2*d.*
The object is to construct an apparatus that can be easily applied to existing chimneys and cowls, and to remain there so as to be always ready for use.

1872. SLIDE VALVES AND EXPANSION GEAR OF STEAM ENGINES, *E. Edwards, London.*—19*th April*, 1882.—(*A communication from E. Sonntag, Germany.*) 6*d.*
The objects are, First, improvements in the method of arranging steam passages and valves by which the slide valve is actuated, so that the latter operates with great regularity and efficiency; and, Secondly, improved methods of constructing and arranging apparatus by which the steam admitted to such slide valve is made to work expansively as desired.

1874. PRODUCTION OF GAS BY COMBUSTION OF CARBON COMPOUNDS, &c., *W. C. Brown, Sheffield.*—19*th April*, 1882. 1*s.* 3*d.*
The object of this invention is the production of a cheap carbon-monoxide to be evolved without the aid of atmospheric air, and the application thereof.

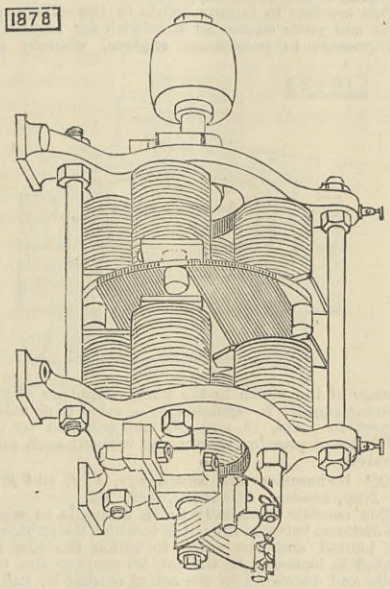
1875. SECONDARY BATTERIES, *D. G. Fitzgerald, Brixton, and C. H. W. Biggs, and W. W. Beaumont, Strand.*—19*th April*, 1882. 6*d.*
Lead crystals are obtained by electrolysis, or finely divided lead is obtained by mechanical methods and compressed, or compressed about a ramifying tang of lead wire or sheet lead cut into various shapes.

1876. STEREOTYPE PLATES, &c., for PRINTING, *W. R. Lake, London.*—19*th April*, 1882.—(*A communication from J. A. Heuse and G. Jouanny, Paris.*—(*Not proceeded with.*) 2*d.*
The invention consists essentially in preparing the stereotype plates by providing them with a series of parallel grooves.

1877. ROLLS FOR GRINDING MILLS, *W. P. Thompson, Liverpool.*—19*th April*, 1882.—(*A communication from R. Birkholz and E. P. Allis, Milwaukee, U.S.*) 6*d.*
The invention consists in providing the ends of the roll with bevelled or inclined faces, and combining therewith correspondingly recessed end plates, or collars and tie rods, or equivalent devices for forcing the plates against the ends of the body with such pressure that the body will be rotated by the friction, and without the necessity for employing interlocking lugs and notches as usual.

1878. IMPROVEMENTS IN DYNAMO-ELECTRIC MACHINES, *J. H. Johnson, Lincoln's-inn-fields.*—19*th April*, 1882.—(*A communication from J. M. A. Gérard-Lescuyer, Paris.*) 6*d.*
This relates to a novel method of coiling the wire on

1878



the revolving armature, and other improvements. The machine is illustrated herewith.

1880. AUTOMATICALLY TRANSMITTING AND STOPPING MOTION, &c., *P. Pfleiderer, London.*—19*th April*, 1882. —(*A communication from W. Kankelwitz, Stuttgart.*) 6*d.*
The invention consists partly in arranging, connecting, and combining with the shaft intended to be driven, a driving pulley, toothed wheel, or driving handle, by means of a pawl gearing as required into a ratchet wheel fixed on the said shaft, such pawl being automatically put or thrown into and out of gear.

1882. TIGHTENING UP AND STRAINING WIRE MATTRESSES AND BED-BOTTOMS, *E. Hoskins, Birmingham.*—19*th April*, 1882. 6*d.*
This relates, First, to mechanism for tightening up and straining wire and other mattresses or bed bottoms; Secondly, to improvements in the construction of ships' berths.

1883. MACHINERY FOR PRINTING ON BOTH SIDES OF A MOVING WEB, &c., *W. Conquest, London.* —19*th April*, 1882.—(*A communication from R. Hoe and Co., New York.*) 1*s.* 6*d.*
This consists partly in the arrangement of mechanism for producing from one or more webs of paper folio or four page folded sheets of printed matter in columns lying transversely of the web, with or without a supplement "inset."

