ANCIENT COUNTERPARTS TO MODERN INVENTIONS.

The statement that Henry VIII. possessed a breech-loader on the Snider system, Mark II., and also a muzzle-loading rifle; that the Spanish Armada carried wrought iron breech-loading guns fixed on pivots, with all recoil checked, like Krupp's pivot guns; and that Marshal Vauban had a breech-loading small-arm whose breech closed with an interrupted screw, would probably be treated as statements containing some double meaning or altogether made in joke. Nevertheless we propose to show how very nearly these are sober facts. The pieces themselves, with innumerable other curiosities in artillery, are open to public inspection in the Rotunda Museum on Woolwich Common. The pieces are well arranged and catalogued, thanks chiefly to Sir H. Lefroy, K.C.B. We propose from them to give some illustrations of modern ideas forestalled in ancient times; but before doing so we would strongly protest against the use to which such anticipations are apt to be put. We hold that if a successful invention has established its reputation, it is a most unjustifiable thing to dig out of some obscure corner in a museum some thing that in a measure has the same idea embodied in it, and treat the unfortunate inventor as a sort of pirate by confronting him with a design that he never had seen or heard of—of which the worth was perhaps never suspected until worked out to a successful issue by the modern inventor. While, however, in no way detracting from the credit of inventors of our time, we cannot fail to see that in very many instances designs subsequently successful have been fairly worked out hundreds of years ago and allowed to drop into disuse. How is this to be accounted for?

We think it is due to the deficiency of machinery and of means of reproduction. A design might be worked out formerly by a skilful mechanic which, although rough to modern eyes, answered fairly well; but the idea of manufacturing the same article by the thousand seemed wild unless the pattern was very simple. With ordnance also we think that the difficulty was aggravated by the comparative ease with which powder was improved. The half-developed breech-loaders with bad, rough joints, for example, would manifest such faults that simple sound muzzle-loaders would be far preferable. The rough wrought iron guns made of hoops and staves would in the same way give place to those of cast metal. Then the real powers of rapidity of a Snider or a Colt's revolver action might be masked by the imperfection of the old-fashioned lock used in connection with them. It is easy to see how designs might remain in the stage of ingenious curiosities until they ceased to attract attention two hundred years ago—designs which would in the present day quickly assert their superiority because they would be well and easily manufactured. Apparently our ancestors had as much ingenuity as ourselves, though circumstances were unfavourable to their success. It is interesting then to trace out the representatives of many of our best modern designs, while we, at the same time, distinctly repudiate the idea that the existence of the old ones detracts from the claims of the new, unless it can be shown that they were actually copied from them. This, we hold, with perhaps rare exceptions, is out of the question; and even were it not so, considerable credit still attaches to the man who can seize what is good in a collection of obsolete arms. To come then to actual designs.

We will first take the question of metal and its structural arrangement. Fig. 1 exhibits a remarkable group of guns. They are classed together in the Rotunda Museum, but by the permission of Major Hime, R.A., the secretary of the Royal Artillery Institution, they were grouped specially in order to make the photograph shown in our cut.

The guns marked $\frac{I}{3}$, $\frac{I}{6}$, and $\frac{I}{7}$—these being their actual Museum numbers—are some of the oldest to be found in England, belonging to the first stage of the existence of artillery. No. $\frac{I}{3}$ is a portion of a wrought iron cannon thought to belong to the fourteenth or fifteenth century, found with others in the sands of Walney, Morecombe Bay, by Mr. C. A. Archibald, and presented by him to the Museum. It may be seen that this piece is built up of longitudinal pieces of wrought iron running along the bore, like the staves of a barrel, held together by hoops or rings of wrought iron. Strength in the tangential and longitudinal directions was in this case separately supplied by the exterior and interior portions of the gun respectively.

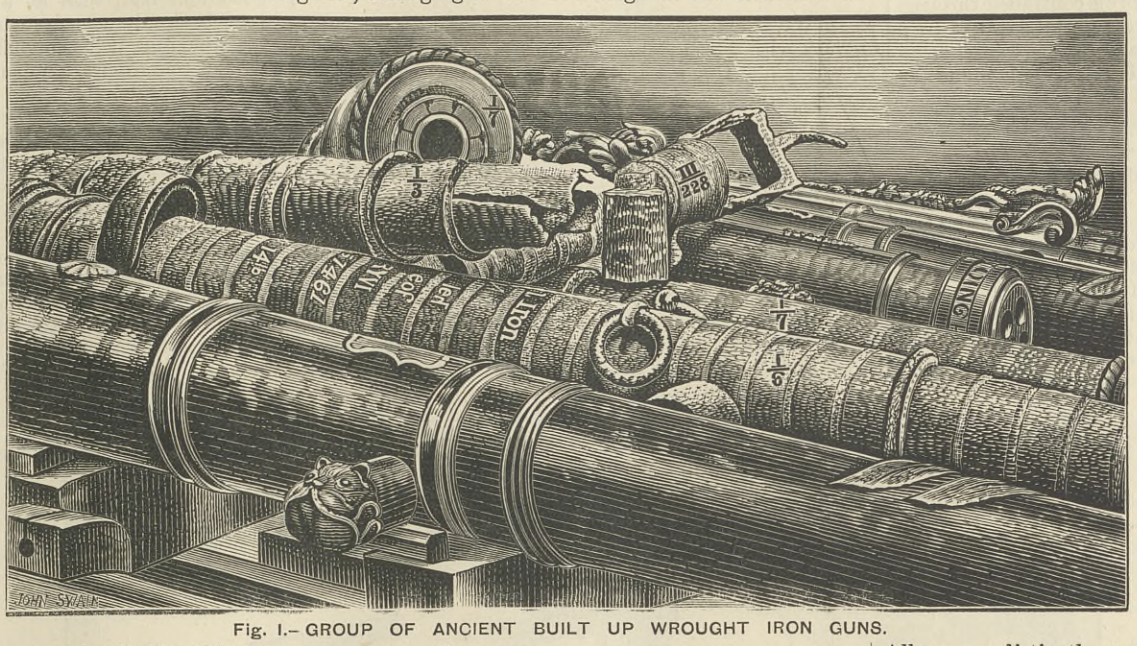


Fig. 1.—GROUP OF ANCIENT BUILT UP WROUGHT IRON GUNS.

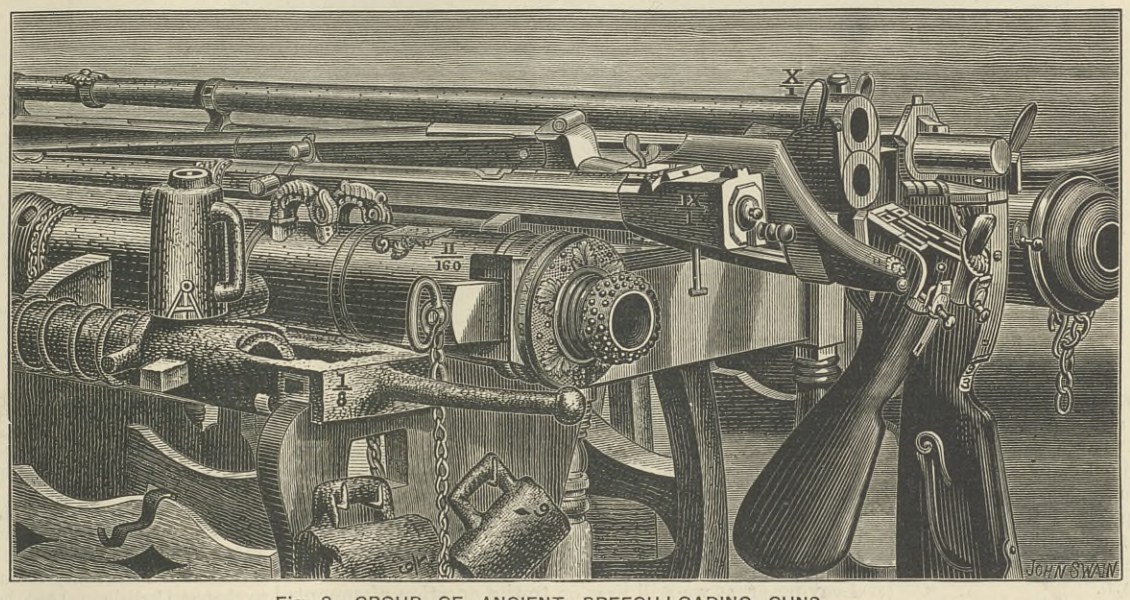


Fig. 2.—GROUP OF ANCIENT BREECH-LOADING GUNS.

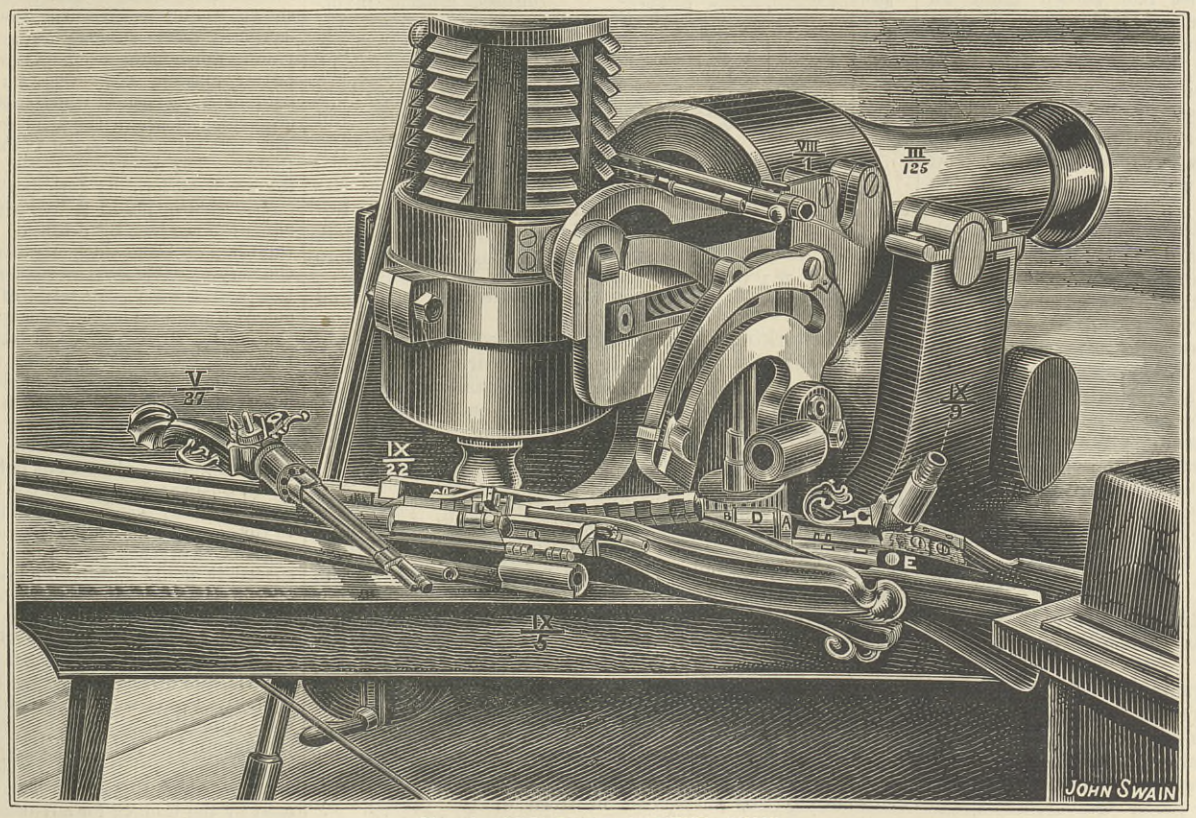


Fig. 4.—GROUP OF ANCIENT ARMS.

The serpent cannons, Nos. $\frac{I}{6}$ and $\frac{I}{7}$, are of nearly similar construction. No. $\frac{I}{7}$ having been injured, it was judged right to cut it open to exhibit its structure. The breech of it is seen in cross-section over the other guns. The interior ring is gun-metal at this portion of the piece, the chamber being lined with a cylinder of this material. Outside this are longitudinal flat bars, placed like staves of a barrel, but two deep, welded together imperfectly, leaving interstices which are sealed up with lead. Outside are thirty-five rings or hoops, averaging 2·3in. in width and 1·5in. thick near the breech. These have been burred down while hot at their edges, and the joint closed. The iron is of excellent quality, giving a tenacity of about 55,258 lb. to the inch, nearly resembling that now employed in wrought iron guns—*vide* R. A. I. catalogues.

How far are modern principles embodied in these primitive designs? We cannot admit that there was great merit in the employment of wrought iron, because in early times it might only mean that the art of casting iron was imperfectly mastered. We cannot, for example, argue that wrought iron was preferred to cast metal because the latter cannot be adjusted to meet the strains that are now known to fall on the successive layers of a gun. All we can distinctly say is, that the iron was placed so as to adjust its fibre to meet longitudinal and tangential strain, and that bronze had been employed to bear the erosion of the powder gas at the seat of the charge, where it unquestionably was better suited to the work than wrought iron with imperfectly closed joints. There is however, altogether a considerable measure of science applied to very rough manufacture.

The wrought iron breech-loader, No. $\frac{II}{228}$, is remarkable. It came out of the Spanish Armada. It has the curious tail-piece running from the breech common to such guns. The chamber may be seen placed on end in front of the piece standing on $\frac{I}{7}$. These chambers were entered into the opening, which was presented upwards when the gun was mounted, the gun, in fact, being slotted through vertically; the chamber was then secured generally by a pin. It may be seen that the charge must have been very weak to suit such a gun. In many cases these guns were mounted on pivots, where there was no more allowance for recoil than in Krupp pivot boat guns. Here, at all events, we have the advantage of loading at the breech connected with absence of recoil, in a way that no roughness of manufacture can conceal. The principle of non-recoil was frequently, of course, embodied in wall pieces on tripod stands. We did not learn breech-loading from the Spanish Armada, for in Fig. 2 will be seen a similar gun $\frac{I}{8}$, which looks better made; but it apparently has not been subjected to the same influences of weather—indeed, the Armada gun looks as if it had laid under water for a long time, which reminds us, by the way, that there is a breech-loader taken up out of the wreck of the Mary Rose, sunk in 1545, on which the action of sea-water for nearly 300 years has indeed played havoc.

This gun, in Fig. 2, No. $\frac{I}{8}$ is of the time of Edward IV—A.D. 1461 to 1483. It is made of longitudinal bars of iron hooped with iron rings. The chamber with lifting handle is complete The vent is well preserved. Length of gun, 3ft.; calibre, 2·5in.; weight, 1 cwt. 13 lb.* (See catalogue.) The breech end in this gun fits on over the barrel below the trunnions. The curious square-shaped projection behind the trunnions appears to be a sort of rough key piece holding the two

* "Mons Meg" in Edinburgh Castle belongs to this period. It is said to have been made in Mons, in Flanders, in the beginning of the fifteenth century, it was employed in the siege of Dumbarton Castle in 1489, and last fired in 1682, when it was injured. (See catalogue.)

parts of the gun together. The bolt hole for securing the chamber may be seen in the side. Other chambers with handles may be seen in this cut.

If we learned nothing in breech-loading from the Spanish Armada, we might apparently at a subsequent date have taken something from the Dutch, judging from No. $\frac{II}{160}$, Fig. 2, which is dated 1650. It is a brass breech-loader, a very handsome gun. The bore is continued through the cascable, being closed at the breech after loading by a wedge—*vide* cut—moving horizontally, being on the same general idea as that of Krupp. This gun was found by Captain—now Admiral—Selwyn, R.N., in a deserted Dutch fort near the mouth of the Gambia river about 1851. The actual wrought iron wedge is modern. The gun $\frac{IX}{1}$, Fig. 2, is another remarkable one—also classed $\frac{I}{21}$—it is of wrought iron, beautifully finished, and bears the date of 1619. It is inlaid with gold and silver, and bears the cypher of Louis XIII., with initials M. and R., &c. The bore is continued from end to end. It has a vertical slot and a vent piece, in which is a vent with the first portion vertical and last portion horizontal, like that of the first Armstrong system. Fig. 3 shows the breech open. It will be seen that the breech-piece is worked from a lever below, reminding one somewhat of the Martini lever, though it has not much in common with it, having comparatively an awkward motion. The lever B brought down the block A to open the breech. In closing the cap C had a catch, which holds into the breech end of the entire gun. The hinge D is broken, there may have been some special piece there suited to the descent of A in a straight line.

The French wall piece $\frac{X}{1}$ Fig. 2, is an ingenious double-barrelled one, loading at the breech. The date is about 1690. The barrels are rifled, being grooved with twelve rectangular grooves. Calibre, 1·45in.; length of rifled portions of the barrels, 7ft. 8·8in.; length of unrifled portion—for the charge cylinders, 9·25in.; total length of piece 8ft. 8in. The breech bolt carries the motto of Louis XIV. The year 1690 is an early date for a rifle; but there is an earlier specimen—namely, a barrel taken from Hungarian insurgents in 1848, with a date of manufacture on it of 1547. The grooving is not visible at the muzzle, having been obliterated; but on removing the breech plug six fine grooves, with a twist of 1 in 26, were discovered. It is thought improbable that a specimen of rifle of an earlier date than this can be found in any collection. Danner, of Nuremberg, having been commonly said to have perfected the rifle about 1552 A.D.

Our object, however, is to select the special features that have come in in modern times as new, and we would call attention to the group depicted in Fig. 4. The musket $\frac{IX}{9}$ is a breech-loader. The invention is ascribed to Marshal Vauban. Mr. Hewitt has shown from an English example in the Tower that this combination of flint lock and breech-loading was known in England in the time of James II. The feature we wish to point out is the interrupted screw which forms so characteristic a point in the new French breech-loading guns and those adopted in our service during the last three years. The interrupted screw was on the front end of the breech block turned up. The corresponding interrupted thread was in the enlarged breech end of the barrel A. The barrel B, with a portion of the stock C attached, was free to slip forward and backward through the collar D attached to the main portion of the stock E. To close the breech the breech block is turned down, the barrel slid home on it, when turned round in the proper position for the interrupted threads to pass through the openings cut away. Then the barrel was turned so far round that the threads engaged and locked, the wood parts of the stock in that position coming fairly together.

This, then, was a very good, business-like breech action, in our opinion far better than many that competed about 1866. That date, however, naturally suggests to us the well-known Snider system of conversion. Now, we will ask our readers who are familiar with the Snider to look at $\frac{IX.}{5}$, attributed to the time of Henry VIII., when we think they cannot fail to be struck with the identity in general idea of this breech-loader with the Snider.

The Snider offered the advantage of adaptation of hammer and lock to firing a central-fire cartridge, and of application of shoe containing breech block to barrel by tapping and screwing without any operation involving the heating of the barrel. These, as well as the sliding extractor, do not belong to this piece. Nevertheless, the resemblance of the general idea is remarkable. Small-arm No. $\frac{VIII.}{1}$, whose barrel is seen in cut C, is comparatively a modern piece, having been proposed by Sergeant-Major Moore, R.A., in 1839. The arm is dated 1843. It is remarkable as having the hexagonal system of rifling recommended subsequently by Sir J. Whitworth. The twist is almost identical, being one turn in 29·5in., the calibre being 0·71in. This amounts to a spiral of one turn in forty-one calibres. The Whitworth rifle pattern, 1862, had a twist of one in 20in., with a diameter across angles of ·49in., which amounts to a spiral of one turn in nearly forty-one calibres. The combination of hexagonal rifling and spiral is, then, almost identical with that afterwards proposed by Whitworth; but we have no sort of reason to question the originality of the latter.

If these two last are striking, what will be said of $\frac{V}{27}$ which is a six-chambered revolver pistol of the 17th century with wheel lock. A casual observer might almost pass it as a Colt's revolver; diameter of bore, 0·35in.; length of barrel, 14in. Among the small-arms there are found examples of rifled-arms, breech-loaders, and a six-chambered revolver. Can we complete the series by anything like the piece that is now finding its way into the equipments of nations, that is a magazine arm. Such an arm is found in $\frac{IX}{22}$ which is seen on Fig. 4. It is a crude affair, the charges being inserted in succession in the magazine B, probably with tight wads between them. Each charge occupies a given space with its own touch-hole. The flint lock is made to slide along a guide bar. It is worked by a trigger in the stock; it is moved forward to fire the front charge, and drawn along to stops in positions fixed to enable it to fire the other charges, probably in rapid succession if everything went right, but this we should think seldom happened. Other magazines were provided to replace the first when exhausted. In this arm then, crude as it is, we have the idea of a magazine fairly carried out, though struggling with difficulties in mechanism.