1884. IMPROVED METHODS OR PROCESSES OF SEPARATING METALS, &c., FROM THEIR ORES, *W. R. Lake, London.*—19*th April*, 1882.—(*A communication from E. Marchese, Turin, Italy.*) 4*d.*
This invention is based on the employment as an electrode of the ore to be treated, and upon the oxidising or reductive action exerted upon the electrodes by the components of an electrolyte, which is decomposed by the electric current. Three different processes are described.

1888. MARINE ENGINES, *J. F. and M. Rankin, Greenock, N.B.*—20*th April*, 1882. 1*s.*
This relates principally to marine engines having four steam cylinders, and has for its object the arranging or combining of these cylinders and other parts of the engines so that whilst under ordinary circumstances the four cylinders work together as one compound engine with triple or quadruple expansion, they are capable of being disconnected in such manner that two of the cylinders may operate independently of the other two.

1889. CASK TILTERS, *B. Howell, Chester, and W. Clancey and J. C. Walker, Lancaster.*—20*th April*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to the employment of a spiral spring.

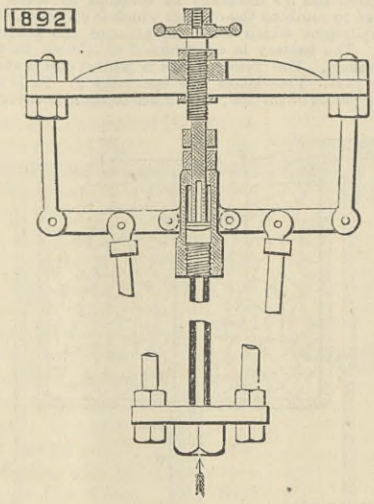
1890. EYE FOR HOLDING STAIR CARPET AND OTHER RODS, *F. Kingston, Deptford.*—20*th April*, 1882. 4*d.*
The inventor claims the manufacture and use of eyes for holding carpet and other rods, fixed in position by points or chisel edges projecting from their limbs.

1893. ACTUATING MACHINERY OR APPARATUS FOR CULTIVATING LAND, *M. R. Pryor, Herts.*—20*th April*, 1882. 6*d.*
This consists essentially in the employment of an electro-motor, in such manner that the conductors shall be supported, paid out, and wound up, so as not to be subjected to material injury by being dragged along the ground by the machine in the course of cultivation.

1894. SPINNING SILK, &c., *W. R. Lake, London.*—20*th April*, 1882.—(*A communication from Messrs. L. Martin and Co., Lyons.*) 6*d.*
This relates to methods of spinning or twisting silk and other materials by means of friction, designed for either winding threads or fibres of silk around any kind of textile thread by a movement of rotation imparting a twist to the latter, or obtaining directly threads of silk with the twist necessary for the weft or the first spinning of the warp or chain.

1892. STEAM TRAPS, *J. Shaw, near Huddersfield.*—20*th April*, 1882. 4*d.*
The object is to utilise the expansive properties of metal to greater advantage than has hitherto been done. A pipe is employed formed of copper or other expansible metal, in one end of which is formed the valve casing. On each side of the valve casing are attached levers, which are connected by rods to the opposite end of the expansible pipe. The ends of the levers are also connected by short rods to a crosshead, through which the valve spindle is screwed. The valve spindle passes freely through the casing, not screwing into the same in the usual manner, and the

1892



result of this combination of apparatus is that as the steam piping expands the rods which are placed in a direction parallel, or nearly parallel, with the said pipe, operate on the levers attached outside the valve casing, and being placed nearer to the fulcrum than the rods which connect them to the crosshead, the expansive power is multiplied, so that the least degree of expansion in the pipe operates very sensibly upon the valve.

1895. IMPROVEMENTS IN AND CONNECTED WITH ELECTRIC LIGHTING AND INCANDESCENT LAMPS, *P. M. Justice, Southampton-buildings.*—20*th April*, 1882. —(*A communication from A. Cruto, Piossasco, Italy.*) 6*d.*
This relates to the manufacture of incandescent lamps. One method of the inventor's for making his carbons is as follows:—He takes a fine platinum wire held by small clamps and places it in a glass tube, through which is passed some gas, such as carburetted hydrogen. The wire is then heated by a current, and the carbon deposited on it from the gas. After this the wire is volatilised. To attach the carbon to the platinum conductors, the ends are enlarged by electro-typing with copper. The two carbon ends and the two wire ends are then placed in clamps in contact with each other, in circuit with a battery, so that on closing the circuit the two ends are heated and soldered to each other. The ends are again coated with copper in a bath, and the carbon, &c., placed in sealed glass globes. The inventor also describes a method of exhausting such globes and an apparatus for regulating the current supplied to lamps, which are illustrated in the specification.

1896. IMPROVEMENTS IN TELEPHONIC AND TELEGRAPHIC SIGNALLING APPARATUS, *A. C. Brown and H. A. C. Saunders, Old Broad-street.*—20*th April*, 1882. 6*d.*
This relates to improvements by which a number of stations connected by one line wire can communicate with any other without the remaining stations being able to overhear or interrupt. The improvements relate more particularly to the inventors' patent No. 2995 (1881), and consist in certain alterations of the mechanical parts of their apparatus, a prolonged contact key and contacts, &c.

1899. SCREW PROPELLERS, *T. Lambert, Plymouth.*—21*st April*, 1882.—(*Not proceeded with.*) 2*d.*
This consists in increasing the pitch of the blade as it nears the boss.

1900. HOOPS FOR BARRELS, &c., *T. Nash and G. H. Brewer, Sheffield.*—21*st April*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to the means of jointing the ends of the lengths of iron to form the hoops.

1901. IMPROVEMENTS IN VOLTAIC BATTERIES, *A. P. Bennett, Glasgow.*—21*st April*, 1882. 4*d.*
The object of this invention is the production of a cheap and effective battery composed as follows:—Negative electrode, iron or steel, &c., with a packing of fragments of same metal. These are placed in a solution of potassium monoxide, or similar solution. The positive portion is formed as described in the inventor's patent, 302, 1882.

1902. ASH GUARDS, *W. Selley, Manchester.*—21*st April*, 1882. 4*d.*
This consists in the combination with an ash guard or screen of an adjustable toast stand, bread toaster, cooking apparatus, and smoothing iron heater.

1903. DEPOSITING MANURE, &c., *T. Reid, Monkton Miln, N.B.*—21*st April*, 1882.—(*Not proceeded with.*) 4*d.*
This relates to improvements in the general construction of machinery for depositing manure, planting potatoes, sowing seed, raising roots, &c.

1904. CALENDERING MACHINES, *C. D. Abel, London.*—21*st April*, 1882.—(*A communication from C. M. Chivolla's Söhne, Vienna.*)—(*Not proceeded with.*) 2*d.*
This relates to improvements in friction calendering machines.

1905. COLOURING MATTERS, *J. A. Dixon, Glasgow.*—21*st April*, 1882. —(*A communication from C. Rumpff, Germany.*)—(*Not proceeded with.*) 2*d.*
This consists in manufacturing colouring matters suitable for dyeing and printing, by the reaction of the sulpho acids of diazo and diazo azo or tetrazo derivatives of the aromatic hydrocarbons, preferably in the form of sodium salts or compounds of the said sulpho acids in naphthylamine, alpha or beta, in acid solution, or any of the sulpho acids of napthylamine, alpha or beta, in acid solution.

1906. SEWING MACHINES, *H. Simons, Manchester.*—21*st April*, 1882.—(*A communication from F. B. Köhler, Chemnitz.*)—(*Not proceeded with.*) 2*d.*
This relates to the construction of sewing machines for producing ornamental stitching by means of two or more needles.

1907. FIRE-ESCAPES, *T. H. Pinder, Exeter.*—21*st April*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to a folding ladder.

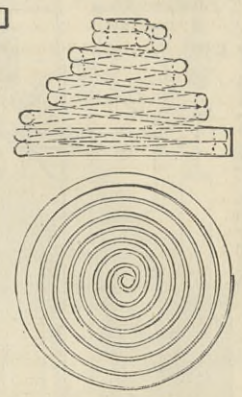
1909. EXTRACT OF ESSENCE OF MALT, *T. Dence and J. J. Mason, London.*—21*st April*, 1882. 4*d.*
The inventors claim the manufacture of concentrated extract or essence of malt from the malt liquor by an improved method, the essential feature of which is the rapid evaporation of the liquor.

1910. GAS ENGINES, *S. Skinner, Eastbourne.*—21*st April*, 1882.—(*Not proceeded with.*) 2*d.*
The invention consists in connecting with the explosion chamber of the engine an air reservoir containing air compressed to a given pressure, the connection between the engine and the reservoir being formed by a cylinder containing an air-tight piston or disc.

1911. TRICYCLES, &c., *J. G. Harrison, Birmingham.*—21*st April*, 1882.—(*Not proceeded with.*) 2*d.*
The object is to make tricycles and other velocipedes collapsible.

1912. SPRINGS, *W. Buckley, Sheffield.*—21*st April* 1882. 6*d.*
This consists in the production or manufacture of a compound spring, composed of two, three, or more wires or rods made of metal or suitable metallic

1912



material, and its application and use for any and every purpose where metallic springs are or can be employed. The drawings show an arrangement of single conical double-lapped springs

1913. TREATMENT OF ORES, &c., *A. M. Clark, London.*—21*st April*, 1882.—(*A communication from A. M. G. Sébillot, Paris.*) 8*d.*
This relates to a process and apparatus for effecting the complete disintegration of minerals in order to separate any metals contained in the ore, and the process consists mainly in a new method of treatment with sulphuric acid.