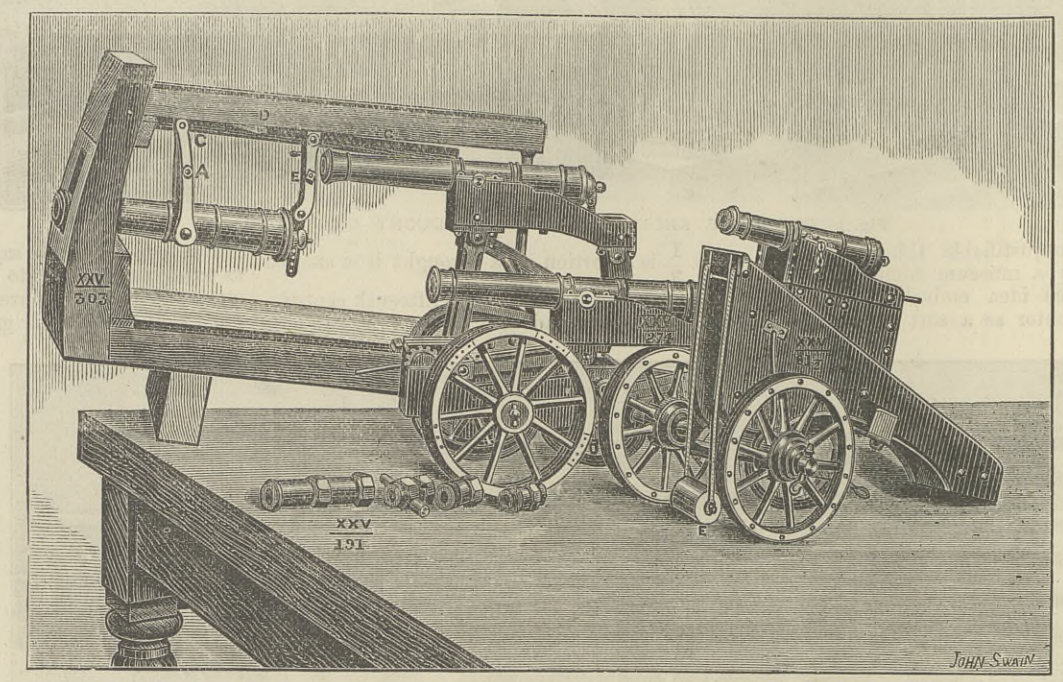
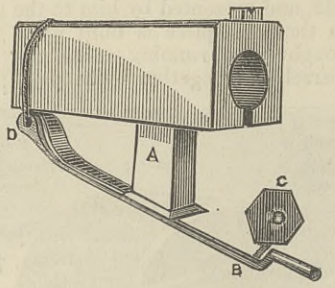


Fig. 5.—GROUP OF DESIGNS FOR CHECKING AND STORING UP FORCE OF RECOIL.

Leaving arms, we will pass on to the question of mounting and working guns. Can we find an ancient inventor corresponding to Moncrieff? or can we find the hydraulic buffers, muzzle pivotting, or overbank arrangements that have latterly come into the service? or, again, guns carried in pieces and united by screwing together in lengths? Now we confess we can find no sign of hydraulics being known, but we can find the remaining ideas fairly represented. In Fig. 5 will be seen a design of Sir William Congreve's $\frac{XXV}{303}$. The object is to deaden recoil and facilitate working. The gun is suspended on a system of jointed bars A and B attaching it to a directing bar C C, which is pivotted nearly over the muzzle of the gun, traversing along the curved arc, whose end is seen at D. This offered the advantages of deadening recoil, of good direction, the gun coming back to the position in which it was last fired, and of a very narrow port. We admit that we wonder Sir William, having got so far, did not make his gun a breech-loader. It is to be observed that the weight of the gun would oppose a gradually increasing resistance to the recoil, on much the same principle as that of the Moncrieff counterweight. So ingenious is this design that we think it is quite open to question whether as a breech-loader it might not be made to succeed at the present day. The gun is not here brought under cover, nor is the work of recoil stored up; but these elements are found in $\frac{XXV}{81\frac{1}{2}}$, Fig. 5. Here a gun is made to descend a steep incline by recoil in its descent lifting a counterweight E suspended in front of the carriage by ropes running over pulleys, which, if sufficiently heavy, would run up the gun when required into the firing position. It was intended evidently for siege train work, the lower carriage being a travelling one and having wheels, of which the hinder pair are removed in the figure.

Fig. 3.



No. $\frac{XXV.}{274}$ is a design for a pair of overbank carriages, the guns travelling on low carriages, but being raised by a jointed frame of bars to fire over a high parapet when required, and lower under cover after ceasing firing. No. $\frac{XXV}{191}$ is a gun made to be unscrewed unto six pieces. We cannot furnish the date of the design. Probably it is older than anyone's memory would take them, but not so old as the guns made to unscrew by the Turks in the middle ages.

We will not tire our readers by describing other things good and bad, such as a naval piece discharging seven barrels simultaneously, which is a very poor attempt at a machine gun, if it is one at all; a leather and copper gun, wound round with hempen cord, said to have belonged to Gustavus Adolphus; and "infernal machines" so called, which are awkward forms of machine guns. These things are generally better understood by actual inspection of the arms than by any description. The Rotunda Museum is a Government one, thrown open to the public free of charge. It is visited as a popular museum by many, but if Woolwich were not out of the way it might be better known to scientific visitors. It certainly contains very interesting designs in war material. In the case of models, of course, we should bear in mind that we have before us only a model, and not necessarily a design that would answer its purpose when worked out, but this does not apply to the case of the arms themselves. We think that it is easy to satisfy ourselves in such a collection that men were as ingenious in designing destructive implements some centuries ago as at the present time. Progress, however, was, as we have said, mainly hampered by the imperfect development of machinery and difficulty of reproduction.

THE ROYAL AGRICULTURAL SOCIETY.

A MEETING of the Council was held on Wednesday, under the presidency of Mr. J. D. Dent. The Prince of Wales was present in his capacity of member of the Board, and there was a large attendance of other members. Forty-seven new members of the Society were elected. Mr. J. Bowen Jones stated as the sales of hay and barley off the trial fields have not yet been completed, the stewards find it impossible to report the exact cost of the trials of hay and corn dryers. They therefore proposed to postpone their final report until the December meeting. The present estimated loss to the Society was between £1600 and £1700, this being in a great measure owing to the protracted inauspicious weather. Mr. Hemsley, as chairman of the Implement Committee, brought up their report, which included a recommendation to postpone the trial of sheaf-binders until 1884, and to offer a prize of £25 for the most efficient portable straw-compressing and binding machine, to be worked in conjunction with a thrashing machine, to be competed for at York next year. This report was adopted. Lord Vernon reported the recommendation of the Dairy Committee that a working dairy, similar to that at Carlisle in 1880, be erected and equipped in the York showyard, and worked by the Society; and that a further portion of the machinery-in-motion sheds be set apart for those exhibitors who take space for showing dairy implements at work. Lord Vernon further stated that an offer had been received through the secretary from a member of the Society, who desired to remain anonymous, to give £100 in prizes for small dairies to be shown in full work during the show:—Class 1: For the best equipped dairy, suitable for a farm on which not more than twenty milch cows are kept, and where the principal object is butter making, £50. Class 2: For the best equipped dairy, suitable for a farm in which not more than twenty milch cows are kept, and where the principal object is cheese making, £50. The committee recommend that this offer be accepted with thanks. The report was agreed to. The date of the York meeting was fixed for July 16th and four following days.

The chairman said it was with great regret that he had to announce the loss, by death, of Mr. C. E. Amos, a member of the Council. The older members of Council were well aware of the very valuable services rendered by that gentleman in connection with the elaborate trials of implements which were carried out years ago. During recent years Mr. Amos had been prevented by ill health from attending the Council meetings regularly, but those who were acquainted with his services in former days knew the indebtedness of the Society to him. A letter was read from Mr. Martin J. Sutton, in reference to the trials of hay and corn dryers at Reading; that gentleman, it will be remembered, having been the donor of the prize of one hundred guineas offered but not awarded.

Mr. Sutton acknowledged the receipt of the judges' report, and went on to say that having watched the experiments from time to time, was sure those gentlemen could have come to no other decision than they have done, and although had it proved a success it would have been a great pleasure to him, through the offer of the prize suggested by Mr. Jenkins, to have brought to the notice of the agricultural world the much vaunted system of artificially drying hay and corn in the stack, it is almost equally satisfactory to know that the exhaustive, elaborate, and costly experiments undertaken by the Society will prevent a very large aggregate loss of valuable agricultural produce from the wasteful and unreliable experiments which would have been made throughout the country. Mr. Sutton enclosed his cheque for 100 guineas, either as a special donation towards the great expenses which these trials have entailed on the Society, or to be used by the Council for any other prize or special purpose which may occur to them. It was resolved that instead of applying the 100 guineas towards the expenses of the trials, it should be devoted to some special prize or purpose to be agreed upon with Mr. Sutton hereafter.

A letter was read from the Foreign Office transmitting documents relating to an international exhibition to be held in Hamburg from July 3rd to 11th next year; and Lord Vernon, Mr. Chandos-Pole-Gell, Mr. R. C. Ransome, Mr. Robert Russell, and Mr. G. M. Allender, were invited to represent the Society at the Exhibition.

RAILWAY MATTERS.

THE new scale of fares on the South Australian Government lines is fixed at first-class 2d. per mile, and second-class 1½d. There are to be no return tickets, and third-class fares have been abolished.

SOME of the reports made to the Railway Department of the Board of Trade seem very "much ado about nothing;" as, for instance, one, of nearly six large size Blue-book pages, recently issued anent some bits of railway crossing accidents away up on the Caledonian Railway.

WE are informed that the Windsor platform of the Waterloo Bridge Station is about to be lit with Edison lamps; about 300 B or 8-candle lamps will be used, the current being furnished by an Edison L-dynamo driven by an Armington and Sims engine. The directors' room will also be lit from the same plant.

THE crowding of the London, Chatham, and Dover Metropolitan Extension trains at Ludgate-hill at some parts of the day has been the subject of public meetings under the auspices of the Railway Passengers' Protection Association. Until the company gets its new station it is difficult to see how it is to make matters better, for there is very little room or time for more trains.

THE prospectus is issued of the Rhondda and Swansea Bay Railway Company, with an authorised capital of £450,000. The object of the company is the construction of a railway from the Taff Vale Railway, which stops at Treherbert, in the Rhondda Valley, to the Swansea Bay Ports. The new railway will reduce the time occupied and the cost of the journey from the Rhondda Valley to these ports by more than 50 per cent. in almost all cases.

THE Queensland loan estimates have been presented to the Assembly, and £1,572,000 have been provided for railways. The Government has concluded a provisional agreement with Messrs. Shaw and Blyth on behalf of an Australian syndicate for the formation of a railway by the land grant system, from the South-Western Railway, thirty miles east of Charleville, down the Warrego to the New South Wales border. A bonus of 10,000 acres a mile is to be granted.

IT is intended to apply to Parliament for powers to construct a new railway connecting Blackpool with the Cheshire Lines, and thus putting them in direct communication with the Midland Railway, the Great Northern, and the Manchester, Sheffield, and Lincolnshire Railways. It is proposed that the new line shall cross the estuary of the Ribble by a high-level swing bridge. A meeting of representatives of public companies and gentlemen on the west coast has approved of the scheme, and £3000 has been subscribed for the purpose of promoting the bill.

GOLD medals are plentiful in Amiens. At a recent meeting of the Société Industrielle d'Amiens, amongst the gold medals offered for the achievements of the year 1882-83, was one "A medal of gold for the discovery of a means of suppression of the noise occasioned by the production of a vacuum in the Smith brake employed by the railway companies." Things in general must be very nearly perfect to make it necessary to go to this for a subject for gold medals, or else the ejector must be growing in power and noise to do and in doing its work; or is this an offer for a design for a new form of pump?

IN reporting the result of his inquiry into the cause of a collision last July at Summerhill Station, Cork, on the Great Southern and Western Railway of Ireland, Major-General Hutchinson says:—"This inquiry has brought to light the objectionable practice of keeping signalmen on duty for periods, in Tomkinson's case—at a level crossing—of twenty-two hours, and in Tyrrell's case—at Grattan-hill Junction—of twenty hours at a stretch. It is true that these long hours occur only occasionally to exchange the night and day duties, but they ought not to be allowed to occur under any circumstances."

EARLY on Sunday morning a fatal imitation of the American train-on-fire accident took place on the Midland Scotch express leaving London on Saturday night at 9.15, and due at Glasgow at 7.45 Sunday morning. Soon after leaving Normanton, namely, soon after 2, the car was found to be full of smoke, and flames showed themselves on the top part. Before the train could be stopped and all the occupants of the car liberated, one, Dr. Arthur, who had just returned from Government medical service in Ceylon, was fatally burnt, having apparently been hurt before being burned. The origin of the fire is not yet certain, but the enquiry is proceeding.

THE Idaho *Statesman* says:—"The activity of volcanic action n the Snake River lava beds, near the line of the Oregon Short Line Railroad, is driving many of the graders from the work. In an area of about twenty-two square miles, at short distances apart, smoke and flames of peculiar odour, colour, and shape, issue from the chasms and seams in the lava. The irritating sulphurous vapours in themselves cause many to quit work, while the unusual agitation of the boiling springs and the general commotion all over the fields of lava has caused a superstitious fear to take hold of many of the railroad hands, and they are leaving the section terror-stricken. The whole area has the appearance from a distance of being on fire."

THE proposal to make a railway between North Derbyshire, *i.e.*, from Chesterfield to Hull, is warmly supported in both towns. The line will give direct access to a seaport for the shipment of Derbyshire steam coal, and increased facilities for the transport of ron from North Lincolnshire, and give that district a new coal supply, and open up a lot of coal about Worksop. The total length of the railway would not be more than seventy miles, and would make Hull a powerful competitor with the Tyne for the export of coal. By means of the Barnsley and Hull and the Chesterfield and Hull railways, Hull, as a shipping port, would be placed in command of the whole of the Great Midland coalfield, extending from Nottingham to Leeds—the largest in England.

THE bridge accident on the Great Western Railway, to which we referred in our last impression, formed the subject of inquiry at an inquest held on Friday at Cattistock. According to the evidence, the foundations of the bridge had been undermined, the structure, which was of wood, easily giving way, as it was only supported by brick abutments. The rails snapped, and the fire-box of the engine of the train passing over was penetrated by a bar 9ft. long, water and steam thus issuing out and causing the injuries which led to the death of the stoker named Cock, the fireman named Kirkby being also severely scalded. Only a few days before the bridge had been inspected and found safe. "Accidental death" was the finding of the jury, and no blame was attached to anybody.

M. GERHARDT has been comparing the French and English railway speeds. Of express trains the mean speed in England, excluding stoppages, with one exception, exceeds 60 kilos. an hour, and reaches or exceeds in seven cases out of twelve 63 kilos.; on the Great Northern particularly it is over 74 kilos. The speed, including stops, is under 55 kilos. only in one case, exceeds 60 kilos. in five, and on the Great Northern it reaches 66·5 kilos. The speed of French express trains, on the other hand, is from 59·5 to 69·8 kilos. an hour excluding stops, and only 52·4 to 63·4 kilos. an hour including stops. A difference between the two countries of at least 10 per cent. is recognised. Attention is called to the fact that in France junctions must not be passed at a higher speed than 20 kilos. for passenger trains, and 10 kilos. for goods trains; hence a loss of time in slowing before the junction—one minute—in passing—one minute—and in regaining normal speed—one minute; or three minutes lost at each junction. In England latitude is allowed in this matter. The Scotch express, which makes 77·16 kilos., passes 144 junctions in the 303 kilos. between London and York. On the French Eastern line the express train from Paris to Delle, furnished with continuous brakes, which reduce to two minutes the time lost in passing junctions, passes fifteen of these, and its effective speed would be 70 kilos. instead of 65 kilos. if it were not required to slow.

NOTES AND MEMORANDA.

DURING some recent trials of Kelway's electric log on board the steam tug Pixie, a number of runs gave a mean of 7·2724 knots, while the same distance by actual measurement was 7·2768; the difference is thus 0·0044, which is probably the nearest approach to accuracy obtained by any log.

THE loss of life, on and near the coasts of the United Kingdom, collision cases included, was, during the past wreck register year, as follows:—East coast, 585; south coast, 94; west coast, 162; north coast, 54; other parts of the coast, 89. Total 984. It will thus be seen that the greatest loss of life happened, as usual, on the east coast of England.

RED RIVER, a great tributary of the Mississippi, rises in North-West Texas, and enters the Mississippi 341 miles above its mouth. Its length is 1200 miles, and its basin 97,000 square miles in extent, 2450ft. above the sea. Eight miles below its source it is 2700ft. wide. Its sources are in a barren plain, the Llano Estacado, in Texas, Steamers of 4ft. draught can ascend to Shreveport, 330 miles from the mouth of the river.

THE *American Miller* gives the following rule for computing the contents of a hopper, the rule apparently relating to the lower square or rectangular conical portion only:—Multiply the length by the breadth in inches, and this product of one-third of the depth measuring to the point. Divide the last product by 2150—the number of cubic inches in a bushel—and the quotient thus obtained will be the contents of the hopper in bushels.

TO produce "crackle" surface glass, a French inventor, M. Bay, covers the surface of a sheet of glass with a paste made of some coarse-grained flux, or easily fused glass, and placed on a table in a muffle, and subjected to a high temperature. When the coating is fused the sheet is withdrawn and rapidly cooled, and the superficial coating separates itself and leaves the irregular surface. By protecting some parts of the glass from contact with the flux, designs and lettering may be left in smooth glass.

THE specific volume of the different constituents of green woods has been estimated by M. Hartig to be as follows, per 1000 parts: Hard green wood, fibre stuff, 441; water, 247; air, 312. Soft green wood, fibre stuff, 279; water, 317; air, 404. Evergreen wood, fibre stuff, 270; water, 335; air, 395. A certain amount of water—7 or 8 per cent. of all—is included with the fibre stuff, showing that about one-third only of the mass of the wood is solid stuff; the remainder is either water or air space. This is quoted in some articles on painting in the *Railroad Gazette*, to show how necessary it is that wood should be in a normal state of dryness before painting.

THE practicability of photographing landscapes from the window of a train running at a rate of even forty miles an hour has been recently proved by Dr. Caudéze, who uses what he calls a gyrograph for the purpose. The apparatus comprises a copper tube similar to that which carries the lenses in ordinary cameras, but the lenses are placed on opposite sides parallel to the axis. Within is a shutter presenting two quadrangular apertures, which, according to the position of the shutter, do or do not let pass the light rays in making a quarter of a turn. This rotary movement is obtained by means of a spring liberated from a catch. An exposure of only $\frac{1}{100}$ of a second may be had.

A RECENT article in the American *Chemical Journal* contains the results of some investigations, by Mr. C. W. Marsh, of various methods of water analysis. One important result is, that when the free and albumenoid ammonia were determined by the usual method, the amounts of the two added together was found to be considerably smaller than the total ammonia found when the oxidising mixture was added at the beginning of the operation, before the water was boiled. This clearly indicated that in the first stage of the process, as usually conducted, there passed over with the free ammonia some nitrogenous substance, capable of yielding ammonia with permanganate of potash.

THE ages of the vessels wrecked during the year 1880-81 are thus given in the "Register." Excluding foreign ships and collision cases, 146 disasters happened to nearly new ships, and 322 to ships from three to seven years of age. Then there were 506 to ships from seven to fourteen years old, and 932 to ships from fifteen to thirty years old. Then follow 463 old ships from thirty to fifty years old. Having passed the service of half a century, we come to the very old ships, viz., fifty-nine between fifty and sixty years old, thirty-four from sixty to seventy, six from seventy to eighty, seven from eighty to ninety, five from ninety to 100, and six upwards of 100 years old; while the ages of eighty-three are unknown.

NOT long since a good deal was heard of a new and secret process for extracting gold and silver, and Mr. W. Crookes, F.R.S., wrote to a daily contemporary to say that it was probably the sodium amalgam process, tried long since. The patent specification of L. F. Gowans, recently published, shows that acccording to his invention a muller fitted to a suspended vertical hollow revolving shaft rotates in a copper pan of rather larger diameter, but similar contour, containing mercury. The ore, fed into the revolving shaft from a hopper, passes down, and is spread out over and through the mercury, and eventually escapes over the edge of the pan. With mundic ores, sodium amalgam is added to the mercury, and the ore, very finely ground, passed through dry.

ANOTHER application of centrifugal force is made in the arts, namely, to leather dyeing. This was formerly done by brushing on the dyes by hand, a process which had several disadvantages, to avoid which Herr Joseph Kristen, of Brünn, the *Dyer* says, has patented a process in which the skin to be dyed is fixed on the centre of a horizontally rotating disc, the colour is also fed on the centre, and by the rapid revolution of the disc is spread equally over the whole surface. The colour is forced on to the disc by means of a pump, or it merely flows from a reservoir standing at a higher level. The excess of colour driven off at the edges of the revolving disc is collected and used over again until the skin is fully dyed. To dye one skin by this method takes from ten to fifteen minutes.

THE third largest tributary of the Mississippi is the Arkansas river. Its course is west of South Park, in the Rocky Mountains, where it is 10,000ft. above the level of the sea. This elevation is reduced one-half in the first 150 miles. It flows first east and south-east, and enters the Mississippi at Napoleon, 575 miles in a direct line from New Orleans; its width varies from 150ft. to 1200ft. Large vessels can ascend with ease to Fort Smith, at the boundary line of Arkansas and the Indian Territory, 508 miles from the mouth, while smaller ones can extend the distance to 884 miles. The Ohio River is another fine tributary. It is navigable from Pittsburg, Philadelphia, to its junction with the Mississippi at Cairo, Illinois, a distance of 1021 miles. The width of the river varies from 500 yards to 1400 yards. The traffic of the Ohio is enormous, and nearly equal to that of the mother river, the Mississippi.