1915. IMPROVEMENTS IN ELECTRIC LAMPS, *W. T. Whiteman, Staple-inn, Middlesex.*—22*nd April*, 1882.—(*A communication from M. Bauer and Co., Paris.*) 6*d.*
This relates to improvements on a patent granted to H. J. Haddan, No. 2038, 10th May, 1881. The inventor claims the arrangement of the oscillatory horseshoe electro-magnet shown in Figs. 1 and 2—Fig. 1 is a full-size plan, and Fig. 2 an elevation, partly in section—one pole of which is in juxtaposition to, or in contact with, the iron rod carrying one of the carbons, and the other pole of which is in contact with a magnetic brake and in proximity to a fixed block of iron, the attraction between which block and the magnet tends to separate the carbons or to oppose

1915 FIG. 2.

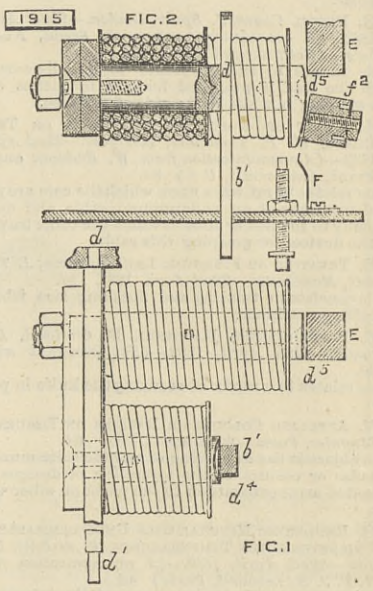


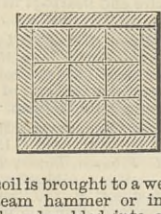
FIG. 1

their approach towards each other. The inventor also claims the magnetic brake, consisting of a block of iron and a piece of non-magnetic metal secured together. The two carbon rods are connected by pulleys and cords so as to move simultaneously. In the Fig. b^1 is the upper carbon rod, d^4 are coverings of brass, d^1 are pivots on which D horseshoe electro-magnet turns. b^1 is held with greatest force when the magnet is in a horizontal position, and with gradually decreasing force as the magnet is turned on its pivots. F is a strip of non-magnetic metal secured to lamp case, f^2 block of iron, a^5 pole of magnet; E is a block of iron.

1916. COMBINATION OF SUBSTANCES FOR THE MANUFACTURE OF BRICKS, &c., *T. A. Riggs, Aldeburgh.*—22*nd April*, 1882. 4*d.*
The object is to utilise coralline craig in the manufacture of bricks, &c.

1917. TIRES, *G. W. Knox, Sheffield.*—22*nd April*, 1882. 6*d.*
The drawing shows a box pile, the interior of which is composed of pieces of steel of suitable size and shape arranged in squares or otherwise, and the exterior iron plates; the pile is heated to a welding heat and rolled down to a bar in the ordinary rolling mill. A coil is made in the ordinary coiling machine from the

1917

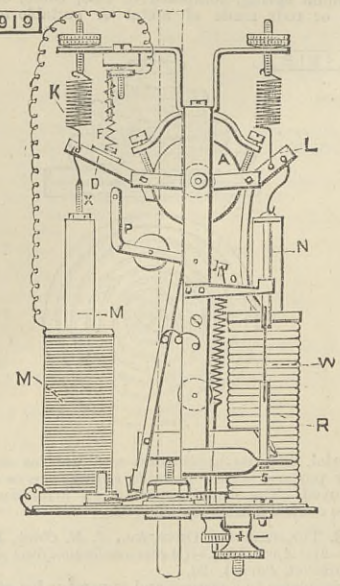


rolled bar, and the coil is brought to a welding heat and placed under a steam hammer or in a press, and thereby compressed and welded into a solid annular mass in the form of a tire blank. This tire blank is then rolled into a tire of the required section and size in an ordinary rolling mill.

1918. MANUFACTURE OF WATER GAS, *J. C. Mewburn, London.*—22*nd April*, 1882.—(*A communication from G. S. Dwight, New York.*) 6*d.*
This relates principally to improvements in the general construction of the furnace.