AT present we believe it has not been found possible to make an ink for cancelling stamps that is really indelible. Dr. W. Reissig, of Munich, has, however, it is said, recently made an ink for cancelling stamps which is totally indelible, and the least trace of it can be detected chemically. It consists of sixteen parts of boiled linseed-oil varnish, six parts of the finest lamp-black, and from two to five parts of perchloride of iron. Diluted with one-eighth the quantity of boiled oil varnish, it can be used for a stamp. Of course it can only be used with rubber stamps, as metallic would be destroyed by the chlorine in the ink. To avoid this the perchloride of iron may be dissolved in absolute alcohol, and enough pulverised metallic iron added to reduce it to the protochloride, which is rapidly dried and added to the ink. Instead of the chloride other salts of protoxide or peroxide of iron can be used. The iron unites with the cellulose and the sizing of the paper, so that it can easily be detected even after the ink has all been washed off. The journal of *Chemical Industry* says sulphide of ammonia is well adapted to its detection.

MISCELLANEA.

A 6IN. breech-loading gun burst in the batteries at Shoeburyness during range practice on the 26th inst. One gunner was badly hurt, and several other men were stunned.

IS is stated that the works of the submarine railway between Calais and Dover are going on, and the gallery is now 445 yards in length. Since the heading has been under the sea there has been, it is said, no leakage. Colonel Beaumont's boring machine is being used.

THE Holborn Restaurant, which will be one of the finest in the kingdom when the alterations now in course have been completed, is to be lit throughout by the Edison Electric Light Company. About 1000 lamps in all will be used, partly of eight and partly of sixteen candles.

MESSRS. CHARLES CHURCHILL AND CO., whose catalogue of tools, hand and machine, makes every manager, foreman, and amateur, feel dreadfully badly off for the necessary things with which to do a job properly, have removed their coveted stocks to new warehouses at 21, Cross-street, Finsbury.

ON Monday afternoon the officials and workmen in the employment of Messrs. Wigham, Richardson, and Co., Neptune Ship and Engine Building Works, Walker, presented an address to Mr. C. J. D. Christie, one of the members of the firm, in commemoration of the twenty-fifth anniversary of his wedding-day.

THE London Chamber of Commerce informs us that it is prepared to exhibit in its Council Room any maps, plans, or models, of bridges, tunnels, or other proposed means of communication across the Thames, below London Bridge, and to receive any communications bearing upon the subject, whether for or against the various projects.

THE Peterborough Corporation have appointed Mr. W. Matthews, A.M.I.C.E., as borough engineer, and under his superintendence a complete overhaul is being made of the engines, &c., connected with the Water and Sewage Works. The works have recently been inspected and reported upon by Mr. T. B. Lightfoot, M.I.C.E., and the above appointment is the outcome of his report.

A PAMPHLET, entitled "The Doomed Comet and the World's End," by Mr. J. A. Westwood Oliver, is being published by Messrs. Wyman and Sons. To some extent it is a history of comets, with explanations of their movements, and particularly it refers to the comet at present to be seen, and shows that its fall into the sun will be accompanied by very small increase in solar energy as affecting this world.

MESSRS. ADAMS AND STILLIARD are publishing a well-executed and clear photograph of a group of about fifty of the members of the British Association who met at Southampton, the central place being occupied by Dr. Siemens. The photograph is published in several sizes, and are exceptionally clear even in the smallest. The Southampton arms, Dr. Siemens' crest, and two views in Southampton occupy the corners of the photograph.

THE formation is announced of the "French Electrical Power Storage Company," with a capital of £1,075,000. This is for the manufacture and so on of the Faure accumulator, of which a great deal has been said in this country, but of which exceedingly little has been seen. Mr. Simon Phillipart, well known in connection with the Faure battery in this country, is the first-mentioned subscriber in this big capital French company, a capital which most people would say it is utterly impossible to employ in Faure battery making.

ON Tuesday afternoon the Birmingham Corporation, met to consider the electric lighting question, and adopted the recommendation of their Gas Committee, deciding not to apply for a provisional order themselves, but to support the application of the companies, subject to certain satisfactory conditions being granted by these. A motion of an exactly opposite effect was rejected by the Wolverhampton Corporation on the same day, and an amendment was carried similar in effect to the Birmingham resolution. Walsall has also adopted a similar course.

AT a meeting last week of the Todmorden Local Board for the purpose of considering the provisions of the Electric Lighting Act, the Board having received notices from several companies of their intention to apply for provisional orders or licences to supply the district with electricity for public and private purposes, passed a resolution to make application to the Board of Trade for a provisional order empowering the Todmorden Local Board to supply electricity for public and private purposes, and that Mr. J. Newton, engineer, Manchester, be employed to assist the clerk in framing a scheme.

THE International Inventors' Institute will open a permanent exhibition on the 1st of December in Dashwood House, New Broad-street, London, E.C. It will be open from 9 a.m. to 5 p.m. free, and the exhibition will consist of specimens and models of inventions, and specimens and samples of manufactures. Catalogues will be published monthly, and the Institute is to afford an agency on commission for the sale of patent rights. It does not seem clear why samples or specimens of manufactures should be on exhibition, unless the Institute is to degenerate into a mere commercial agency for the exclusive benefit of a few.

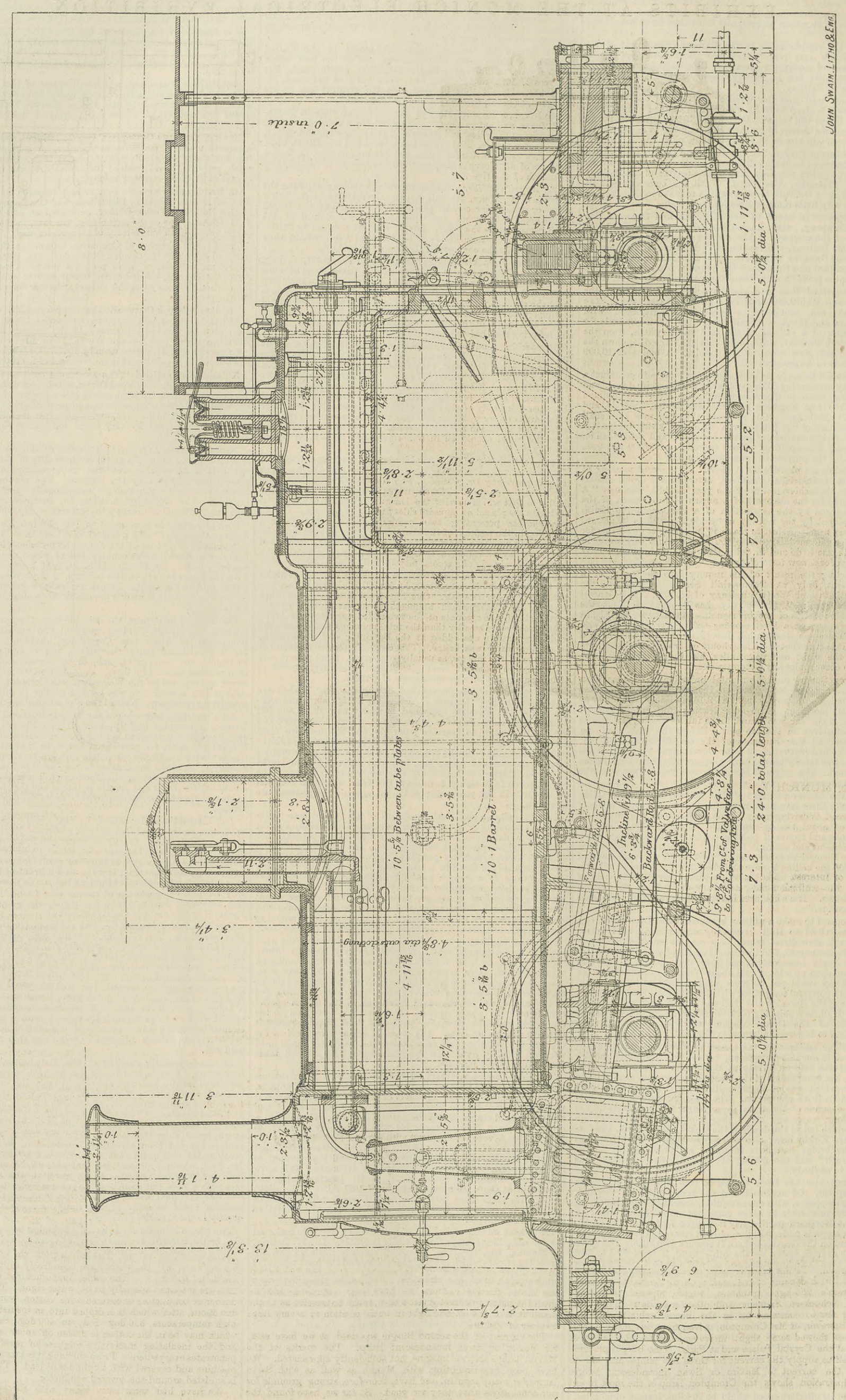
THE Postmaster-General has just contracted with Messrs. D. J. Dunlop and Co., Port Glasgow, to build for the service of the Post-office an iron screw steamer, specially constructed for the laying and repairing of telegraph cables. This vessel has long been much wanted, and will be built from designs by Mr. Joseph H. Ritchie, Fenchurch-street, London. The principal particulars of the vessel are:—Length, 240ft.; breadth, 33ft.; depth, 20ft.; to be propelled by a pair of engines, having cylinders 30in. and 58in. diameter, with a length of stroke of 48in. To meet the requirements of the special work to be performed, the steamer will be fitted with three circular telegraph cable tanks and a double bottom for water ballast, with fittings adjusted to trim the ship as the cable is paid out.

AT the fortnightly meeting of the Manchester Association of Employers, Foremen, and Draughtsmen, held on Saturday, Bull's process of making iron and steel direct from the ore was brought before the members by Vaughan W. Jones, who read a paper on the subject similar to the one supplied to the members of the Iron and Steel Institute. The advantages claimed for the process are that iron and steel ingots can be produced in any district at a cost much lower than the most inferior pig iron; but as yet the process has not been actually in operation in this country, and considerable disappointment was expressed by the meeting that Mr. Bull, who was present, was not able to lay before the members any tangible results as to its practical working. The paper met with a keen criticism, and the general feeling of the meeting was one of doubt as to whether the results anticipated by the inventor could be achieved, especially as regards uniformity of quality in the material produced.

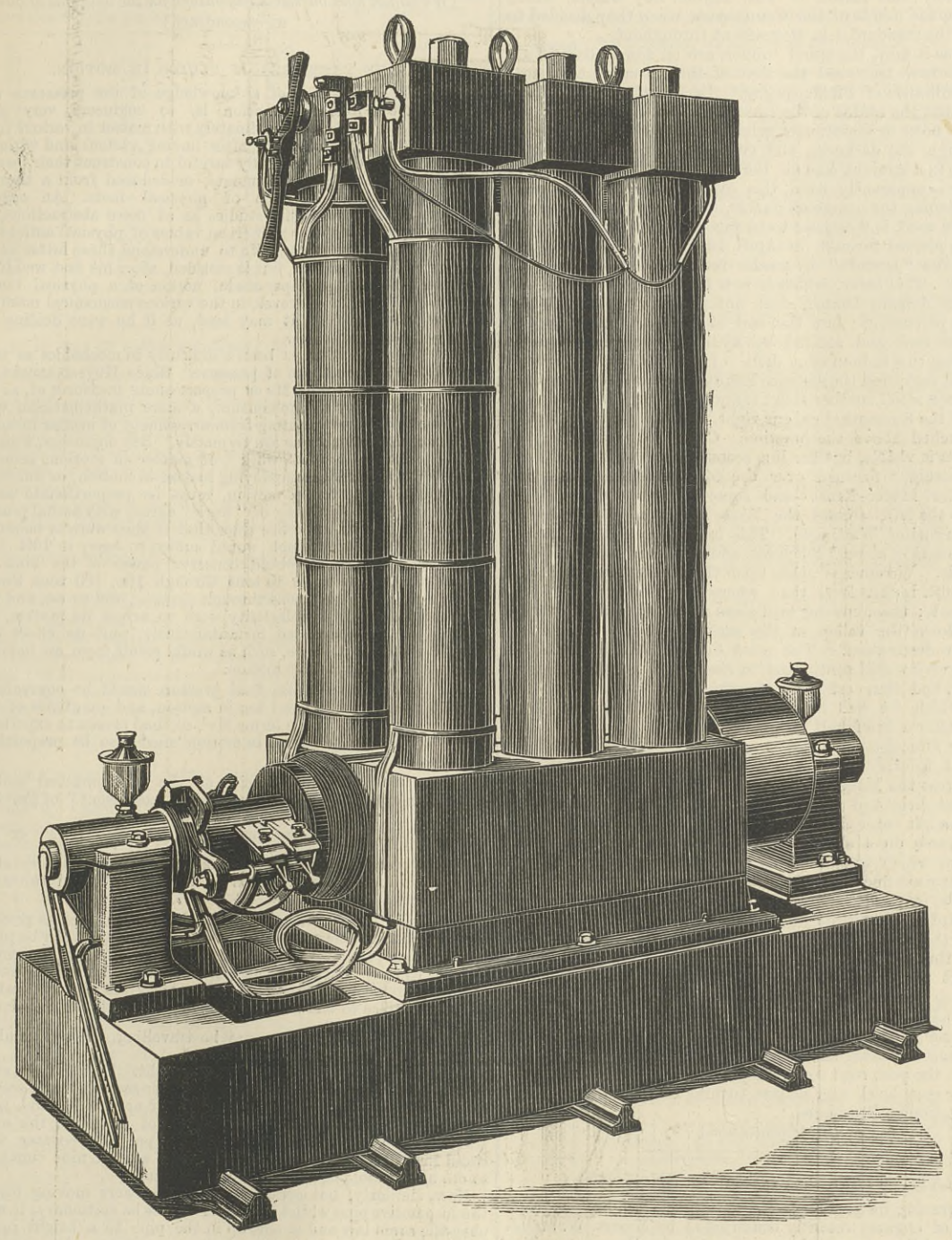
THE Saxon Minister for Internal Affairs has issued a circular to the boiler inspectors under his jurisdiction, which states that modern science has designed various methods of arriving at the smokeless combustion of fuel combined with economy in the quantity used. It is remarked that notwithstanding this fact much damage is often done by smoke to the districts immediately adjacent to factories, and therefore the inspectors are urged to see that the instructions as to the prevention of smoke as far as possible, which were issued by the Government in 1871, are carried into effect. The technical press of Germany approves of this measure, and it is expected that the example of the Saxon authorities will be followed in other parts of Germany. The relative perfection of the arrangements existing in England is referred to, showing what can be effected by legislative measures; while the recent exhibition in London of smoke-consuming apparatus is considered to have proved that the practical part of the question has been fully solved by modern scientific research. This shows that the Saxon Minister does not know much about it.

CONTRACTS OPEN—SIX COUPLED LOCOMOTIVES FOR THE EAST INDIAN RAILWAY.

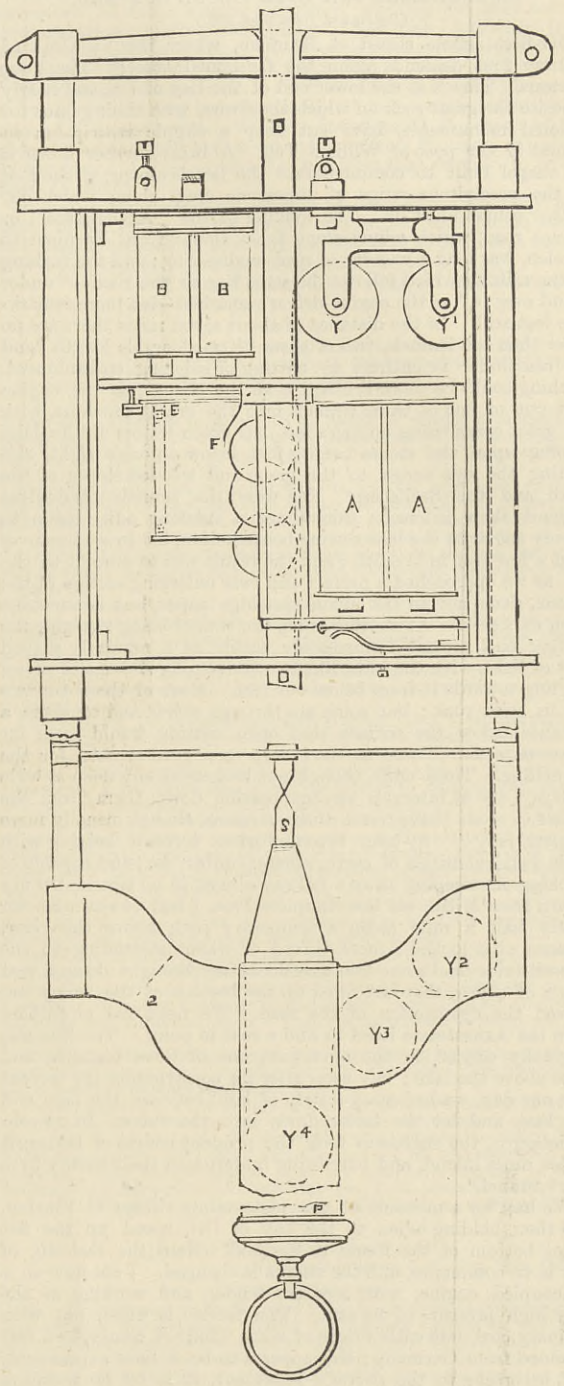
(For Specification see page 337.



EXHIBITS AT THE MUNICH ELECTRICAL EXHIBITION.



EDISON'S DYNAMO.

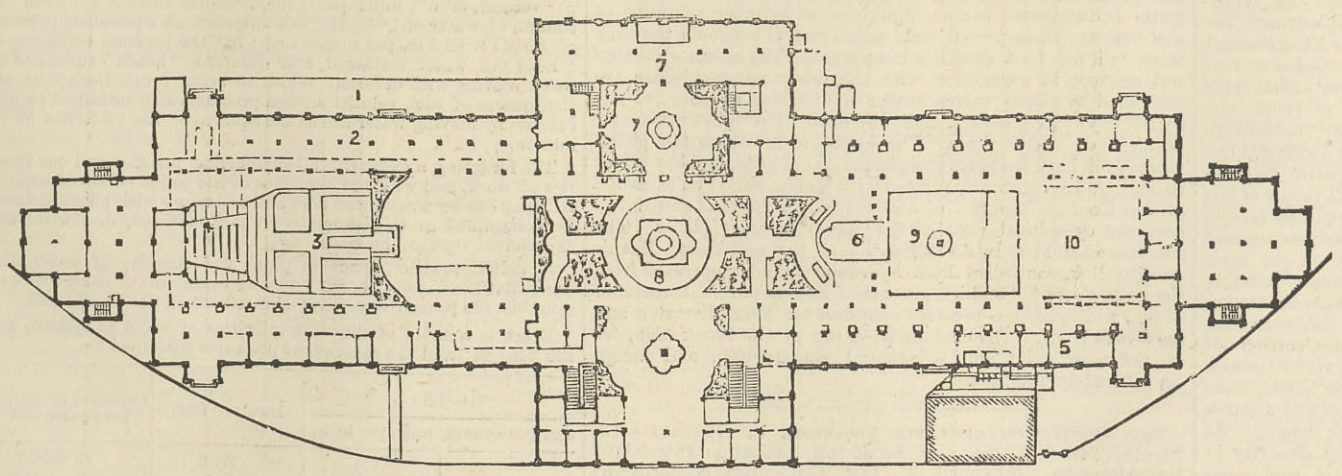


CROMPTON'S ARC LAMP.

THE MUNICH ELECTRICAL EXHIBITION.

No. I.

WE have already briefly alluded to the recent Electrical Exhibition at Munich, and although much might be said concerning the apparatus exhibited, provided we had space to spare for the description of old instruments, we shall restrict our remarks to those pieces of apparatus which present some new feature of interest. The accompanying illustration shows the plan of the exhibition, the numbers showing the position of the principal exhibits, or the principal points of interest. Thus the space indicated by 1 was filled with the steam engines, engines for the most part in a state of senile decay. Edison, however, had managed to obtain a good example of Ruston and Proctor's



PLAN OF THE EXHIBITION BUILDING.

construction, and hence this exhibit was not subject to the disadvantages which arise from the lack of plenty of steam and good governors. The motors were connected by intermediate shafting to the dynamos arranged in the space indicated at 2 in the diagram. To the extreme left—standing facing the engines—was a Brush dynamo of the usual type, to the right were three of Edison's 250-light machines, whilst between these were Bürgin, Schuckert, Siemens, and other machines. There was nothing new to comment on in the Brush exhibit. The arc lamps, however, of Mr. Crompton, driven from one of the Bürgin machines, showed some slight improvements on the lamps as shown at the Crystal Palace and at Paris. One Bürgin machine was used to supply the current for three arc lamps, and one to supply the current to Maxim or Swan incandescent lamps. Our illustration shows the Crompton lamp of the most recent pattern.