1919. IMPROVEMENTS IN ELECTRIC ARC LAMPS, *J. Lea, Regent's Park.*—22*nd April*, 1882. 6*d.*
The object of this invention is to ensure better regulation of the carbons, and to enable long carbons to be used, so as to burn for a long time. Referring to the illustration, the action of the lamp is as follows:—When to be lighted, and should the carbons be apart, the current enters at the positive terminal and traversing shunt coil M pulls core M^1 until gripping lever D comes against stud X on arm P, and displacing the jockey roller, causes the upper carbon to make contact with the lower. The current then passing by thick wire solenoid W, the core of the shunt coil is drawn back by spring K, the core N is brought down upon the piece of iron S; arm R displaces gripping lever L, after turning roller A in the proper direction, and the arc is formed. As the arc becomes longer,

more current passes by the shunt pulling down core M¹ gradually until contact between F and D is



broken, when the greater resistance thrown in allows spring K to pull back gripping lever D ready for the next feed.

1920. Boilers and Heating Apparatus, *J. Keith, Edinburgh.*—22*nd April*, 1882. 6*d.*
This relates to improvements in sectional boilers and heating apparatus in which water is heated, or hot water or steam is caused to circulate, for the purpose of heating buildings, &c.

1921. Mordant, *S. Musgrave, Leeds.*—22*nd April*, 1882. 2*d.*
This consists of a mordant composed of oxalic acid, 3 lb.; alum, 12 lb.; bi-chromate of potash, 4 lb.; and white argol, 3 lb.

1922. Lawn Edge Clipping Machines, *A. Ridgway, Macclesfield.*—22*nd April*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to the employment of a rotary circular steel disc.

1923. Pencil Cases, *J. Spear, London.*—22*nd April*, 1882.—(*A communication from G. Benda, Nuernberg.*—(*Not proceeded with.*) 2*d.*
This relates to improvements in pencil-cases in which the lead is propelled forward by means of a slide working in a slot in the side of the case.

1924. Chain or Rope Traction Rail or Tram Roads, *W. P. Thompson, Liverpool.*—22*nd April*, 1882.—(*A communication from W. Haddock and J. Frank, Cincinnatti, U.S.*) 8*d.*
This relates to railways upon which the cars are propelled by means of an underground cable, and more especially to the box or tube in which the cable travels, and the devices for grasping this cable.

1925. Treating or Finishing Lace Fabrics, *J. Tuffnell, Manchester.*—22*nd April*, 1882. 2*d.*
This consists in treating and finishing lace fabrics by beetling machines.

1926. Paper-cutting Machines, *W. Crosland, Lancaster.*—22*nd April*, 1882.—(*Not proceeded with.*) 2*d.*
This relates to a mode of securing the knife in position.

1927. Applying Colours or Designs on Tissues, *J. Mugnier, Paris.*—22*nd April*, 1882. 6*d.*
The object is the depositing of an indefinite number of shades or colours, or the formation of designs or variegated arrangements on tissue paper or other surfaces.

1928. Rendering Mineral Oils Uninflammable at Pre-determined Temperatures, *E. de Pass, London*—22*nd April*, 1882.—(*A communication from G. P. J. N. Labouret, Paris.*) 4*d.*
This consists partly in the process of obtaining from all the products of mineral oils, especially those of petroleum, oils free from admixtures, and in an uninflammable condition, by treating the said oils by means of aqueous vapour or steam in divided jets agitating the oil.

1930. Apparatus for Exhibiting Advertisements, &c., on Tram-cars, Omnibuses, &., *F. H. F. Engel, Hamburg.*—22*nd April*, 1882.—(*A communication from G. Richter, Germany.*) 6*d.*
This relates to the construction of revolving discs or rings on top of tram-cars, &c., driven by gearing from the axles or wheels of the vehicles.

1934. Bushing Material, Journal and other Bearings, *W. R. Lake, London.*—22*nd April*, 1882.—(*A communication from G. F. Senter, New York.*)—(*Not proceeded with.*) 2*d.*
This relates to the employment of a mixture of talc and plumbago.

1935. Plumbers' Furnaces where Liquid Fuel is Used, *W. S. Cooper, Philadelphia.*—24*th April*, 1882. 6*d.*
The chief object is to provide a portable furnace for melting lead, tin, Babbet metal, or other easily fusible metal, and for heating plumbers' irons, &c.

1936. Hutches or Wagons, *J. McCulloch and W. Cook, Glasgow.*—24*th April*, 1882. 6*d.*
This relates to the construction of the buffers and of the oil reservoirs and bearings in combination with a tubular framing or "trams."

1937. Drawing Pens, *C. D. Abel, London.*—24*th April*, 1882.—(*A communication from Messrs. E. O. Richter and Co., Chemnitz.*)—(*Not proceeded with.*) 2*d.*
The pens are constructed out of steel tubes, or of sheet metal bent into tubular form.