The coils A A are the coils through which the main current passes attracting the armature C, which thus raises the clockwork and consequently the rack rod D D, by which means the arc is struck. The resistance of the coils B B being much greater than those of A A, a small portion of the current only passes through them, they being arranged, in fact, to act as a shunt to the main current. The action of the coils B B raises the armature E, which is fastened to the brake F. When this brake is lifted the train of wheels is liberated and the lamp feeds. The focussing arrangement is, we believe, that part of the lamp which shows recent progress. A flexible wire cord is fixed in a groove in the rack rod, passed up the groove over pulleys Y Y_1, then down the side tube over other pulleys Y_2 Y_3 Y_4 to Z, where it is fixed. The pulley Y_4 is pivotted on the frame carrying the lower carbon S. It will be seen that by this arrangement when the top carbon holder rises the lower one falls, and *vice versâ* One of the arc lamps was used to light up the chapel No. 6 on plan. This chapel was built to represent a mediæval structure, with a kneeling figure to represent a cardinal in front of the altar. The light streamed, as it were, from a window near the roof, and threw a broad band of golden rays over the kneeling figure. The realism was carried further in that the soft strains of the organ filled the structure. The whole presented one of the most effective exhibits we have ever witnessed, and we should imagine will have given a favourable impression as to the capabilities of the electric light in such position to a very large number of visitors.

The current of the second Bürgin was used, as we have said, for Maxim or Swan incandescent lamps. The merits of the Maxim lamps are, we imagine, not sufficiently appreciated. We have been experimenting with Maxim as well as with Swan lamps for many months, and have, therefore, strong grounds for our conclusions that they are good. So far we have found the Maxim has a fair life, and where run so as to give 45 or 50-candle power it is economical. The lamps at Munich were arranged to light a furniture showroom. The Swan amps exhibited at Munich were of a new kind. His ordinary lamps give about 20 candles. New ones have, however, been designed and made to give some 40 candles, some 100 candles. The increased candle-power is obtained by increasing the resistance of the carbon filament and the electro-motive force of the dynamo, keeping the current through the carbon about the same as in the ordinary lamps. The lamps exhibited were greatly admired. We believe the resistance of this new lamp to be about 80 ohms, and that it requires a current of from 1·2 to 1·5 Ampères in order to give the normal 40-candle power. The largest exhibition of incandescent lamps was found in the Edison exhibit. The Edison rooms, No. 5 plan, the greatest part of the restaurant No. 7 plan, the stage of the theatre No. 4 plan, and partly towards the latter part of the Exhibition the body of the theatre No. 3 plan, were all lighted by these lamps. The street directly opposite the entrance to the Exhibition was similarly lighted. Each street pillar carried three 16-candle power lamps, and the light compared very favourably with that of gas. These street lamps were driven by a separate machine, the motive power being obtained from a double cylinder Otto gas engine, placed almost exactly on the opposite side of the building to the machine used to obtain the current for the lamps in the building. The only special feature in this exhibit was the dynamo, which is of a type not well known in England. The machines used at the Crystal Palace were 60-light machines, known as the Z machine; the K machine, that used at Munich, is somewhat similar to three Z machines combined. Our engraving shows the K machine. It has six of the extended cores, which together form the coils of the field magnets, with massive pole pieces, between which revolves the armature. The economy of larger machines is seen from the fact that the Edison Z machine is termed a 60-light machine, while three of these forming the K machine give 250 lights, or a gain of $250 - 3 \times 60 = 250 - 180 = 70$ lights. As we have previously stated, the great interest in this Exhibition is in the result of the tests, which have been carefully and exhaustively taken. The cables from the machines to the testing room and elsewhere have been freely supplied by Messrs. Berthoud and Borel. The cables manufactured by these gentlemen are intended specially to be water-tight. The copper conductor or conductors is covered with cotton wound in opposite directions, after which it is dipped into an insulating liquid at a high temperature, 350 deg. Fah. to 400 deg. Fah. The water which may be in the cotton is driven off under such conditions, and the insulating material, a mixture of paraffine and resin, penetrates everywhere. From the tank it is taken to an ingenious machine and covered with a cylinder of lead. The lead, in fact, is squirted around the covered conductor.

We have had some tests taken with short pieces of this wire, which show that the insulation is fairly good, but it will be necessary to make further tests before giving numerical results.

THROUGH THE ALPS BY LOCOMOTIVE.

AN ENGINEER'S TRIP OVER THE ST. GOT ARD.

(*Continued from page* 290.)

My first article closed at Brunnen, where the St. Gothard Railway first descends upon the far-famed lake of The Four Cantons. This is at the lower end of the Bay of Uri, and nearly opposite the great rock on which the Swiss, with their genius for national monuments, have cut deep a simple inscription in honour of the poet of William Tell. A little further down is the chapel built to commemorate the hero's escape, at the foot of the precipitous range of limestone crags along which our further course must lie. The making of the "Axenstrasse," or terrace road, which winds along these slopes from Brunnen to Fluelen, was long a wonder of road engineering; and the making of the railway which follows the same line as the road—"under it and over it," as the engine-driver remarked—is a more remarkable feat still. In the distance of about seven miles there are no fewer than ten tunnels, two of them of considerable length; and the remainder is entirely in cutting or sidelong embankment. Nothing could be more brilliant than the change, as the engine shot out of one of these tunnels into the bright sunshine, with the great crags rising on one's left, the green waters of the lake lapping upon the stones twenty feet below on one's right, and leading the eye across to the green and wooded slopes of the Rütli and the Seelisberg. Nor were the tunnels themselves without their interest. Sometimes a sidelong adit, made to convey *débris* to the lake during construction, let in a stream of light a few feet in breadth; and the result was to present to the eye as we approached a perfect and ever enlarging section of the tunnel, done not in ink upon cartridge paper, but in sunshine upon darkness. At another time, the tunnel being straight, the further end became immediately visible as a regularly shaped spot of light, with the rails, like two converging ribbons of silver, rippling towards it from below our feet. Most of these tunnels are in solid rock; but some are through *débris*, and so short a distance below the surface that open cutting would seem far more natural. There is, however, very good reason for the tunnelling. These cliffs, though not broken by any deep or wide valleys, have at intervals streams passing down them from the higher lands above; and these streams, though usually mere rivulets, may any hour become furious torrents, bearing with them vast quantities of earth, stones, timber, &c., and capable of blocking or sweeping away a railway almost in no time. On my return from Milan, *viâ* the Simplon Pass, I had to scramble for nearly half a mile along a temporary path above the river, because what looked a mere thread of water descending on the opposite side had some two months before brought down a vast influx of *débris*, that had filled up the bottom of the valley and caused the destruction of the road. We need not go further than the Axenstrasse itself to find a case in point. The line was originally carried in the open past one of these torrents, and close above the lake; but soon after its construction the torrent rose one day, washed away a strip of land between the lake and the line, and let the latter down into the water. In re-constructing it, the engineers took the prudent course of taking it rather more inland, and burrowing underneath their enemy in a short tunnel.

We halt for a moment at the picturesque village of Fluelen, and then, bidding adieu to the bay of Uri, speed up the flat valley bottom of the Reuss to Erstfeld. Here the real tug of war is to commence, and the engine is changed. I am now on a six-coupled engine, with separate tender, and working at the very high pressure of 9½ atm. The tender is filled, not with ordinary coal, but with bricks of some kind of compressed fuel obtained from Germany; this appears to be a new experiment, and, according to the driver's judgment, it is by no means a successful one. Possibly this may in part have been prejudice; certainly there seemed no difficulty in keeping steam during the heavy work before us. We rise through meadows and orchards, by gradients sometimes of 2·6 per cent., till we reach the station of Amsteg. Much of this part of the journey is in sidelong cutting, and the slopes on the left-hand are often very high and steep, formed in loose glacier detritus. To prevent these from slipping they are crossed diagonally by rows of fascines or brushwood, about 3ft. apart, firmly planted; they are then, I presume, sown with grass seed, as some, which could not have been more than two or three years in existence, were already turfed over and made quite secure. The method seems a good one, as I saw no instance where a slope so protected had failed. At Amsteg the flat bottom of the valley shrinks to vanishing point, and the great gorge begins, which leads without a break past the Devil's Bridge to Andermatt. The line has now risen some 200ft. above the stream, and here, driving through the Windgelle tunnel—180 yards long—we come out full athwart the deep ravine by which the waters of the Maderaner Thal descend upon the Reuss. As we emerge into daylight we find ourselves on a lattice girder viaduct of two spans, each about 150ft., with the lateral torrent flowing below us at a depth of 180ft., and plunging into the main valley on our right. These viaducts are never provided with parapets of any kind, and the flooring is not usually filled in, so that the eye looks straight down into the depth below one's feet. At this spot begins the full rigour of the ascent. The gradient steepens to 1 in 40; the speed falls to, say, nine miles an hour; and tunnels, cuttings, and viaducts succeed each other in rapid succession. Sometimes we are on one bank of the main river, sometimes on the other; sometimes spanning a lateral ravine, or the river gorge itself; sometimes burrowing through a projecting corner of rock, or behind the avalanche tracks of the Bristenstock. After passing the station of Gurtnellen, we come on the first of the celebrated spiral tunnels —Kehrtunnel is the German word—which are the distinguishing feature of the St. Gothard line. Of the nature and motives of their construction I need not here speak at length. At first sight, if it be desired to surmount a steep declivity in the floor of a narrow valley, no expedient could well seem more clumsy and costly than to dive into the mountain wall on one side or the other, and make a spiral turn a mile or so long within it, for the mere sake of gaining some 150ft. in vertical height, without advancing a single inch thereby towards the journey's end. In the present case the matter is even worse, for the train returns to the daylight some way lower down the valley than the spot where it entered, so that it runs for some distance parallel to and directly above the track it has already measured. There was, however, as one learns when on the spot, more method than would at first be suspected in the madness of the Swiss engineers. In the first place, the working of heavy traffic over gradients much steeper than 1 in 40 would have been an experiment, though certainly a promising one, and the constructors of such a line were naturally anxious to try as few experiments as they could. Again, when the great difficulties of constructing a line in the open, in such a position as this, is considered, it will be found that the first cost of tunnelling is not so greatly in excess as would be supposed, while the cost of maintenance is of course much smaller. Lastly, however successful a steep gradient line might really have been, it would no doubt have afforded a handle for competitors to assert that the St. Gothard was a sort of toy railway after all, not fit for the regular conveyance of heavy through traffic, especially in goods; and probably this reason it was, beyond any others, which weighed on the minds of the Commission when they decided to adhere to the standard 1 in 40 gradient throughout.

Be this as it may, the spiral tunnels are an accomplished fact, and I have now traversed the first of them, bearing the somewhat difficult title of Pfaffensprung. Its length is about 1600 yards, so that the radius of the curve is not over 300 yards; yet there is no noise or sensation of grinding, as the engine makes its way through the darkness, and one might imagine oneself to be moving in a straight line all the time. As the wheel base of the engine is apparently fixed, this can only be due to the practice of widening the gauge on curves, which, with the moderate speeds here used, is doubtless to be recommended. This tunnel, which was pierced through in April, 1881, is remarkable as that in which the "Brandt" hydraulic rock borer first made its reputation. This borer, which is now employed at the east end of the great Arlberg tunnel, does not act, like most other machines, by percussion; but the end of the tool, being pressed against the rock and rotated by hydraulic pressure, grinds its way in after the fashion of a drill. Having emerged from its mouth, and recovered the distance lost during our journey in darkness, we soon reach another short tunnel, and come out upon the opening of the Sustenthal on our right, with the little village of Wasen perched above the junction. Close to this village a railway station is visible, but the line seems to take no heed of this; it holds straight forward over the torrent coming from the Susten—the Mayen-Reuss—and some distance beyond turns sharply to the left, crosses the Reuss once more, and plunges into the tunnel of Wattingen. This is the second spiral tunnel, having a length of about 1200 yards, and in plan a little more than a semicircle. We emerge again upon the Reuss, further on, and at about 80ft. higher level than where we entered, and cross to the left bank; then, curving still more round, we quietly pursue our way down the valley, in the exactly opposite direction to that of our destination. The word "down" is, however, equivocal, for we are still continuing to rise at our regular gradient of 1 in 40, and thus ere long we come back to the station at Wasen, which we had looked up to some quarter of an hour before. After a brief halt here we resume our journey, still in the wrong direction; we pass an artificial tunnel, 65 yards long, solely built to carry the flood waters of the Entschigbach over the line, cross the Mayen-Reuss by the second or middle bridge, at the great height of 260ft. above the stream, and curving a little to the left enter the Leggistein tunnel. This tunnel passes for 1200 yards on a sharp curve through granite of the finest description, which was much admired during its construction. On emerging we find that we have completed rather more than a semicircle, and have once more our faces southwards; so that for the third and last time we find ourselves crossing the Mayen-Reuss, by the upper bridge, which, owing to the narrowness of the cleft through which it foams, is only some 60 yards in length. It will be seen that we have thus made a gigantic zigzag, each arm of which is a full mile in length; so that we are soon looking down upon the exit and entrance of the Wattingen tunnel, though from a considerably increased elevation. Our way now lies straightforward; we pass the mile-long Naxberg tunnel, see the post road come creeping up the side of the mountain to our own level, and at last, turning off steam, run gently into the station at Göschenen.

(*To be continued.*)

RAIL MILL REVERSING ENGINES.

The engraving we give on page 334 is taken from a photograph of a pair of engines recently constructed by Messrs. W. and J. Galloway and Sons for a large steel works in France, to which brief reference was made in our Lancashire Notes a short time back. Owing to the high prices of fuel it was deemed expedient to construct the engines on the compound principle, to work in connection with an independent condenser and air pump, which are of sufficiently large dimensions to be available for the whole of the engines in the works. As will be seen from the illustration the engines are horizontal, on the tandem principle, the high-pressure cylinders being attached directly to the main framing of the engine, with the low-pressure cylinder placed in the rear of the same. Both cylinders are jacketted, as well as the covers of the low-pressure cylinders. The front cover of the low-pressure cylinder is put in from the inside, so that by simply slackening the nuts in the front of the same and loosening the back covers of both cylinders, both the pistons with their rods can be easily withdrawn. The crank shaft is constructed of wrought iron in two pieces, and the crank pins have a diameter of 18in. The steam is distributed to the high-pressure cylinder by means of the ordinary three-ported slide valve, the pressure on the back being relieved by a simple arrangement. The steam admission and exhaust in connection with the low-pressure cylinder are controlled by piston valves having a diameter of 18in., of the special type which Messrs. Galloway have been constructing for upwards of twelve years. The cylinders in which the piston valves work have the ports straight instead of slant, and the valves themselves are constantly rotated with their spindle by means of a ratchet fixed on the end of the valve spindle, thus ensuring a perfectly cylindrical wear of the valves in their places. The valves are actuated by a modification of the well-known Allan's straight link, controlled by a hydraulic cylinder operated from the stage above. The high-pressure cylinders have a diameter of 33½in., whilst the low-pressure cylinders are 59in. diameter, and the stroke is 4ft. The engines, as shown by our illustration, are of the most solid and substantial construction, and weigh approximately 200 tons.

The Institution of Civil Engineers of Ireland.—On Tuesday, 24th ult., the members of this Institution entertained Mr. Alexander McDonnell, M. Inst. C.E.—past president—at dinner at the Shelborne Hotel, and also presented him with an address containing a copy of the following resolution:—Resolved, "That we heartily congratulate our past president, Alexander McDonnell, on his appointment as locomotive engineer to the North-Eastern Railway, and we feel sure that the capacity and knowledge displayed by him for so many years in a similar position on the Great Southern and Western Railway of Ireland will ensure his success in the performance of more extended duties. We must, however, express our personal regret at his removal from amongst us, which is enhanced by our recollection of the great interest always taken by him in the progress of the Institution, and especially evinced when he held the office of our president in the years 1875 and 1876. We can assure him that in leaving Ireland he carries with him the cordial wishes of the members of this Institution for his continued success and welfare." Amongst those present at the dinner were Sir Robert Kane, Sir John Lentaigne, Dr. Robert McDonnell, Messrs. Parke Neville, president; B. B. Stoney, Howard Grubb, Rev. J. A. Galbraith, S.F.T.C.D.; G. F. Fitzgerald, F.T.C.D.; Dr. Cameron, J. C. Smith, hon. sec.; J. A. F. Aspinall, Robert Manning, Thomas Fitzgerald, John Bailey, R. R. Greene, J. C. Park, M. Atock, J. Tighe, W. G. Strype, S. W. Haughton, &c. Messrs. W. H. Mills and Kennett Bailey were unavoidably prevented from being present.

LETTERS TO THE EDITOR.

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

THE PRESSURES OF FLUIDS IN MOTION.

Sir,—The importance of a knowledge of the pressures to be expected from fluids in motion is, to engineers, very great. Engineers, having to work ultimately with matter in various forms, under various conditions, and after having various and variously-produced motions, are generally careful to construct their formulæ on bases obtained by experiments, or deduced from a thorough knowledge and appreciation of physical facts. An ordinary mathematician pursues his studies as of mere abstractions, and practically deals with the numerical values of physical actions and effects, taking but little trouble to understand these latter as they actually occur in nature, but is satisfied, after his first wedding of a formula to his, perhaps crude, notion of a physical fact, to follow such formula wherever, in the various mechanical manipulations it is capable of, it may lead, as if he were dealing with physical facts themselves.

Now, there has always been a difficulty in mechanics as to the expression of Mv in terms of pressure. Since Huysen taught, and Newton accepted, terms Mv as proportionate measures of, as supposed, impetus, styled momentum, a mere mathematician would teach that pressures resulting from arrestment of matter in motion would be proportionate as are terms Mv. But engineers, who have chiefly to deal with the "work" of matter in motion, soon perceive that pressures accompanying matter in motion, or due to the arrestment of matter in motion, must be proportionate as are terms Mv^2; for, the theory of "work" agrees with actual practice, and both theory and practice show that if they were to be moving freely with a velocity which would suffice to carry it 10ft. above the earth's surface, it would conserve power of the kind that would allow it to raise 10 tons through 1ft., 100 tons through $\frac{1}{10}$ of a foot, 1,000,000 tons through $\frac{1}{1000000}$, and so on, and that, if matter of infinite inelasticity were to arrest its motion, such motion would be arrested instantaneously, and its effect could only be stated as pressure, such as would result from an indefinite mass commencing to have motion.

But still such indefinite final pressure would be equivalent to the work conserved in the 1 ton in motion, and quantities of work being proportional, as are terms Mv^2, so, final pressures experienced on the arrestment of masses in motion must also be proportional, as are terms Mv^2.

To get over the discrepancies of the mathematical and the engineering theories as to pressure, the "coefficient" of gravity = 32ft. has been devised, the formula $\frac{v^2}{32} \times$ weight = P, or pressure, has been accepted, and the results are confirmatory of the engineers' theory as to pressures to be expected from the arrestment of mass in motion.

But whilst the formula just named correctly gives us pressures proportionate, as are terms Mv^2, it errs otherwise, as can be plainly shown from present engineering knowledge and by experiment. For, let us take the case of the system that is adopted for supplying water to locomotive engines. In such system simple calculation will suffice to show us the height water will be raised to, at whatever speed the engine may be travelling. The formula $\frac{v^2}{2g}$ affords us the means of learning the height. Thus, if an engine were travelling at the rate of, say, 10ft. per second, water would—leaving bend and so-called friction out of account—stand, in the pipe lowered into the trough, a height of 1·5625ft.; the engine travelling 20ft. per second—13·6 miles per hour—water would stand four times that height; at 30ft. per second nine times, and so on, as per table in after part of this letter.

Now, similarly, but oppositely, if water were moving towards the locomotive pipe whilst the latter might be stationary, it would obey the same law and mount up in the pipe to a height proportionate to the square of its velocity of motion. Any pump in motion could mount or have its power so utilised as to cause another and help to mount to a height which could be stated in equivalent terms $\frac{Mv^2}{2g}$, and different velocities of motion would indicate different powers to raise from our earth's surface to heights proportionate as are terms v^2.

We see, then, that in the case of a moving fluid it can either cause its own mass or an equivalent to rise to certain heights proportionate as are the terms of its velocities of motion squared, or it can, as in a locomotive water elevator, sustain columns of water of the same heights.

In the latter case the columns of water exactly counterbalance the power of the water to raise itself to different heights when moving at different velocities, and so we can ultimately state the pressure of flowing water in terms of the pressure due to the "head" it contains. Thus if water be flowing at the rate of 10ft. per second, or 6·8 miles per hour, it would sustain a "head" or column of water of 1·5625ft., and therefore an equivalent pressure of 1·5625 × 62·3 lb. per square foot; but the pressure being due to "head" of water sustained, and different "heads" sustained by water moving with different velocities being proportionate as are the squares of such velocities, then pressures also sustained by and exerted by moving water are as the squares of the velocities of its motion.