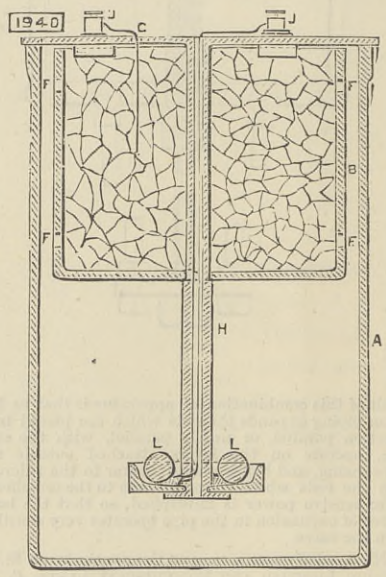
1938. Centrifugal Separating Machines, *F. H. F. Engel, Hamburg.*—24*th April*, 1882.—(*A communication from H. Petersen, Hamburg.*) 6*d.*
This consists in the combination of a centrifugal drum or drums fastened to the free end or ends of a horizontal shaft or axle, with one or more ring-shaped gutters attached to the outer or inner wall of the drum or drums communicating with one or more different layers of the liquid contained in the drum or drums whilst rotating, together with cutters and a cover.

1939. Metal Rollers used in Coating Steel and Iron Plates with Tin, &c., *D. Davies, Crumlin.*—24*th April*, 1882.—(*Not proceeded with.*) 2*d.*
The object is to reduce the weight of such rollers without reducing their diameter, and it consists in making them hollow, of a uniform section of metal throughout, and reduced at the ends to form bearings.

1941. Crystallised Hydrochlorate of Alumina, *W. R. Lake, London.*—24*th April*, 1882.—(*A communication from T. Gladysz, Marseilles.*) 4*d.*
This consists, First, in the preparation of crystallised hydrochlorate of alumina by the action of hydrochloric gas in a hydrochloric solution of alumina; Secondly, the concentration of hydrochlorate of alumina in aqueous solutions without decomposition by effecting the evaporation under a lower pressure than that of the atmosphere; Thirdly, in the methods of carrying out the invention.

1942. Fastenings for Gloves, &c., *W. Bown, Birmingham.*—24*th April*, 1882. 6*d.*
A small plate is fixed to one side of the glove, and in it slides a slotted or corrugated bar operated by an arrangement of teeth on the end of a hinged piece, the other end of which has a catch to take into a recessed projection on the end of the sliding bar.

1940. Improvements in and Relating to Electric Batteries, *W. R. Lake, London.*—24*th April*, 1882.—(*A communication from L. Maiche, Paris.*) 6*d.*
The object of this invention is to provide a battery in which the air naturally in solution in water is utilised to combine the oxygen which it contains with the hydrogen which tends to polarise the positive plate. The battery is constructed as shown in the illustration. The vessel A has a porous cup B at its upper part. This latter has apertures F. In B are placed pieces of carbon; B is fixed to ebonite cover G



by means of ebonite tube H. A small porcelain cup is fixed to bottom of H. Terminal J has a platinum wire attached, which passes down and is fixed by torsion to one of the pieces of carbon; another platinum wire is attached to terminal J¹ and passes through H to bottom of porcelain cup. At the bottom of this cup a small quantity of mercury is placed, which covers the wire, and on this mercury are placed pieces of zinc L.

1943. Taps, *E. C. Sutcliffe, Halifax.*—24*th April*, 1882.—(*Not proceeded with.*) 2*d.*
The tap has four water ways, two valves and one check valve, the water ways serving for the supply from main, one leading to the boiler, and one from the boiler to the baths, &c.

1944. Raising, Transporting, Lowering or Depositing Ships, &c., *W. L. Wise, Westminster.*—24*th April*, 1882.—(*A communication from A. Westerman, Genoa.*) 6*d.*
This consists in the use of pontoons capable of being immersed and connected by removable cross girders, the pontoons being also provided with hydraulic apparatus for raising and lowering the cross girders.

1945. Improvements in the Arrangement of, and in the Mechanism for Telephonic Alarms, &c., *W. M. Brown, London.*—25*th April*, 1882.—(*A communication from J. F. Kettell, Worcester, Mass., U.S.A.*) 8*d.*
This invention relates to that class of telephone alarms known as "individual calls," the object of which is to enable the central office to ring the alarm of one subscriber without ringing the others on same circuit.

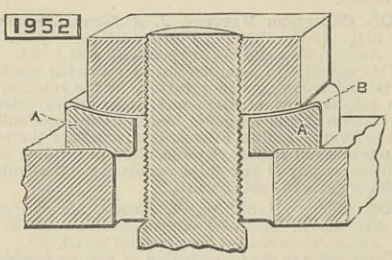
1946. Secondary Batteries, *C. V. Boys, near Oakham.*—25*th April*, 1882. 6*d.*
Compresses finely divided lead which has been covered with mercury, or finely divided lead which has not been so covered.