The foregoing agrees with all engineering practice and our theories of work, and with the doctrines of the conservation of energy. All that has been advanced does and will agree with physical facts, as exemplified in the locomotive water elevator, and with any experiment that can be made.

In actual practice, bends in pipes and viscosity of water may somewhat lessen the "heads" moving water would otherwise sustain, but the pressures we have deduced would not be affected.

Below is a table of different velocities of water in motion, and the "heads" and the consequent pressures sustained:—

Velocities in		Heads in feet.	Pressures in pounds per square foot.
feet per second.	miles per hour.		
5	3·4	·39061	23·835937
10	6·8	1·5625	95·34375
15	10·2	3·5155	214·5234
20	13·6	6·25	381·375
30	20·4	14·0625	858·09378
40	27·2	25	1525·5

Water, then, flowing at different velocities, would sustain "heads" and pressures due to such, as per above table, but flowing water would sustain equivalent pressures to those due to "heads." We could have water flowing and impinging against a board of 1 square foot of surface, or we could move the board in still water, and in both cases the pressure on the board would be proportionate to the squares of the velocities of either motions, and agree with our deductions and table. Any fluid in motion would exert pressures or sustain counter pressures similar to those shown in our table, but proportionate as its weight to that of water. The weight of water being 1, the weight of air is about $\frac{1}{827}$, or its actual weight is about ·0765 lb. per cubic foot; then the following table will show the "heads" of its own or equiva-

lent substance, and the pressures due to such "heads," that air in motion would sustain and exert or counteract:—

Velocities in		"Heads."	Pressures in pounds per square foot.
feet per second.	miles per hour.		
10	6·8	1·5625	·11953125
20	13·6	6·25	·478125
30	20·4	14·0625	1·07578
40	27·2	25	1·9125
50	34	39·0625	2·98828
60	40·8	56·25	4·303125
70	47·6	76·5625	5·857
80	54·4	100	7·65
90	61·2	126·5625	9·682
100	68	156·25	11·953
110	74·8	189·0625	14·46328
120	81·6	225	17·2125
130	88·4	264·0625	20·2
140	95·2	306·25	23·428
150	102·0	351·5625	26·894
160	108·8	400	30·6
180	122·4	506·25	38·728
200	136	625	47·822

Then, as it may be rather a difficulty to conceive "head" of air, the equivalent $\frac{1}{827}$ lb. head of water may be substituted.

The above table will show pressures of about one-half those found by Hawksley's formula—given in a paper before the G Section of the British Association's meeting book, 1881—and will be found to differ materially from the table in "Molesworth;" but nevertheless, it has been rigidly deduced, and will agree with fact and experiment.

In another letter I may show how to deduce the pressures resulting from the impacts of solid projectiles in motion.

G. PINNINGTON.

14, Grosvenor-place, Chester, October 28th.

ELECTRICAL STANDARDS OF MEASUREMENT.

SIR,—I have read with satisfaction to myself your article entitled "Dyne," bearing upon the mysteries of the electrical art as at present practised by its professors. I have also floundered through the lamentations of your correspondent, "J. B. W.," published in your previous issue, and have noted the invitation of "Omega" to his assistance by "B." Now, I have been so much astounded by "J. B. W.'s" equation $C = \frac{1}{1}$ or zero (!) that I am under the impression that "Omega's" deep researches would be of small avail in such a case without more elementary instruction, and I, "Alpha," therefore venture to make one practical suggestion.

I have just received a little pamphlet, by Mr. A. B. Holmes, entitled "The Electric Light Popularly Explained," and published by Bemrose and Sons, which seems to me to treat of these mysteries in terms within the comprehension of engineers of ordinary intelligence and education, and I believe that "J. B. W." and many of your readers would, like myself, derive instruction—I might almost say relief—from its perusal. ALPHA.

October 28th.

SIR,—It is not my intention to take part in the discussion which I am glad to see has commenced in your pages on standards and definitions in electrical science; but I cannot suffer a statement made by your correspondent, "An Electrical Student," to pass unnoticed. "J. B. W.," writing that he cannot understand Ohm's law, because the electro-motive force must be always equal to the resistance, "An Electrical Student" replies that if the force were equal to the resistance no motion would result. This is an error, and I may point out that authorities as high as Newton, Pambour, and Rankine, all show that a force cannot exceed a resistance. In Newton's words, "action and reaction are equal and opposite." Pambour has shown mathematically that the resistance offered by a piston to the steam pressing on it is precisely equal to the pressure, no less and no more. As a familiar illustration of the meaning of all this, I may point out, that if a rope is tied to a boat, a certain force can be exerted in the way of pulling that rope; if now the rope be cut the resistance vanishes, and so does the force. I have gone very fully into this question in letters which you courteously published in your impressions for June 9th and June 30th, and your correspondent will, if he refers to these letters, find why it is that motion takes place under conditions of apparent equilibrium.

Your correspondent "J. B. W." evidently does not understand what it is Ohm's law is intended to convey, perhaps, because he has failed to comprehend what the term electro-motive force means. Although it is commonly enough said to be analogous to head of water, it is not strictly so—but I shall leave the discussion of such points to others. I may, however, explain for "J. B. W's." benefit that he can find the horse-power expended in any case by a very simple formula:—Let the electro-motive force be ascertained for any particular case, by means well known to electricians; let the resistance also be ascertained, then $C = \frac{E}{R}$ and $\frac{CE}{746}$ = the horse-power. Thus, for example, let the resistance of a given arc lamp be 4 ohms, and the electro-motive force 40 volts, then $C = \frac{40}{4} = 10$ and $\frac{10 \times 40}{746} = \frac{400}{746}$ = ·536-horse power nearly. Φ. Π.

London, October 30th.

SIR,—As some question has been raised on the meaning of such words as "current," "electro-motive" force, "intensity," and so on, perhaps the following passage from Ganot's "Physics" may be of service to your correspondents. It places the theory of the current in a light somewhat different from that usually received:—"When a plate of zinc and a plate of copper are partially immersed in dilute sulphuric acid a disturbance of the electrical equilibrium ensues. . . . So long as the metals remain in the liquid, the opposite electrical conditions of the two plates discharge themselves by means of the wire, but are instantaneously restored and as rapidly discharged; and as these successive charges and discharges take place at such infinitely small intervals of time that they may be considered continuous, the wire is said to be traversed by a *current*. . . . But the existence of this current is purely hypothetical, and must not be taken as more than a convenient mode of explaining the phenomena developed in the wire."

Professor Ayrton has recently stated his opinion that electric currents are transmitted wholly on the outside of conductors, but he does not explain why. The resistance in all cases varies with the length and the sectional area of the conductor, which appears to be fatal to his hypothesis.

Ganot defines electro-motive force "as the force produced by the difference in chemical action on two metals in a liquid."

It may also be defined as the force by which a current overcomes an obstacle. Thus, for instance, the current has to leap over the space between the two carbons of an arc lamp, and if it lacks electro-motive force it cannot take the requisite jump. Electro-motive force alone will not do work, and quantity of electricity alone will not do work. The two must be combined; but the quantity of electricity which can flow through any medium offering resistance is also measured by the electro-motive force of the current. For $C = \frac{E}{R}$. If, for example, we double E, it is clear that we also double C. Therefore C may be taken under the given limitations to mean quantity, and E to mean intensity. But Ganot says "the *quantity* of electricity which in any unit of time flows through a section of the circuit is called the *intensity* of the current;" and he uses I instead of C, and lays down Ohm's law in the following terms:—"The intensity of the current is equal to the electro-motive force divided by the resistance, which is expressed by the simple formula, $I = \frac{E}{R}$." But he has already defined, as we have seen, quantity as synonymous with intensity. Therefore, if we let Q stand for quantity, we can write the formula, $Q = \frac{E}{R}$, which appears to me to be more satisfactory than the somewhat vague C. The division, when worked out numerically, gives us something. Your correspondent "J. B. W." wants to know what.

Let E be 50 volts, let R be 5 ohms, then we get Q = 10. This means that we have a quantity of electricity represented by 10. This result is a purely arbitrary thing known as the Ampère; but before we can do anything with this Ampère, which may be taken to represent, say, a given quantity of water, we must multiply it by its electro-motive force, which is equivalent to head, and we then get an expression of energy. Thus 10 Ampères multiplied by 50 volts gives 500, and this 500 divided by the invariable constant 746 will give the horse-power represented by the current. I cannot occupy your space by explaining whence this 746 is obtained. It is, I may say, purely a deduction from the 550 foot-second-pounds which represent a horse-power. The formula is $P = \frac{C\,E}{746}$, but I prefer to write it $P = \frac{Q\,E}{746}$, which means quantity multiplied by head and divided by 746 gives horse-power; a statement far more intelligible than that current or intensity multiplied by head gives horse-power.

It is proper to state that the Ampère is defined by electricians as the current produced by an electro-motive force of one volt in a circuit whose total resistance is one ohm, and the unit of quantity is the Coulomb, which is the quantity of electricity transported in one second by one Ampère. Thus Ampères multiplied by seconds give Coulombs. The Coulomb is, however, never used by electric light engineers, who only need the ohm, the volt, and the Ampère in their calculations, and it will be readily understood that the Ampère is, as I have put it, really a sufficient measure of quantity.

"J. B. W." may want to know why the volts are used twice as multipliers. He will understand this if he bears in mind that, in the case of electricity, we have no means of measuring the quantity which passes through a circuit save its electro-motive force. In other words, this is the same thing as measuring the quantity of water delivered through a pipe by the head. Given the diameter of the pipe—which is the analogue of R—and the head—which is the analogue of E—and we can at once calculate the quantity of water delivered in a given time. To calculate the *work* which this quantity of water can do we must again multiply the quantity by the head. In precisely the same way we first find the quantity in Ampères by the aid of the electro-motive force, and we then find the energy of the Ampères by multiplying them, in their turn, by the electro-motive force. But the mere fact that a given machine is receiving or transmitting so many Ampères really means nothing, save this, that as the heating of a conductor appears to depend solely on the quantity of electricity passing through, and not at all on the electro-motive force, we can, if the Ampère current is known, predicate the amount of heating which will take place.

I think that "J. B. W.'s" troubles have all arisen from the indefinite use of "C" and "I." I met with the same perplexities myself. Let it be once understood that $C\,\frac{E}{R}$ merely means that the quantity of electricity passing through any conductor is found by dividing the electro-motive force by the resistance, and all will become clear. In other words, C should be written, as I have said, Q. WALMHO.

Brixton, October 31st.

GORDON'S DYNAMO-ELECTRIC MACHINE.

SIR,—I have had two opportunities of seeing the dynamo illustrated in THE ENGINEER last week, at work, and I was much pleased with its performance. The design and workmanship of the machine are alike admirable, and I have no doubt that the Gordon dynamo has a great future before it. I wish, however, with your permission, to ask for some information, or more properly, explanations which Mr. Gordon can give.

The machine is now being run at Greenwich at about half speed. The two Burgin exciters are also run at slow speeds. The lamps sustained in action are about 1500 in number. When the machine is in full work it can keep about 5000 going, and allowing eight lamps to a horse-power this represents, say, 625-horse power. The power now expended is, I believe, about 180-horse power. Even at the slow velocity of 140 revolutions per minute the cast iron framing becomes so hot that the hand can scarcely be borne on it, and there is a strong smell of melting shellac in the dynamo room. I understand that Mr. Gordon proposes to cast the frames of his dynamos hollow and to circulate water through them. This will keep them cool, but will there not be a great loss of power? Perhaps Mr. Gordon will explain how much may be lost in this way or, rather, how little. The heating manifests itself in a curious way. The magnets secured to the framework are spaced off from it by distance pieces, through which pass the bolts, shown very clearly in your engraving. The armature in revolving causes a strong radial current of air, and this keeps the outside of the stationary magnets quite cool; but the cores of these magnets must be very hot indeed, because the warming up of the frame is due entirely to the transmission of heat through the bolts. This species of heating is just what is to be expected from an alternating current machine. It has not necessarily anything to do with the wire, but depends for its existence on the circumstance that when a bar of iron is rapidly magnetised and demagnetised it becomes hot. In the alternating current machine the magnet cores are powerfully magnetised and demagnetised with great rapidity, and as a consequence it seems to me that they must get very hot; and that in the case of the Gordon dynamo, unless means are taken to conduct the heat away rapidly, the insulation on the wires next the cores must suffer, although the outer coils may be quite cold. When the machine is driven up to its full power the heating will be tremendous, and cold water will have to be freely used to keep it down. That it can be kept down I fully believe, but this will not affect the waste of energy carried away in the shape of heat in the water. I am certain this point must have struck many of your readers as well as myself, and I hope Mr. Gordon will give us his views on the matter.

Again, it seems to me that much energy must be wasted by this machine in the shape of induced currents. If we have two wires running parallel to each other—parallelism is not necessary—when a current of electricity is set up in one, an induced current is also set up in the other, which last is but momentary. At the instant the current ceases to flow in the first one, a second induced momentary current is set up in the second wire. Now, with continuous current machines there is no induction worth mentioning; but in the alternating current machine there must be induction, not only in the machine, but in every wire near the leads. This must cause loss of energy. Again, there are eight miles of leads in the Telegraph Construction and Maintenance Company's works, this wire has all to be emptied and filled again with electricity—I use conventional terms, but electricians will readily understand what I mean—many times in a second; the incessant reversal of the current will tend to heat the wires. May I ask Mr. Gordon to say what loss of energy, if any, is caused by this alternating action in the machine, the leads, and the lamps? Lastly, is it not possible to fit a commutator to the machine and so get rid of the whole difficulty? C. E.

Great George-street, Westminster, 1882.

THE BOARD OF TRADE AND BOILER EXPLOSIONS.

SIR,—You will probably have seen the "Report of the Preliminary Inquiry" of the Board of Trade under the new Act, of what is designated "boiler explosion No. 10," which refers to the giving way of a fusible plug in a furnace crown of a "Lancashire" boiler. As the boiler in question was insured with us, I wrote a letter to the assistant-secretary, Marine Department, Board of Trade, and received a reply thereto; copies of these I subjoin.

When the Act was submitted to Parliament, I strongly urged the promoters to define a boiler explosion, pointing out that serious misconception might result if this were not done; but either from fear of committing themselves, or otherwise, my suggestion was not adopted by them. I much regret this.

The case above referred to is an illustration of the absurd manner in which the Act may be misapplied. If judiciously carried out it may be of great service. We have investigated the cause of the plug giving way, and find it did not arise from the cause explained by the Board of Trade Inspector, but from that referred to in my letter to them.

It is not simply because we have an interest in the boilers, &c., that I direct your attention to this matter, but that public attention may be aroused to what will prove a system of serious annoyance unless a proper understanding is arrived at.

HENRY HILLER, Chief Engineer and Manager,

Manchester, November 1st.

[COPY.]

The National Boiler Insurance Company,
22, St. Ann's-square, Manchester, Oct. 21st, 1882.

Assistant Secretary, Marine Department, Board of Trade, Whitehall, London.

Dear Sir,—Allow me to thank you for copies of reports of preliminary enquiries Nos. 8, 9, 10. I am certainly astonished to find amongst the reports, the description of an "Explosion at the Dye Works of W. E. Davies, Liverpool" (No. 10).

The boiler in question is insured with us, and we have never received any intimation of any explosion having occurred, and the consequent claim in respect of such explosion; but I find on reading the report you have forwarded, that there was no explosion whatever, of any description, but simply an escape of steam and water through the round hole on top of the fusible plug, consequent on the cone coming out from some cause.

It is to be regretted that the gentleman who investigated the matter did not at once designate this occurrence in a proper manner instead of allowing it to be misnamed a "Boiler Explosion." If such simple matters are to be designated boiler explosions, and an official enquiry to be made respecting them, it will bring the examinations under the new Act into the deserved contempt of many engineers, or others conversant with boiler explosions.

Last year, *i.e.*, twelve months ending 31st Dec., 1881, I received particulars of 34 boiler explosions which occurred in the United Kingdom, but if such occurrences as the giving way of a fusible plug and the escape of steam and water into the furnace and firing place are to be designated explosions, a few thousands should be added to this number, say to include, for example, the following:—The fracture of the glass of a water-gauge (many of which give way, and the rush of steam and water in consequence is usually far more dangerous to the attendant than any discharge through the hole of a plug in a furnace). Failures of small tubes, such as those in locomotive, portable, or semi-portable boilers, would also be designated explosions. Severe leakage through the blowing out of a joint. Sudden opening of a safety valve with rapid discharge of steam. Even the opening of a blow-out tap, with its attendant rush and roar, might be called an explosion.

I need not enumerate other cases which might be included, and can only express regret that our name is connected with the occurrence, as we have some pride in the comparative immunity from explosion of the thousands of boilers which are inspected and insured by our Company. Although not intended, such a report is calculated to affect us prejudicially.

I think that the coming out of the plug referred to has been due to overheating, consequent upon deposit from the water. The furnaces of the boiler have suffered from deposit.

Fusible plugs are often melted out, consequent on overheating which occurs with ample water supply; and such an occurrence is simply an indication of overheating. Of course the plug referred to might have failed as described, but I think that the cause of the overheating in this instance would be the deposit from the feed-water supplied to these boilers.—Apologising for thus troubling you, I am, yours faithfully,

(Signed) HENRY HILLER, Chief Engineer and Manager.

[COPY.]

Board of Trade, Marine Department,
Whitehall-gardens, S.W., Oct, 26th, 1882.

BOILER EXPLOSIONS.

Sir,—I am directed by the Board of Trade to acknowledge the receipt of your letter of the 21st inst., stating that in your opinion the explosion which recently took place at the Dye Works of Mr. W. E. Davies, Liverpool, was not one which called for an inquiry under the Boiler Explosions Act, 1882, and in reply to state that the Report shows distinctly not only in the words of the Act, that there was an explosion from the boiler, but that the stoker narrowly escaped a scalding. The Report further shows the cause of the explosion.

I am to point out to you that the Report in no way condemns the use of fusible plugs. Indeed, it expresses no opinion on them one way or the other. It merely shows that if they are used they ought to be properly fitted, and the Board of Trade know of no grounds on which such a conclusion can be called in question.—I am, Sir, your obedient servant, THOMAS GRAY.

To the Manager of the National Boiler Insurance Company,
22, St. Ann's-square, Manchester.

KING'S COLLEGE ENGINEERING SOCIETY.—At a general meeting, held at the College on the 26th of October, there was a discussion on "Gas *v* Electricity for Lighting Purposes." The discussion was opened by Mr. E. H. Horne, and terminated much in favour of electricity. There was a large attendance of students of the Applied Science Department.

VOYAGE OF TORPEDO BOATS.—The Brazilian Government dispatched to the Brazils during August last four torpedo boats built by Messrs. Yarrow and Co. These vessels, we understand, have arrived at Rio de Janeiro in perfect safety, having encountered very severe weather during a portion of their voyage. It will be remembered that a short time since we gave an account of the official trial of one of these, when a speed of 20·3 knots an hour was obtained with a load of twelve and a-half tons during a continuous run of three hours, which is the highest speed ever recorded under such severe conditions of trial. The above torpedo boats and the four built by Messrs. Yarrow and Co. for the Argentine Government are, we believe, the only torpedo boats that have ever made long sea voyages, and we think it is conclusive proof of the sea-going qualities of them.

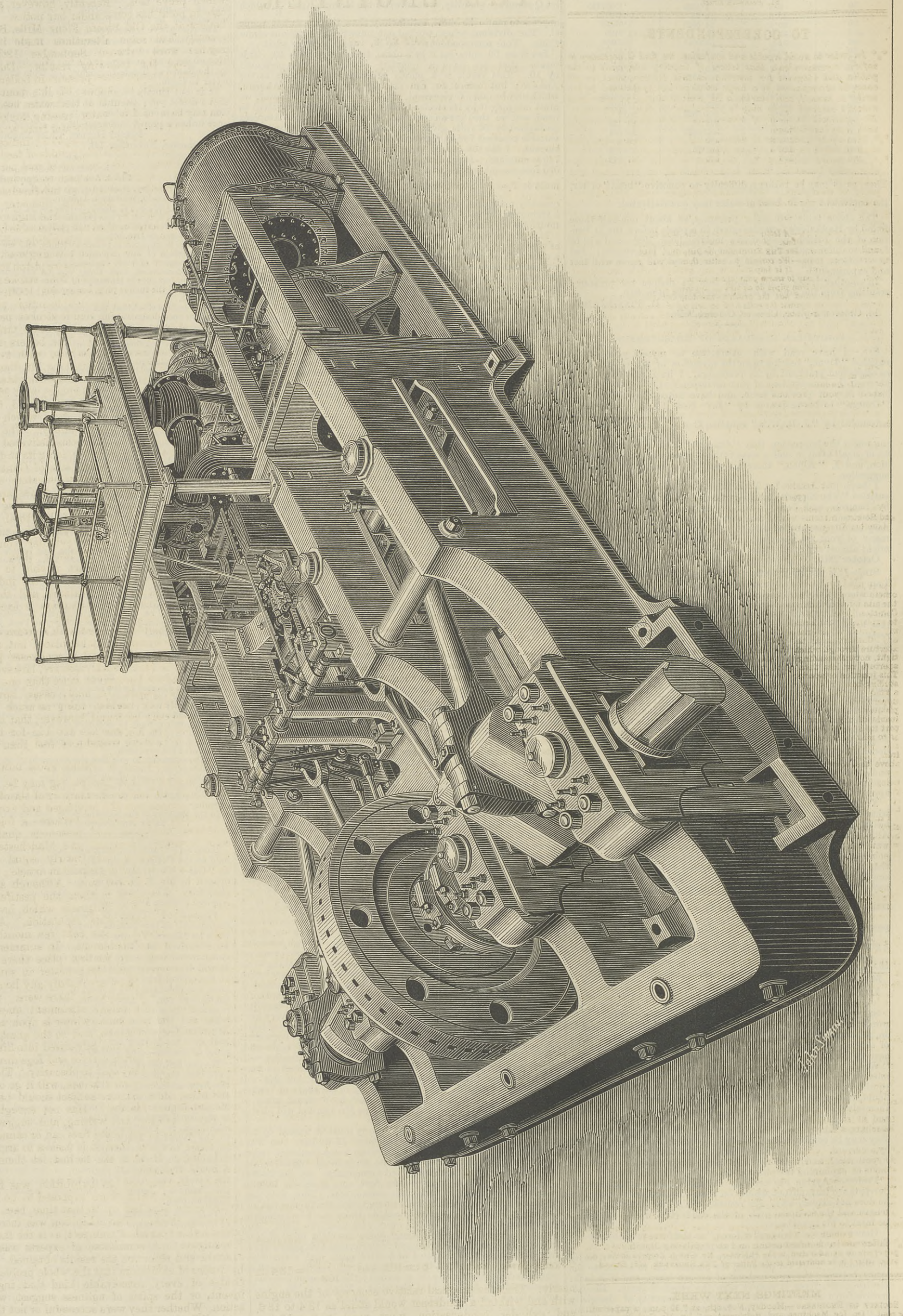
NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—W. Castle, chief engineer, to the Asia, additional, for the Volcano; W. H. Moon, engineer, to the Indus, additional, for the Himalaya, vice Brumage; John T. Morgan, engineer, to the Tenedos; Jeremiah P. Lloyd, engineer, to the Northampton; William Bromley (a) engineer, to the Indus, additional, for Coastguard, vice Jones; Joseph W. Allen, engineer, to the Tenedos; Richard J. P. Jones and Benjamin J. Barnes, engineers, to the Northampton; Percy J. L. Bolland and James A. Reynolds, engineers, to the Northampton, for temporary service; Alfred J. Nye, assistant engineer, to the Hercules, additional, for the Lively, vice Allen; Sylvester Rawling, assistant engineer, to the Tenedos; James M. Thompson, assistant engineer, to the Northampton.

TRACTION ENGINES ON THE HIGHWAY.—Mr. Dodson, President of the Local Government Board, is to receive an influential deputation to-day, at one o'clock, on the subject of further legislation relative to the use and licensing of traction engines. In Yorkshire, Derbyshire, and other parts of the country, great damage, it is stated, has been done to the highways by these traction engines, and the public safety endangered. The accident, resulting in the loss of two lives, near Sheffield, was the origin of the agitation, which has been promoted by many influential people—and it happens unfortunately for the users of traction engines, that people do not much object to them until they are sufficiently well-to-do to be influential. A preliminary meeting is to be held at the Grand Hotel, Trafalgar-square, and the deputation—which will consist of public bodies from various parts of the country—will include several Members of Parliament. At the interview a memorial, signed by 9000 persons, will be presented on behalf of the Sheffield Traction Engine Association, praying for the amendment and consolidation of the law into one Act, and for a better system of licensing.

RAIL FINISHING MILL ENGINES—FORGES DE ST. NAZAIRE, FRANCE.

MESSRS. W. AND J. GALLOWAY AND SONS, ENGINEERS, MANCHESTER.

(For description see page 332.)



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TO CORRESPONDENTS.

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

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

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

T. F. W.—*Messrs. Tangye, of Birmingham, make the Fosbery diaphragm pump.*

W. S. (Greenhanger).—*A letter addressed to the Guildhall, E.C., will find the gentleman you name. A Basaile bridge is one in which one of the side strains is a draw. See* The Engineer *for July 28th,* 1882.

An Old Subscriber.—*We cannot do better than advise you to read Box's treatise "On Heat." It is impossible to say, without further information, what is the best way to warm your fitting shops, but you will probably find steam-heated cast iron pipes do as well as anything else.*

M. H. R.—*A side wind has the greatest retarding influence on a train. It forces the flanges against the rails and so sets up a great resistance. We do not know of any instance in which a train has been actually stopped in this way, but it has occasionally been deemed imprudent to run trains in gales lest they should be blown off embankments exposed to the full fury of the wind.*

D. P. O.—*You must have served a regular apprenticeship for at least three years with a firm of mechanical engineers; then you must get an appointment as third engineer on board some steamship, and you must serve* 365 *days at sea, as a minimum; at the end of that time you can go up before a Board of Trade examiner, and pass if you are competent, and get a certificate as second engineer. You have not the least chance of getting into the P. and O. Company's service. You can obtain all further information by applying by letter to the Marine Department of the Board of Trade, Whitehall.*

Erratum.—*In our last impression, page,* 318, *column* 2, *line* 13, *for* $F = \frac{Wv^2}{32{\cdot}2t}$ *read* $F = \frac{Wv}{32{\cdot}2t}$. *We may add that a similar error will be found in Clark's "Manual of Rules, Tables, and Data," page* 284.

CARBONS FOR THE ELECTRIC LIGHT.

(*To the Editor of The Engineer.*)

Sir,—Can any reader tell me where in London I can procure Mignon and Rouart's carbons for arc lamps? Arc.

London, November 2nd.

WHO INVENTED THE STUFFING-BOX?

(*To the Editor of The Engineer.*)

Sir,—In your number dated Oct. 20th, a correspondent asks, "Can any of your readers say who invented the ordinary hemp-packed stuffing-box? Was it James Watt?" For the edification of "Inquisitive Sam," and any others who may feel interested in the above query, I beg to quote from the famous letter addressed to Sir J. Eyre, then Lord Chief Justice of the Common Pleas, by Mr. J. Bramah, dated 1797:—"Fifthly, I shall proceed to explain to your lordship a circumstance in this part of the engine in my opinion as material and of equal consequence with the preceding, or any other article in the machine. This is the method of rendering the aperture through which the piston-rod passes constantly air and steam tight, notwithstanding the said rod, in many engines, slides through this aperture no less than 320ft. per minute during the time they work. This junction or aperture is a very ingenious contrivance, and is called a stuffing-box; it is a part formed in the cap or top of the cylinder, and is a kind of cylindrical box of about 6in. or 8in. deep, made of iron. The upper part of this box is considerably wider than the diameter of the piston-rod above mentioned, and the bottom or lower part, next the inside of the cylinder, is made exactly to fit the said rod. From this part for a small distance upwards, the box is turned in a conical form, so as to make a chamber exactly in the shape of a snuff mill; at the top of this conical part is turned a rebate or seat, into which is fitted a brass or iron ring, the extreme circle of which exactly fits the cylindrical part above the conical part described. This conical chamber is then filled with hemp or junk, so as to surround the piston-rod on all sides, and being secured down by the brass or iron ring above mentioned, causes the rod to slide steam and air tight. But the quantity of rub which is constantly on this part, and the nice perfection required, soon discovered the want of some further help," &c. &c.

I think I have quoted sufficient from this very interesting letter to show that James Watt was the undoubted inventor of the "common hemp-packed stuffing-box," and I am of opinion that this contrivance was included amongst several other claims in the patent granted to him in 1769. C. J. Watts.

Duke's Palace Ironworks, Norwich, Oct. 30th.

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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.

Society of Engineers.—Monday, Nov. 6th, at 7.30 p.m., a paper will be read "On Ice Machines and Refrigerators," by Mr. Carl Pieper, the leading features of which are as follows:—How refrigeration is caused, at what cost, and by what technical appliances; comparison of the results obtained therefrom; ice and ice-water making; the applicability of a compound air pump for that object, and its use for numerous industrial purposes.

Society of Telegraph Engineers and Electricians.—Thursday Nov. 9th, at 8 p.m., a paper will be read "On the Munich Elec trical Exhibition, 1882," by Mr. W. H. Preece, F.R.S., Past President.

DEATH.

On the 27th ult., at Brixton, in his 75th year, John Samuel Stephens, for 33 years Superintendent of the City of London Gas Company.

THE ENGINEER.

NOVEMBER 3, 1882.

CONDENSING AND NON-CONDENSING ENGINES.

In our impression for Feb. 11th, 1881, appeared an article on the value of a vacuum, in which we endeavoured to show exactly what the steam engine gains in the way of economy from a condenser. We then explained that the condensation of 1 lb. of steam in the cylinder would neutralise all the gain to be derived from condensing 3 lb. of steam in the condenser. In the last volume of the *Revue Universelle* will be found a short and interesting paper—translated into French by M. Doerfel—from the pen of Professor Schmidt, of Prague. The article is entitled *Sur l'Inutileté de la Condensation.* The author has taken for his text an experiment carried out in the United States on two Corliss engines, one with and the other without a condenser, and of identical dimensions, with the exception that the condensing engine had a cylinder 50 per cent. larger in diameter than its fellow. The condensing engine had a cylinder 24in. diameter, and a piston stroke of 4ft. The non-condensing engine had a cylinder 16in. diameter, with the same stroke. The pressure in the first engine was 63 lb., and in the non-condensing engine 67 lb. on the square inch. The steam was expanded nearly eight times in the condensing engine, and 4·36 times in the non-condensing engine. Two careful experiments showed that in one sense, and contrary to what might have been expected, the condensing engine required more fuel than its fellow. Mr. Isherwood has already dealt with these experiments, and Professor Schmidt adopts his figures, and proceeds to show that the unfavourable result obtained from the condensing engine was due entirely to excessive condensation in the cylinder, brought about by the cooling influence of the condenser. The calculation has been made in rather an unusual way, and is open to criticism.

We find from Mr. Isherwood's figures that the feed-water required per hour per indicated horse-power by the condensing engine—which we shall call A—amounted to 25½ lb., while the non-condensing engine—which we shall call B—used a fraction over 29 lb. Thus neither engine had any pretensions to be called economical. But when we come to examine the performance of the two engines calculated in absolute horse-power, we are told that A required 22½ lb., while B needed but 18½ lb. of feed-water. The absolute power of an engine means the work expended in overcoming all resistances; and in the case of the non-condensing engine part of the resistance—and that a very considerable part—was expended in overcoming the resistance of the atmosphere. Thus in the case of the engine B much more work was done than was accounted for by the indicator, while in the case of A the unaccounted-for work, as we may call it, was comparatively small. So far as the performance of the steam is concerned, the result is interesting enough; but inasmuch as the steam user wants the greatest return he can get from his fuel, it is of little practical importance. When the back pressure of the air is not removed, condensation in the cylinder is reduced, and the steam does its work to more advantage; but, unfortunately, it is not working solely for its owner. On the contrary, it is expending energy uselessly on the atmosphere. It remains to be seen whether any conditions can arise under which the loss of power in this way would be more than balanced by the gain secured by reduced cylinder condensation; and it ought not to be difficult to ascertain the conditions under which such a result is possible of attainment. In a non-condensing engine, with a jacketted cylinder, nearly all the steam used ought to be accounted for by the indicator. We may take a piston with one square foot area, making 500ft. of piston speed per minute, neglecting clearance. This engine will use, let us say, 100 cubic feet of steam per minute, of which 10 will be condensed, and the remainder available for work. Let the absolute pressure be 100 lb., then each foot will weigh ·23 lb., and the total weight used per hour will be $·23 \times 100 = 23$ lb. The steam will be expanded five times, and its average pressure will be 52 lb. on the square inch, but deducting 2 lb. as equivalent to the loss by cylinder condensation—although it will not appear practically in this way—we have $\frac{50 \times 144 \times 500}{33{,}000} = 109$-horse power, and $\frac{23 \times 60}{109} =$ 12·75 lb. of water per horse per hour. But from the 109-H.P. has to be taken the work expended in overcoming the back pressure, which cannot be much less than 16 lb. on the square inch. Now $\frac{144 \times 16 \times 500}{33{,}000} = 35$, in round numbers, and $109 - 35 = 74$, which is the indicated horse-power and, $\frac{23 \times 60}{74} = 18{\cdot}6$ lb. of water. If, now, everything else remaining unaltered, a condenser was added, the back pressure would fall to about 3 lb., and we should have $\frac{144 \times 3 \times 500}{33{,}000} =$ in round numbers 6-horse power, and $109 - 6 = 103$, and $\frac{23 \times 60}{103} = 13{\cdot}4$ lb. nearly. Thus the practical relative economy of the engine with and without a condenser would stand as 13·4 to 18·6, and cylinder condensation must reach $18{\cdot}6 - 13{\cdot}4 = 5{\cdot}2$ lb. per indicated horse-power per hour before the condenser ceases to be a means of economy. It is true that there are one or two other matters to be thought of, such as the work done by the air pump, and the fact that with the non-condensing engine the feed-water may be heated boiling hot, while with the condensing engine it cannot; but these are things of small import, and the whole question centres on the one point—can or cannot condensation in the cylinder be kept below the point stated? The answer must be in the affirmative. We have cited the results of many careful experiments made at various times which prove this. Recently, however, a very instructive case in point has come under our notice. The engines and boilers at the Old Steam Flour Mills, Birmingham, have recently had some alterations made in them, and in regular work between September 13th and the 21st they gave the following results:—Duration of trial, 88 hours; average steam pressure in boilers, 63 lb.; average initial pressure in engine, 57 lb.; pounds of coal used per hour, 738; pounds of feed-water used per hour, 4843; temperature of feed water passing donkey pump, 82 deg. Fah.; temperature of feed-water from economiser, 132 deg. Fah.; revolutions per minute, 45·3; indicated horse-power, 244·605; vacuum, 26·50in.; pounds of feed-water per horse-power per hour, 18·08; pounds of coal per horse-power per hour, 3. The engines are a pair compound horizontal, with cranks at right angles and an intermediate receiver. The cylinders are 20in. and 38in. diameter and 4ft. stroke. There is a plain slide valve on the high-pressure cylinder, with cut-off plates on the back, adjustable by a wheel outside the valve-box. There is a plain slide valve to the low-pressure cylinder. The air pump is single-acting, and worked from the back end of low-pressure piston rod by a bell crank. The pump is 24in. diameter, 20in. stroke; the condensing water is supplied by an artesian well 150ft. deep, 5in. bore; it is drawn therefrom by a double-action pump 10in. bore, 18in. stroke, making 50 double strokes per minute. This pump delivers into an underground tank, whence it is drawn by the air pump. The boilers used during the trial are two plain Lancashire, with two internal flues 2ft. 6in. diameter, shell 28ft. long, 7ft. diameter; no water tubes. The safety valves were weighted to 65 lb. per square inch. Green's economiser, with 96 pipes, is fitted. A separate duplicate boiler was used for working the donkey pump, the flame, &c., from which passed through a bye-flue direct to the chimney. The coal is what is termed "rough slack," and costs delivered 6s. 6d. per ton. During the trial the mill was doing its ordinary work with nine pairs of stones, seven sets of Gantz and Bucholtz and other rolls, silks, purifiers, elevators, chain hoists, and so on. The cylinders, it is worth notice, are not jacketted, but carefully covered with non-conducting material.

Here it will be seen that the total consumption of steam is about that of a non-condensing engine working with very little cylinder condensation. But the effective pressure is lower than we have used in our calculation. We are unable to say how much of the steam is accounted for by the indicator, as we do not know the amount of clearance, and the cut-off is not clean. The low-pressure diagram is excellent, and the high-pressure diagram very good.

It is impossible to meet with a steam engine in which no cylinder condensation takes place; but, as we have said, the conditions under which a condenser proves uneconomical must be rare. Such cases are, however, by no means wanting, and we have given more than one example of this truth in our pages. In many cases, however, the condenser is simply useless, doing as much harm as good. It will generally be found, however, that under such circumstances the engines are too big for their work, and nothing can be more wasteful of fuel than this.

THE PREVENTION OF SMOKE FROM DOMESTIC FIRES.

The advent of the London fog may be daily expected. As far back at least as the memory of the oldest inhabitant extends, London was the privileged and exclusive possessor of a peculiar fog of special texture—a fog unrivalled for toughness, blackness, and poisonous qualities. Of late years, however, Liverpool and Manchester have started fogs for themselves, very nearly equal in abominable characteristics to the metropolitan article; and, strange to say, Paris has followed suit. Although smoke does not cause fogs, it imparts to them the pestiferous characteristics and superlative dinginess which have given those of England a world-wide reputation. Accordingly we shall, in the course of the next few months, hear a great deal about smoke abatement. In summer the subject is put by on a shelf. In the first place there are no fogs in London, Liverpool, and Manchester in summer; and, in the second place, there are hardly any house fires to impregnate them with smoke if there were. "Out of sight, out of mind;" the smoke abatement question is left in abeyance. But as soon as winter is upon us men begin to talk about fog and smoke, and so the question is taken off the shelf, cleaned up, and galvanised into life; and nothing comes of it, until spring arrives and fogs disappear, and the question is again relegated to obscurity. This goes on year after year. We venture to ask, will it go on always? Is it not about time that the subject should be dealt with in some intelligent fashion? Has not enough been done in the way of talking, and writing, and suggesting, to prove either that smokeless house fires can or cannot be had? If they cannot be had, then it is useless to argue about them any further. If they can be had, let them be produced, and made available.

Many months ago an exhibition was held at South Kensington, at which were supposed to be shown all the contrivances that had up to that time been produced for preventing smoke. The exhibition was introduced with a considerable flourish of trumpets, as is the fashion of South Kensington. A committee of experts was appointed to examine and report on the results obtained. It was stated by dozens of exhibitors that the whole problem was solved. Grates of every conceivable kind that ingenuity could invent, or the spirit of ugliness suggest, were shown in action. Whether they were successful or not the public had some difficulty in ascertaining. The good people living in the neighbourhood of the Horticultural Gardens were rude enough to threaten to prosecute the Exhibition Committee under the Smoke Nuisance Act. They certainly did not believe in the grates exhibited. But the visitors within the colonades of the Horticultural Gardens had not the same opportunities for arriving at facts as those out-

side. It is true that clouds of smoke now and then eddied through the building; but this, it was explained, was caused by cross draughts, such as would not exist in a dwelling-house. Again, the grates were always in the hands of skilled attendants, and as for the most part good heavy fires were made up in the grates in the morning, little firing took place during the day. However, people consoled themselves with the belief that no matter how the visitor might be gulled or mistaken, there was, after all, a vigilant Experimental Committee, which would promptly issue a report, and then the truth would be known. But no report has ever been published. We have made diligent inquiries as to why the document in question has not been issued, and we have received various replies. According to one statement the report is in type, but the committee are doing their best to obtain advertisements, and when these have been got together the report will be published. The principle involved is that followed by certain omnibus conductors; they will not move until their vehicle is full. According to other statements there is no report in existence; nothing but certain disjointed memoranda not yet put into shape. According to another there was nothing exhibited worth reporting about. It is hardly perhaps necessary to add that the non-publication of the report is a distinct breach of faith with the exhibitors, to say nothing of the public. Medals have been awarded, but no one quite knows why. If it were worth while, a vigorous demand might be made for the production of the report. We are disposed to think, however, that it will prove of very little service. Yet it would be more satisfactory to all parties that, bad, good, or indifferent, it should be produced.

Leaving the South Kensington Smoke Abatement Exhibition to its fate, let us consider what it is that is required. At this season of the year multitudes of domestic fireplaces pour forth volumes of light smoke into the air. The smoke from ordinary dwelling-houses is a very different thing from the smoke evolved from a factory chimney. There is, to begin with, no want of air, such as may exist in a closed furnace. The temperature is, however, too low to secure the combustion of the flying particles of carbon, but the chimneys act beneficently, and great quantities of soot are collected within them. We have already stated, and we now repeat, that it is impossible to design an open fire which will not evolve smoke at least when the fire is first lighted. There are certain forms of grate more or less complex in which the fuel is added from time to time below that already ignited, and these act fairly well by preventing the evolution of that yellow smoke given off by raw coal when first put on a fire, and which is mainly composed of steam evolved from coal more or less damp; but there are objections to such grates which are fatal to their general adoption. It is possible to burn coal without smoke in close stoves, but the game is not worth the candle. Dwellers in London, at all events, will never give up the cheerful open fire for the close stove. No amount of writing or arguing or urging will have the slightest effect in this direction. The want of an open fire in an English winter is an instinct, an appetite, and will be gratified, no matter how much theorists may rave about it. It follows that there are only two remedies that can be used to modify existing defects in house-warming appliances. The first is the use of gas as fuel, the second is the use of smokeless fuel. Now it so happens that the employment of gas in this way has attracted the attention of many ingenious and competent men for years, and they have simply effected nothing. The percentage of houses heated solely by gas in England is infinitesimal. In the first place the price steps into the way. A ton of coal costs, let us say, in London, 27s.; about 10,000ft. of ordinary gas can be got from a ton of coal. It is quite clear that as the coke is left behind the gas cannot contain as much heat as the coal, but the 10,000ft. of gas represent to the consumer about 30s. A ton of coal when all the gas has been extracted is reduced to about 14 cwt. of coke, and this coke is quite as efficient, ton for ton, in heating as coal, but the man using gas for heating does not get this. It may be and, of course, is argued that the gas can be burned to more advantage than the coal, and that the comparison is all in its favour. This may be so, but the open fireplace in which gas can thus be burned has yet to be invented. The nearest approach to it is the well-known arrangement with burners and imitation cinders made of asbestos. No one outside the lists of enthusiasts says that this is a satisfactory substitute for the open fire. We think we can put gas on one side; if so, we have nothing left for consideration but the possibility of using smokeless fuel.