1947. Manufacture of Coke, *J. Jameson, Newcastle-on-Tyne.*—25*th April*, 1882. 6*d.*
This relates to the method of producing hard coke without losing the products of distillation, and it consists in extracting the gaseous products of distillation at the bottom of the oven wherein the charge is ignited and burned, and also in passing hydrocarbon gas, vapour, or fluid through the incandescent charge.

1948. Converting Liquid into Spray, *L. H. Armour, Gateshead.*—25*th April*, 1882. 4*d.*
This consists essentially in the use of rapidly-rotating discs for the production of spray.

1951. Hooping Casks, &c., *A. J. Boult, London.*—25*th April*, 1882.—(*A communication from M. E. Beasley, Philadelphia.*) 6*d.*
This relates to machines for hooping casks, and it consists in mounting on a bed-plate a truck with adjustable V-saddles to hold the cask and present it to the operating parts of the machine. Two heads are fitted at the two ends and can slide to or from each other, and are fitted with a series of adjustable jaws carrying claws with shoulders to bear against the hoops and force them on or remove them from the cask.

1952. Nut Lock, *H. J. Haddan, Kensington.*—25*th April*, 1882.—(*A communication from W. Courtenay, New York.*) 4*d.*
The inventor claims a compound washer, having a body A of fibre, and upon one side only of the body



A a flanged cap B secured to it by pinching or crimping or otherwise.

1956. Improvements in Electric Batteries, &c., *J. T. Handford, Southampton-buildings.*—25*th April*, 1882.—(*A communication from Benoit Jarriant, Paris.*) 8*d.*
This relates to improvements on Grenet's batteries working with bichromate of potash and injection of air, so as to render them useful for lighting purposes. This the inventor proposes to do by combining with the cells tilting distributors for intermittently supplying a definite quantity of liquid to each cell, mercurial contacts for the copper and zinc at the negative electrodes, devices for emptying the cells, and a compressor and gas engine for supplying air under pressure for agitating the liquid. The inventor also claims the use of bichromate of soda for the production of the exciting liquid.

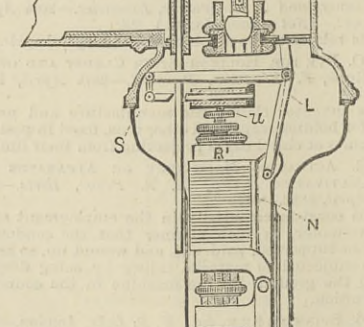
1960. Clock Movements, *H. H. Lake, London.*—25*th April*, 1882.—(*A communication from F. A. Lane, New Haven, U.S.*) 6*d.*
This relates to the adaptation of the "marine movement" to clock movements designed for very small cases.

1963. Surgical Splints or Supports, &c., *H. Hides, Uxbridge-road.*—25*th April*, 1882.—(*A communication from E. Porteus, Antwerp.*)—(*Not proceeded with.*) 2*d.*
This consists in the use of splints or supports made of sheets of fibrous material composed of woollen or other fibres, felted, pulped, or otherwise formed into sheets. The sheets when desired to be used are soaked in hot water containing salicylic acid, and are then bent to the desired shape and dried, saturated with gums, and perforated. Ambulance sheets so moulded are connected to the poles by bands of elastic material.

1982. Removable Repeating Cartridge Magazines, *G. E. Vaughan, London.*—27*th April*, 1882.—(*A communication from J. Werndl, Austria.*) 6*d.*
This relates to improvements on patent No. 712, A.D. 1882, and it consists, First, in an arrangement whereby the repeating magazine, even when in position on the rifle, can be refilled at any time with cartridges; Secondly, in an arrangement which permits the magazines filled with cartridges to be carried without the necessity of a covering for the mouth or opening; Thirdly, in an improved magazine spring formed of single spring bows, each pair of which are united at the centre by means of rivets, and at their free ends by rings or other similar contrivances.

1983. Gearing for Actuating Slide Valves, &c., *A. W. Cooper, Dundee.*—27*th April*, 1882.—(*Not proceeded with.*) 2*d.*
The object is to reduce the number of working parts in marine and other motive power engines, and also to effect a more compact and accessible placing of the parts. An intermediate shaft is carried in bearings parallel to the crank shaft, and rotated by cranks on the two shafts coupled by rods, and from the intermediate shaft the valves are driven by excentric.

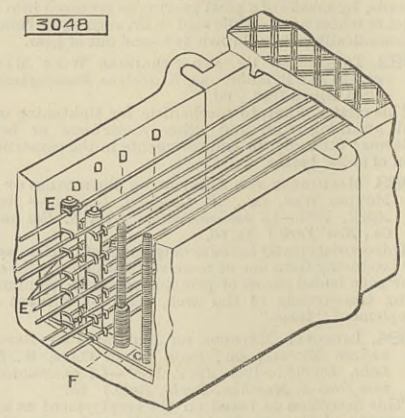
1988. Valve Apparatus for Regulating the Passage to Pulsometer Engines, *E. H. Greeven, London.*—27*th April*, 1882.—(*A communication from G. A. Greeven, near Cologne*) 6*d.*
This consists in improvements in the valve apparatus and parts connected therewith for regulating the passage to pulsometer engines, whereby the



passage of the steam to the pump chambers of pulsometer engines is regulated by a valve C or valves formed in parts, C¹ and C², and actuated by the difference of pressure within and without such valve or valves.

1993. Umbrellas and Sunshades, *J. T. and F. S. Liley, London.*—27*th April*, 1882. 6*d.*
This consists essentially in an umbrella in which the distance between the notch to which the stretchers are jointed and the notch to which the ribs are jointed is increased in the act of opening the umbrella and decreased in the act of closing it, and in which the movable notch is acted on by a spring in such manner as to open the umbrella.

3048. Improvements in Insulating and Protecting Telegraph Wires, &c., *G. M. Cruikshank, Glasgow.*—28*th June*, 1882.—(*A communication from W. E. Banta, Springfield, Ohio, U.S.A.*) 6*d.*
The invention is sufficiently explained by the accompanying illustration. In a trough is placed a base plate C, supporting posts D, the latter being



brass or non-magnetic metal. On the posts glass spools E and washers F are fitted. Each spool has a circumferential groove for a fine wire, by which the telegraph wires are held.

3795. Improvements in Electric Lamps, &c., *W. R. Lake, London.*—9*th August*, 1882.—(*A communication from J. B. Wallace, Ansonia, Conn., U.S.A.*) 6*d.*
This invention relates to a protector or shade for the lamp which prevents the circulation of air round the

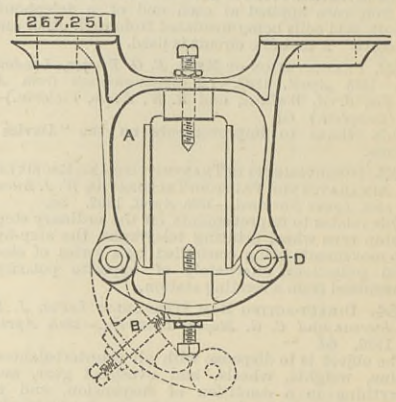
carbons, and also to certain improvements in mechanism, which are shown in the illustration herewith. The rod I is extended upwards and curves over at the top in ∩-shape to support the upper carbon. When the circuit is closed and armature N is in contact with pole R¹, the arm L is raised, and the clutch with the rod which it holds is raised enough to strike the arc. When the circuit is broken the weight of I operating on the armature through the clutch and the bell crank lever, turns the armature upon its pivot away from its pole, the clutch descending with the rod until the body comes in contact with set screw U, then the hinged end of S of the clutch continues its descent with arm L of lever until the armature is fully thrown back. This last movement turns the jaws out of their grasp on the rod. Rod I then drops until the carbons coming into contact complete the circuit.

3644. Indicating the Presence in Mines of Fire-damp, *J. Kitsee, Cincinnati, U.S.*—1*st August*, 1882.—(*Complete.*) 6*d.*
This relates to a means for indicating the presence of fire-damp in a mine in dangerous volume, at a point or station distant from the point where such fire-damp exists by the ignition or combustion of fire-damp closing a normally broken electric circuit to actuate suitable signalling devices.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

267,251. Hanger for Shafting, *R. Pryibil, New York, and E. D. Mackintosh, Brooklyn, N.Y.*—*Filed August 26th*, 1882.
Claim.—(1) The combination, with the main portion or body of a hanger adapted to receive within it an adjustable bearing, of a yoke which is to support the bearing, forming the lower part of the hanger and hinged to the main portion or body at the bottom, so that it may be dropped or allowed to swing downward as desired, substantially as and for the purpose described. (2) The combination, with the upper part or body of a hanger and a yoke forming the lower



portion of the hanger, both provided with matching lugs, ears or bearers, of bolts inserted transversely through the said lugs, ears, or bearers, and either of which may be removed to allow said yoke to swing downward on the other bolt, substantially as and for the purpose specified. (3) The combination of the hanger A and yoke B, provided with the pairs of lugs, ears, or bearers, having male and female conical faces, which engage with each other, and the bolt D, all substantially as and for the purpose specified.

CONTENTS.