There are two varieties of smokeless fuel available—these are anthracite coal and coke. For reasons which we have already very fully explained, it is improbable to an extreme degree that anthracite will ever come into favour as a fuel in London. Is the case quite the same with coke? We think not; and we even go so far as to say that the only solution of the London smoke difficulty seems to lie in the substitution of coke for coal as fuel; but we are by no means sanguine that it will ever be adopted on the large scale necessary. Ordinary gas coke would hardly answer the purpose; immense quantities of it are, however, used as fuel in London, especially since the gas companies found out that when broken into small pieces people would buy it who before would not have it at any price. But once coke was used in this way on a large scale it would have to be specially made. Some millions of tons of coal would have to be converted each year for London alone, and the cost of the operation would be heavy, unless some means could be devised for utilising the products of distillation. The 14 cwt. or so of coke obtained from a ton of coal would cost as much as the coal did and the cost of carbonising it besides, and the 14 cwt. of coke would not do more heating than 14 cwt. of coal would do. The adoption of coke would therefore mean an increased outlay for fuel which the metropolitan householder would not like. He would prefer to take his chance of fogs rather than pay 6d. a ton more for coal or other fuel. No matter then from what point of view we examine the question of the prevention of the emission of smoke by house fires, we are met by apparently insuperable difficulties. There are, in fact, a multitude of points to be considered. The open fire must be retained; that is imperative. Can an open fire be made to burn without producing smoke, more or less, with bituminous coal? The answer must be in the negative. As we have said, certain complex grates have been made which partially effect the required purpose; but they are not worth the trouble and expense incurred by their use. Again, the grate or "stove" must be of pleasing design; undue dimensions, or ungraceful appurtenances, will suffice to condemn any fireplace. Then cheapness must be considered. We shall be over the mark if we assert that a grate for the people must not exceed £5 in price. This limits the field of invention very closely. The only true remedy consists in washing the smoke, and this could be effected easily enough in some cases. Thus all the fires of a terrace of dwelling-houses might be made to communicate with a detached chimney common to them all, and the smoke in ascending this chimney might be washed; but it is evident that this scheme could not be applied to any extent in existing large towns. It must not be forgotten, as regards the prevention of smoke, that even if all the flying carbon particles which render products of combustion black were to be burned up, everything would not be gained. Fogs in London would, it is true, be cleaner, but they would not be less pungent; neither the carbonic acid nor the sulphurous acid, which now give peculiar noisomeness to a London fog, would be absent. The outlook is, on the whole, very unsatisfactory. Perhaps someone will arise and solve the whole problem, and tell us how to burn coal without making smoke in our dwelling-houses. Meanwhile, we should like to have the report of the South Kensington Smoke Abatement Committee; they ought to have had admirable opportunities of acquiring information which it is time was made public. The latest authoritative announcement concerning it is this:—"The reports of the experts who gave their valuable services as jurors, together with the details of the tests, are now in print, and have undergone final revision." But nothing is said as to the date of publication. We are also informed that, "Encouraged by the practical success of the exhibition held in South Kensington, and the connected exhibition subsequently held in Manchester, the Smoke Abatement Committee has now resolved itself into a Smoke Abatement Institute, which has been duly incorporated and authorised by the Board of Trade, and the details of the proposed mode of action of the Institute will shortly be published." Mr. Hart, the chairman of the new Institute, seems to be thankful for small mercies. In what the success of the South Kensington Exhibition lay has not been defined. The best result obtained being, it appears, that "many of the kitcheners tested are found to be practically smokeless, even when consuming ordinary soft coal; and that the means exist for converting, at moderate expense, ordinary grates and kitcheners to the forms which will, to a great extent, suppress the production of smoke. How far householders will be willing to impose upon themselves the slight inconvenience and expense involved in these alterations remains to be seen." Yet even this is subsequently qualified by the statement that, "It must not be forgotten that, in the opinion of the most eminent authorities, a fully satisfactory result will only be achieved when our present methods of consuming coal for warming our houses are so completely revolutionised that the use of solid fuel is altogether abolished, and for it substituted a cheap and economical gaseous fuel on principles such as those successfully applied by Dr. Siemens in his now well-known coke and gas fire." This is very like an admission that coal cannot be burned in our dwelling-houses without smoke. We have already expressed our opinion concerning the gas fires which are to be substituted for them. As a practical illustration of the nonsense which is being written and published on this subject, we may cite a letter from Mr. Bartlett which appeared in the *Times* on the 25th ult. Mr. Bartlett proposes to solve the whole difficulty "by the simple expedient of a short Act of Parliament, requiring that for the future every building erected within the metropolitan area shall be supplied with stoves or furnaces which consume their own smoke; and, further, that it shall be the duty of the district surveyors to see that the provisions of the Act are effectually carried out." Seeing that no open fireplaces exist which comply with the conditions laid down, this would be tantamount to abolishing the open fireplace by Act of Parliament. Can absurdity go further?

THE INTERNATIONAL ELECTRICAL CONFERENCE.

As far back as the year 1861 the British Association undertook the task of endeavouring to establish satisfactory international standards of electrical measurement. Ever since the British Association has been endeavouring fruitlessly to arrive at a final result, and it has always been baffled by the defects in the systems proposed, and by the want of agreement among electricians and others most concerned. Not only indeed have disputes arisen concerning the nature of the unit to be adopted, but concerning the name which it shall receive; thus what was once known as a Weber, namely, the current produced by 1 volt, in a circuit having 1 ohm resistance, is now called an Ampère; and the change was not made without a battle. Persistent efforts have been made to force on unwilling men units of measure which they did not like, and which have nothing to recommend them. During the electrical exhibition last year at Paris an attempt was made to get certain points settled, but without success. During the present year the International Conference has continued its labours without arriving at any result, and after passing certain more or less meaningless resolutions, it has adjourned until October, 1883. The great fight has been over the ohm standard. For some time back it has been represented by the resistance at zero Centigrade of a column of mercury 1·0486 metres long, and 1 millimetre in diameter, or 41·261in. nearly in length by 0·039in. in diameter; but there is reason to conclude that this is incorrect. One of the resolutions to which we have referred is to the effect that at present there is not a sufficient concord of opinion to enable the numerical value of the ohm to be definitely fixed in terms of the length of a mercurial column, and that all Governments be appealed to by France to encourage further research on the subject. The section for "Electrical Currents and Lightning Conductors" resolved that Government should be requested to favour regular and systematic observations of atmospheric electricity; that it is important for the study of storms to be extended to every country; that wires independent of the telegraphic system should be provided for the special study of earth currents; and that, so far as possible, the great subterranean telegraphic lines, particularly those running north and west, should be utilised for the same purpose, observations being instituted on the same day in the various countries. The section for "Fixing a Standard of Light" expressed the opinion that the light emitted by melting platinum would furnish an absolute standard. In closing the Conference, M. Cochery, the Postal Minister, assured the members that the French Government would endeavour to give effect to their resolutions by representations to the various Governments concerned. It is hoped that the twelve months for which the Conference is adjourned will be sufficient for the searches in the various departments in question to be completed. For ourselves, we do not see the least prospect of finality. There is a want of homogeneity in the Conference and a manifestation of jealousies which must prove fatal to its work. It is fortunate that practical electricians manage to get on very well without the aid of the Conference.

BURSTING OF KRUPP 11-INCH AND WOOLWICH 6-INCH GUNS.

Two serious cases of guns bursting have been recently reported. Curiously enough one is a Krupp gun and the other one of our own. The information received is as follows:—It is reported from Wilhelmshaven that on October 18th, firing took place to test the platform of a 28 cm.—11in.—gun of Krupp's mounted in Fort Heppens. At the second round the steel barrel of the gun burst. As it was a case of proof firing, the detachment were under cover and no one was hurt. The charge was 58 kg.—128 lb.—of powder, the largest employed in this gun. One fragment of the barrel weighing about 1000 kg. —2200 lb.—flew to a distant of over 100 metres, without causing injury, however. The strictest inquiry is to be instituted immediately with regard to this accident. At Shoeburyness, on Thursday, October 26th, a 6in. new type gun—Mark II. we believe, that is a gun of 81 cwt. firing a 100 lb. shot with a charge of 38 lb. of P_2 powder—burst at about its 250th round in front of the powder chamber. The breech is reported not to have been blown out, although fragments of the barrel were blown to a distance of 200 yards. The detachment, who were standing round the gun, did not suffer much, only one man being injured sufficiently to go to hospital. It may be seen that there is an experimental element in both these cases. The Krupp gun was being tried under circumstances when it was considered that some danger might arise to the detachment, though apparently it was the platform that was supposed to be the doubtful element. The Gun Factory gun has already been superseded by a pattern Mark III., weighing 2 cwt. more than Mark II. gun. Nevertheless, unquestionably the accidents are both such as should call for much investigation. It would be unwise to offer conjectures as to the causes where so little is known. The burst in each case has taken place in a barrel of steel.

THE FURNESS RAILWAY.

The probable acquirement by the Midland Railway Company of the Furness line would be another proof of the tendency of railways to merge into great companies. The Furness Railway dates back over thirty years—the first Act for its incorporation on a small scale being passed in 1844, and others in later years elongating it, until it now holds possession of that rich iron field from Carnforth by Barrow to Whitehaven—one of the richest of our iron deposits. It has grown greatly in the past few years, and now its capital approaches £6,000,000, and the length of the line authorised is 180 miles. It is chiefly a mineral line—mineral traffic giving it more than two-thirds of the entire revenue, though its passenger traffic is growing. Of late there has been with the improvement in the iron and steel trades an improvement in the prospects of the Furness, and there has been a satisfactory dividend for several years. Indeed, the Furness Railway may be said to be in the north-west of England a miniature North-Eastern Railway. The acquirement of the railway by the Midland would give to that company what it has long desired—a great and growing port, and would be of the utmost value to it as a feeder in rich mineral traffic. And there would be great benefit to the Furness also, for the shareholders would not find their dividends fluctuate so much as they have necessarily done with the prosperity or the reverse of the iron trade, whilst many of the improvements and extensions that are hesitated over by a comparatively small company would be speedily effected by that great and influential railway that takes its name from the midlands it traverses. It would also give to that company the benefit of a direct access to the lakes, and that benefit cannot be too greatly estimated, when to it is added the fact that the Furness has also a large traffic with the Isle of Man and with Ireland. These facts point to an early union if the interests of the public in the districts served be well protected.

AN ELECTRIC TRICYCLE.

The use of electricity has often been proposed as a motive power for tricycles. Success seems at last to have been attained by Professor Ayrton. Indeed, it appears that the improvements in the storage of electric energy and in electro-motors have so far advanced that tricycles cannot only be lighted, but also propelled solely by electricity, as was seen from the tricycle ridden last week by Professor Ayrton in the City. The Faure accumulators, in which the energy was stored for the lighting and drawing, were placed on the foot-board of the tricycle, and the motion was produced by one of Professors Ayrton and Perry's newly patented electro-motors placed under the seat of the rider. Using one of these special made tricycle electro-motors and the newest type of the Faure accumulators, the total dead weight to be added to a tricycle to light and propel it electrically is only 1½ cwt., a little more than that of one additional person. In the tricycle ridden by Professor Ayrton the ordinary foot treadles were entirely absent, so that there could be no question as to electricity being the sole propelling agency; but with ordinary electric tricycles it may be desirable to leave the treadles, so that while electric propulsion alone is used on the level, the rider can, on going up a steep hill, supplement it by using the treadles, instead of, as at present with the ordinary non-electric tricycle, having to get out and ignominiously push his tricycle up the hill before him.

THE LIFTING STAGE AT MADISON THEATRE, NEW YORK.

Something has been heard in this country of very novel stage effects which are being introduced into the United States, but no details have been published. The arrangements as carried out at the Madison Theatre, New York, are very ingenious. In place of the usual fixed stage a framework is constructed, which may be best described as a box having two open sides—that is,

the front and back of stage. This forms two platforms or stages, and it is lowered or hoisted by steam power vertically, the operation occupying but ten seconds, and the material saving of time to the audience being much appreciated, the upper platform being arranged for use in the next scene, while the lower one is being acted upon. When that is finished with, the whole is lowered into an excavation below, bringing the upper stage on a level with the footlights. The arrangements in rear are necessarily three floors—one level with stage, one above, and one below. Of these two latter only scene-shifters' apparatus are necessary, the centre floor, as usual, being devoted to actors' necessities, with this advantage, that it is left entirely clear for them, being free from the scene shifters' arrangements.

LITERATURE.

Applied Mechanics. By Henry T. Bovey, M.A., Professor of Civil Engineering, &c., at M'Gill University, Montreal. Lovell, Montreal. 1882.

How far the scope of this work really answers to its title may be judged by the following list of its chapters :—Frames, Roofs, Bridges, Suspension Bridges, Arched Ribs, Details of Construction. It will be seen that a young engineer, buying the work in hopes of finding it a complete course of applied mechanics, such as is contained in the works of Rankine and others, would have reason to feel himself aggrieved. The providing and designing of means for bridging over a space is a very important point of applied mechanics, but it is scarcely the whole of it. The book should have been called a treatise on roofs and bridges. With this restriction, it may be commended as containing a good deal of useful information on the forms and joints of roof trusses, the modes of allowing for wind pressure—the value of which the author, after a sweeping condemnation of all anemometers, fixes at 40 lb. per square foot—bridge trusses of various kinds, suspension bridges, and arches. As a Cambridge graduate who has migrated to Canada, the author would seem to have exceptional opportunities for comparing European with American practice in bridge-building—a comparison which ought to be made exhaustively, and could not fail to yield valuable results. Of these opportunities we cannot say that he has altogether availed himself, and we suspect that his practical knowledge has been chiefly acquired since he left this country. He goes carefully into the different trusses—Howe, Whipple, Fink, &c.—and gives a sketch of wire rope suspension bridges, but he assumes that a girder bridge must necessarily be for a railway, he says little or nothing upon plate webs, and scarcely does more than touch the controversy as to the advantages of pin or rivet connections. It is true he gives a dissertation on the strength of rivetted joints, but in this he seems to ignore all that has been lately done in England to advance our knowledge on this subject. On the whole, while there is undoubtedly much in the book that is useful, it is rather hard to say to what class of readers it should be recommended. If it be meant for practical engineers, desirous of studying the subject of trusses, then the copious supply of examples to be worked out seems rather unnecessary. For junior students, on the other hand, these would be valuable, but to make a text book suitable for such readers much more is wanted in the way of preliminary information and statement of principles. Nor is the little we have by any means as clear and satisfactory as it might be. For instance, it is difficult to reconcile the description of the funicular polygon on p. 2 with the definition of the line of resistance on p. 1. Again, on p. 12, in speaking of a strutted king-post roof, we find the following :—"A portion of the weight upon the rafters is transmitted through the struts to the king-post, which again transmits it to the rafters to act partly as a vertical pressure upon the supports and partly as a tension in the tie beam." On this we must remark that the king-post certainly cannot transmit to the rafters anything which they have already transmitted to it, and that all weight on the rafters must be not only partly but wholly represented by a vertical pressure on the supports. Such blemishes as these—not to speak of minor ones in the numbering of figures—should be removed, and the whole preliminary matter rewritten. With greater care and fuller explanations the book may thus be made a valuable introduction to roof and bridge-work, though it will still fall far short of a complete treatise on applied mechanics.

Grundzüge der Graphischen Statik, und deren Anwendung an Continuirlichen Trägern. By Dr. Karl Stetzel. Graz, 1882.

In a review, some time back, of Captain Clarke's "Graphic Statics," we expressed our regret that writers on this subject should insist on applying the graphical method over the whole domain of mechanics, instead of being content to use it in cases where it possesses real advantages. The present short treatise, coming to us from the ancient and pleasant capital of Styria, carries out the principle we contended for in its fullest extent. In fact, it can hardly be said to be a work on the principles of graphic statics, except in so far as these apply to the particular class of problems aimed at, viz., those relating to continuous girders. The author begins by assuming the truth of the parallelogram of forces, describes its graphic representation, and then goes on to give those of the funicular polygon and polygon of forces. The properties of these, as they are demonstrated, are exemplified by applying them to various cases of ordinary girders. He then gives a short account of the continuous girder, and—assuming the ordinary principles of elasticity to be known—shows how to construct the funicular polygon for this case. In finding the vertical axis, he follows a method given in 1868 by Professor Mohr, of Stuttgart. Methods are then given, in girders of uniform section, for finding the deflection, bending moments, &c., under various cases of loading, special reference being made to those where some spans may be taken as altogether unloaded, and also where there is uniform loading over part of the girder only. The influence of unequal height in the supports is then considered, and finally a few words are said on girders with variable section. The question of live loads, which is of high importance in almost all practical cases of continuous girders, is not, however, treated at all; and the work must therefore be pronounced incomplete in both the subjects covered by its title. It is a promising fragment, and one is therefore the more disappointed that it is a fragment only.

FRIEDRICH WOEHLER.

At the age of eighty-two years and full of honour, after a life actively devoted to scientific work of the highest and most accurate kind, which has contributed more than that of any other contemporary to establishing the principles on which an exact science like chemistry is founded, the illustrious Wöhler has gone to his rest.

After he had worked for some time with Berzelius in Sweden, he taught chemistry from 1825 to 1831 at the polytechnic school in Berlin ; then till 1836 he was stationed at the higher polytechnic school at Cassel, and then he became ordinary professor of chemistry in the University of Göttingen, where he remained till his death. He was born on the 31st July, 1800, at Eschersheim, near Frankfort-on-the-Main.

Until the year 1828 it was believed that organic substances could only be formed under the influence of the vital force in the bodies of animals and plants. It was Wöhler who proved by the artificial preparation of urea from inorganic materials that this view could not be maintained. This discovery has always been considered as one of the most important contributions to our scientific knowledge. By showing that ammonium cyanate can become urea by an internal arrangement of its atoms, without gaining or losing in weight, Wöhler furnished one of the first and best examples of isomerism which helped to demolish the old view that equality of composition could not co-exist in two bodies A and B with differences in their respective physical and chemical properties. Two years later, in 1830, Wöhler published, jointly with Liebig, the results of a research on cyanic and cyanuric acid and on urea. Berzelius, in his report to the Swedish Academy of Sciences, called it the most important of all researches in physics, chemistry, and mineralogy published in that year. The results obtained were quite unexpected, and furnished additional and most important evidence in favour of the doctrine of isomerism. In the year 1834, Wöhler and Liebig published an investigation of the oil of bitter almonds. They prove by their experiments that a group of carbon, hydrogen, and oxygen atoms can behave like an element, take the place of an element, and can be exchanged for elements in chemical compounds. Thus the foundation was laid of the doctrine of compound radicles, a doctrine which has had and has still the most profound influence on the development of chemistry—so much so that its importance can hardly be exaggerated. Since the discovery of potassium by Davy, it was assumed that alumina also, the basis of clay, contained a metal in combination with oxygen. Davy, Oerstedt, and Berzelius attempted the extraction of this metal, but could not succeed. Wöhler then worked on the same subject, and discovered the metal aluminium. To him also is due the isolation of the elements Yttrium, Beryllium, and Titanium, the observation that silicium can be obtained in crystals, and that some meteoric stones contain organic matter. He analysed a number of meteorites, and for many years wrote the digest on the literature of meteorites in the *Jahresbericht der Chemie;* he possessed perhaps the best private collection of meteoric stones and irons existing. Wöhler and Sainte Claire Deville discovered the crystalline form of boron, and Wöhler and Buff the hydrogen compounds of silicium and a lower oxide of the same element. This is by no means a full statement of Wöhler's scientific work ; it even does not mention all the discoveries which have had great influence on the theory of chemistry. The mere titles of the papers would fill several closely-printed pages. The journals of every year from 1820 to 1881 contain contributions from his pen, and even his minor publications are always interesting. As was truly remarked ten years ago, when it was proposed by a Fellow of the Royal Society that a Copley Medal should be conferred upon him : "for two or three of his researches he deserves the highest honour a scientific man can obtain, but the sum of his work is absolutely overwhelming. Had he never lived the aspect of chemistry would be very different from that it is now."

While sojourning at Cassel, Wöhler made, among other chemical discoveries, one for obtaining the metal nickel in a state of purity, and with two attached friends, he founded a factory there for the preparation of the metal.

Among the works which he published were "Grundriss der Anorganischen Chemie," Berlin, 1830, and the "Grundriss der Organischen Chemie," Berlin, 1840. Nor must we omit to mention "Praktischen Uebringen der Chemischen Analyse," Berlin, 1854, and the "Lehrbuch der Chemie," Dresden, 1825. 4 vols.

At a sitting of the Academy, held on 2nd October, 1882, M. Jean Baptiste Dumas, the permanent secretary, with profound regret, made known the intelligence of the death of the illustrious foreign associate, Friedrich Wöhler, professor in the University of Göttingen. He said :—"M. Friedrich Wöhler, the favourite pupil of Berzelius, had followed in the lines and methods of work of his master. From 1821 till his last year he has continuously published memoirs or simple notes, always remarkable for their exactness, and often of such a nature that they took among contemporaneous production the first rank by their importance, their novelty, or their fulness. Employed chiefly, during his sojourn in Sweden, in work on mineral chemistry, he has remained all his life the undisputed chief in this branch of science in German universities. This preparation and pre-occupation, which one might have thought sufficient to occupy his time, did not, however, prevent him from taking the chief part in the development of organic chemistry and of filling one of the most elevated positions in it.

"His contemporaries have not forgotten the unusual sensation produced by the unexpected discovery by which he was enabled to make artificially, and by a purely chemical method, urea, the most nitrogenous of animal substances. Other transformations or combinations giving birth to substances which, until then, had only been met with in animals or plants, have since been obtained, but the artificial formation of urea still remains the neatest and most elegant example of this order of creation. All chemists know and admire the classical memoir in which Wöhler and Liebig some time after made known the nature of the benzoic series, and connected them with the radicles of which we may consider them as being the derivatives comparable with products of a mineral nature. Their memoirs on the derivatives of uric acid, a prolific source of new and remarkable substances, has been an inexhaustible mine in the hands of their successors.

"This is not a moment when we should pretend to review the work which M. Wöhler has done in mineral chemistry. Among the 240 papers which he has published in scientific journals, there are few which the treatises of chemistry have not immediately turned to account. We need only confine ourselves to the discovery of aluminium to which the energy and inventive genius of our *confrère*, Henry Deville, soon gave a place near the noble metals. United by a rivalry which would have divided less noble minds, these two great chemists carried on together their researches in chemistry and joined their forces to clear up points still obscure in the history of boron, silicium, and the metals of the platinum group, and remained closely united, which each year only strengthened.

"The reader will pardon me a souvenir entirely personal. We were born, M. Wöhler and I, in 1800. I am his senior by a few days. Our scientific life began at the same date, and during sixty years everything has combined to bind more closely the links of brotherhood which has existed for so long a time."

CONTRACTS OPEN.

The East Indian Railway Co. requires tenders for the supply of twenty-five locomotive engines, each engine to have inside cylinders, 18in. diameter and 24in. stroke, and six wheels 5ft. diameter, all coupled ; wheel base 15ft., gauge 5ft. 6in. (Indent 48). (1) The work comprised in this specification consists of twenty-five locomotive engines without tenders, suited to the 5ft. 6in. gauge. The engines are to be built in general accordance with the drawings marked 1960, Nos. 1 to 148, which are exhibited with this specification subject to such alterations as are named in this specification, or may be directed subsequently by the company's engineer. The contractor whose tender is accepted must make his own copy of the drawings, and must prepare, at his own cost, from them, from the specification, and from the instructions of the company's engineer, a complete set of detail drawings, which are to be in every respect as shall be approved by the company's engineer. The contractor is to be entirely responsible for the efficiency of the engines in all respects, notwithstanding any approval which the company's engineer may have given of the detail drawings prepared by the contractor; and the company do not guarantee the accuracy of the drawings exhibited. (2) The general dimensions and capacity of the engines are as follows :—

Engines.

Diameter of cylinder	18in.
Length of stroke	24in.
Diameter of wheels	5ft. ½in.
Total wheel base	15ft.
Working steam pressure, per square inch	140 lb.
External heating surface of tubes, not less than	1146 sq. ft.
Heating surface of fire-box, not less than	1115 sq. ft.
Grate surface	19½ sq. ft.

Materials.—(3) The whole of the boiler plates which are flanged or otherwise worked in the fire, the rivets used in the boilers, and also all other parts specially mentioned in the specification must be of Lowmoor iron, supplied by the Lowmoor Iron Company. The remainder of the plates, angle irons, bars, and rivets to be used in those engines, except in the platforms, tanks, smoke-boxes, chimneys, ash-pan, clothing, awnings, fire doors, buffer, and framing plates are to be of Lowmoor, Bowling, Farnley, or Taylor Brothers best quality of iron obtained from the makers. Frame plates are to be of Yorkshire quality, made by Messrs Cammell, Messrs. Sir T. Brown and Co., or the Park Gate Iron Company, or makers of equal character in the opinion of the company's engineer. All other plates and all angle irons must be of best best, made by some manufacturer approved by the company's engineer, unless otherwise specified. All plates and angle irons are to be legibly marked with the maker's name and brand, which are to be so placed that they can be seen when the part of the engines in which it is used is finished. The cast iron used in all articles having working surfaces is to be made from cold blast pig iron, and must be close-grained, hard, tough, and perfectly free from all defects and blemishes. The india-rubber is to be of the best quality, obtained from a maker approved of by the company's engineer. The names of the makers from which it is proposed to obtain the copper plates, copper and brass tubing, steel, and all other materials, are to be submitted to the company's engineer, and must be approved by him before the orders for the materials are arranged. Where brass is not otherwise specified, it must be good tough metal. Gun-metal is to be composed five parts copper and one part tin. All steel used in this contract is to be made of Swedish iron, of high quality, approved by the company's engineer, properly converted in this country by cementation, and then cast in small crucibles, unless other steel be specially mentioned. The company's engineer is to have power to adopt any means he may think advisable in order to satisfy himself that the kinds of materials specified are actually used throughout the contract.

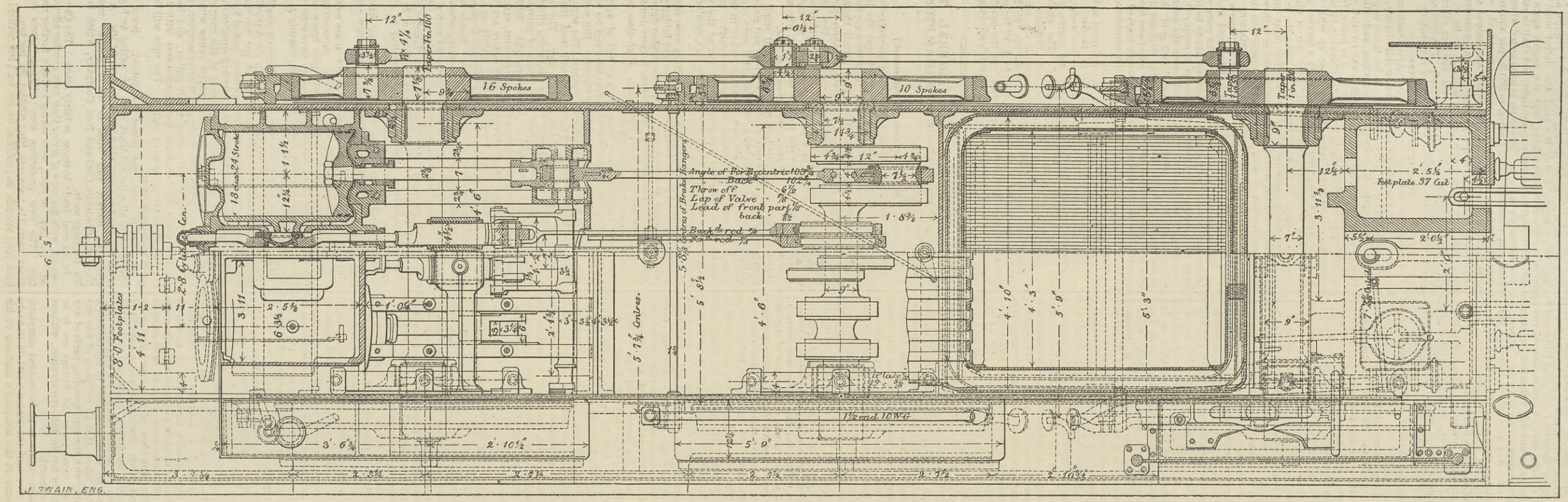
Boiler Barrel.—(4) The barrel of the boiler is to be made of two $\frac{7}{16}$in. and one ½in. plates, in three rings, each of one plate, arranged telescopically, the least internal diameter being 4ft. 3in. The vertical seams are to be lap-jointed and single rivetted, 2½in. lap, 1¾in. pitch of rivets, and ¾in. diameter of rivets. The longitudinal seams are to be jointed and double rivetted, with inside and outside butt strips, 7¼in. wide by ⅝in. thick. The butt strips are to be so rolled that the fibre of the iron may be in the same direction as in the plates they connect. The joint of the middle plate will be welded under the dome, and the inside strip must be carried round the opening to the edges of the plates, and be ½in. thick ; the joints of the other rings must be above the water level. The front tube plate is to be ⅝in. thick, flanged forward to carry the smoke-box, and secured to the boiler barrel by an angle-iron ring, bored, faced, and turned on the edges. When finished this angle-iron ring must be nowhere less than 1½in. thick, and it must be zig-zag rivetted to the barrel, but single rivetted to the tube plate. A wrought iron ring, 2ft. inside diameter, made of one plate ⅝in. thick, welded and flanged, is to be rivetted to the middle plate of the boiler barrel. A dome of the same diameter, and made in the same way of ⅝in. plate, having a corresponding flange, is to be bolted to the upper flange of the ring. The meeting flanges of ring and dome must be turned all over, and the joint scraped perfectly true, and when finished they must be each 1in. thick. The joint must be held by ⅝in. bolts at not more than 2½in. pitch. Suitable wash-out plugs are to be inserted in the smoke-box tube plate, fire-box shell, and in any other place they are required.

Mud Collector.—(5) A hole not larger than 6in. diameter is to be cut at the bottom of the middle ring of the boiler barrel, over which a wrought iron ring flanged at each edge is to be rivetted. The flange on the boiler must be not less than 2⅜in. wide by $\frac{9}{16}$in. thick. On this ring a wrought iron cover is to be bolted. The ring and cover are to be turned and faced to make the joint, and the cover is to be fitted with a gland cock worked from the foot-plate, and a copper discharge pipe carried out to the front of the cylinder.—(6) The fire-box casing is to be raised above the level of the top of the barrel. The top and sides of the fire-box casing are to be made in one plate ½in. thick. The front plate is to be ⅝in. thick, and back plate ½in. thick. The front plate is to be flanged and double rivetted to the boiler barrel and to the fire-box casing. The back plate is to be flanged all round, and double rivetted to the side plates.

Safety Valves.—(7) A hole not larger than 1ft. 1½in. in diameter is to be made in the top of the fire-box casing, over which a wrought iron ring is to be rivetted. The upper face of the ring is to be turned and faced, and finished to form the seating for a pair of Ramsbottom safety valves, made in one casting.—(8) *Boiler Staying :* The front tube plate is to be stayed by a deep tee iron rivetted across the tube plate inside the boiler. The upper part of the back plate of the fire-box casing is to be stayed to the barrel of the boiler and to the front tube plate. Palm stays will also be fixed to the boiler barrel and the front plate of fire-box.—(9) *Boiler Expansion Brackets :* The after part of the boiler is to be carried by angle irons rivetted on the sides of the fire-box shell, and supported by wrought iron brackets fixed to the frame plates. A steadying stay is also to be fixed on back of fire-box shell, and held by suitable attachment to frame or cross stay. Al

CONTRACTS OPEN.—SIX COUPLED LOCOMOTIVE FOR THE EAST INDIAN RAILWAY.

(For Specification see page 337.)



sliding surfaces are to be planed.—(10) All holes for rivets, tubes, stays, cocks, washing-out plugs, and other fittings in all parts of the boiler are to be set out to template. All rivets must completely fill the holes, which must be perfectly fair with each other in all plates. No drifting will be allowed under any circumstances. The edges of all plates, butt strips, flanged plates, flanged or angle iron rings, and covers must be planed or turned, and if the edges are to be caulked or otherwise worked, they must not be left square, but be shaped to an angle of 1 in 8, so as to leave a full side for caulking or working.

Firebox.—(11) The fire-box is to be made of copper plates of the very best quality, obtained from makers approved by the company's engineer, and the plates are to be obtained from at least two makers. The plates are to be flanged by the contractor for the engines in his own works, and pieces of each plate are to stand a test of being doubled cold without showing any signs of cracking. A piece of copper will be taken from the set of plates for each fire-box and tested by a metallurgist selected by the company's engineer. The cost of each analysis, which will not exceed £3 3s., is to be borne by the contractor. Should the piece analysed show more than one-half per cent. in all of arsenic, antimony, and other deleterious substances, the set of plates represented by the test will be rejected. All holes are to be drilled and the edges of the plates planed. The tube plate is to be $\frac{7}{16}$in. thick tapering below the tubes to $\frac{1}{2}$in. thick at the bottom. The top and sides are to be made in one plate $\frac{1}{2}$in. thick. The back plate is to be $\frac{1}{2}$in. thick and thickened to $\frac{5}{8}$in. thick round the fire-hole. The lap of the plates is to be 2½in., diameter of rivets $\frac{5}{8}$in., and pitch 1$\frac{13}{16}$in. Brackets or studs for supporting a fire-brick arch are to be fixed in the fire-box. Two brass plugs, with fusible centres, are to be inserted into the crown of the box, clear of the brick arch, and are to project $\frac{1}{2}$in. into the water above the top of the fire-box. (12) The side, back, and front plates of the fire-box are to be stayed to the fire-box casing by copper stays made of the best soft rolled copper bars, which must be obtained from the same makers and be subject to the same tests and analysis as the plates. These stays are $\frac{5}{8}$in. diameter, screwed 14 threads to the inch, and spaced not farther apart than 4in. centres. Both plates are to be tapped and the stays tightly screwed into them by hand. The ends are to be sawn off to avoid drawing the thread. They are to be snap rivetted on the outside and hand rivetted on the inside, the thread being turned off the portion of the stay between the plates. Such of the stays as may be directed shall have holes drilled down the centre. The stay hole may be tapped by machinery, but the stays must be screwed in by hand. (13) The crown plate is to be stayed by solid forged wrought iron bars, bedded on the ends of the fire-box, and secured to the crown plates by iron bolts 1in. diameter, tapped into the roof stays. These bolts will have square heads, and must be turned with a radius of $\frac{1}{4}$in. in the necks, so as to bed closely to the plate. There is to be an iron ferule on each bolt, to act as a distance piece between the bottom of the stay and the plate. This distance must not be less than 1$\frac{3}{4}$in. These bolts must not be spaced at greater distances than 4in. centres. The roof stays will be attached to sling stays fixed to the roof of the fire-box shell.

Tubes.—(14) The tubes are to be made of a mixture of 70 parts of copper and 30 parts of best Silesian spelter. They are to be solid drawn, and obtained from makers approved by the company's engineer, and they are to be obtained from at least two makers. They are to be 1$\frac{3}{4}$in. diameter outside No. 11 B.W.G. thick for 1ft. next the fire-box, then tapering to No. 13 B.W.G. at the other end. The tubes must be parallel on the outside, the difference of thickness being given on the inside. The ends are to be carefully annealed. At the smoke-box end the tubes must project through the plates at least $\frac{1}{4}$in. There will be no ferules at this end, but the tubes must be fixed with one of Dudgeon's tube expanders. At the fire-box end the tubes must be expanded and carefully laid over, $\frac{1}{4}$in. projection being allowed for the same. The ferules are to be of solid drawn cast steel tube, turned to go into the tubes a tight driving fit, care being taken that the ends of the tubes are not cracked. The ends of the ferule inside the tube must be rounded to prevent its cutting the tube, and the ferule must project $\frac{1}{4}$in. outside the tube. The company's engineer will have power to select one tube from every five boilers, which will be tested by a metallurgist selected by himself; the cost of analysis, which will not exceed £3 3s., is to be borne by the contractor. If any tube is found to differ from the specification, or to show the presence of more than 1 per cent. of other metals or impurities, the lot of tubes from which it was selected will be rejected.

Fire-hole and Door and Foundation Rings.—(15) A square opening is to be made in the back plates of the fire-box and fire-box casing for firing. The bar round this opening must be formed of a forged ring, 2$\frac{3}{4}$in. wide by 3$\frac{3}{8}$in. thick, planed on both sides, and made so that a projection of $\frac{3}{8}$in. is inside the copper plate. The rivets in the shell plate must be countersunk. The fire-hole door is to be made so that, when running with the door partly open in the usual way, there shall be no direct radiation of light or heat from the fire on to the foot-plate, and a deflecting plate is to be fitted inside the fire-hole. The fire-box and casing are also to be connected together at the bottom by a forged ring, 2½in. by 2½in., which must be slotted all round both inside and outside. (16) Proper brackets and bearers are to be secured to the foundation ring of the fire-box to receive the fire-bars, which are to be of wrought iron. (17) An ash-pan is to be placed under the fire-box and secured to the foundation ring by an angle iron running the whole length of the sides. The doors at the front and back ends are to be worked from the foot-plate by levers and connecting bars. There is to be a perforated plate at each door to act as a spark arrester, which must be so arranged as to open when required, for cleaning out the ash-pan. The plates of the ash-pan are to be $\frac{1}{4}$in. thick, and the bottom part must be made water-tight. (18) The top, front, and sides of the smoke-box are to be made of $\frac{1}{4}$in. plate, the whole to be rivetted with csk. rivets, and all plates are to be ground smooth. It must be perfectly air-tight. All nuts in smoke-box are to be of gun-metal with ends cast on. A plate is to be placed across the smoke-box to form a spark arrester. (19) The chimney is to be made of $\frac{1}{4}$in. plate, rolled and worked smooth. The seams are to be butt jointed, with inside butt strips and all the rivets countersunk, and the whole when rivetted up is to be ground smooth. The top is to be finished with a bell mouth of iron. The body of the chimney is to be carried down until it joins the smoke-box, the bell-shaped base being outside the body.

Boiler Fittings.—(20) The boiler is to be fitted with two clack boxes, having gland cocks placed between the clack and the boiler, with four wash out plugs and seatings, not less than seventeen mud plugs, and a mud door, one gland blow-off cock to be worked from the foot-plate, two glass water gauges, one scum cock, injector cocks, two whistles, one reducing valve of approved make for the brake cylinder, pressure gauge to indicate up to 200 lb. per square inch, and which must be of Bourdon's own make, and all other usual and necessary fittings. The four wash out plugs are each to have the thread on the outside, and are to be placed two on each side of the fire-box casing on a level with the crown of the fire-box; one of the mud plugs is to be placed at each of the bottom corners of the fire-box casing, six on the side plates of the firebox casing, and two in the back plate on a level with the crown of the fire-box, and five in the smoke-box-tube plate. All the mud plugs are to be 1$\frac{1}{4}$in. diameter, and to have the same taper, and are to be screwed with eleven threads to the inch. The steam jet will be formed by the gun-metal nozzle of the blast pipe being cast hollow and being perforated with small holes. Two nozzles of different sizes must be supplied with each engine. The cock is to be worked by a handle from the foot-plate, and the steam for the injectors is to be taken from the dome by means of pipes inside the boiler. All the above-mentioned mountings are to be of gun-metal, and they are all to be finished in the best possible style; all joints connected with them are to be faced perfectly true, and made with boiled oil. Wherever possible the fittings are to be fixed on to seatings rivetted on the boiler or fire-box casings. All the nuts are to be faced and polished. All the fittings in this clause are to be finished bright. A cast iron regulator, with two gun-metal slides opening upwards, is to be fixed in the dome. Stops are to be cast on the valves to prevent them falling in case the regulator rod should fail. The valve is to be worked by a crank on a rod passing through the boiler.

Steam Pipes.—The internal steam pipe is to be of copper 9 B.W.G., having a gun-metal cone at its junction with the regulator, to which it is to be attached by wrought iron clips and bolts. It is fixed to the tube plate by a gun-metal flange brazed on to the pipe and bolted to the tube plate. The steam pipe is to be continued from the tube plate by a strong cast iron tee piece, and pipes of copper No. 9 B.W.G. thick, with gun-metal flanges to each cylinder. The internal steam pipe and the breech pipes are each to be 4½in. diameter inside.

Boiler Clothing.—The boiler and fire-box shell are to be covered with strips of well-seasoned teak placed inside a crinoline framing of hoop iron, on which the smooth iron covering sheets are to be fixed by bands drawn together by a bolt under the boiler or at the side of the fire-box shell, and by screws at the longitudinal joints. The dome is to be covered with strips of wood in the same manner as the boiler barrel, and with an iron casing neatly worked, hammered smooth, and painted. The wrought iron base of the safety valves is also to be covered with an iron casing, hammered smooth, and painted.

Framings.—The frames are to be each rolled in one plate. They are to be planed all over on the inside, and when finished are to be 1$\frac{1}{4}$in. thick in the thinnest place, and are to be perfectly sound and free from all lamination, scale, or other blemish or defect. All the holes are to be marked from one template, and drilled and rhymered out to the exact size given. The frames must be finished with a good smooth surface, and they must be free from cross winding. When the frames and cylinders are rivetted and bolted together, both before and after the boiler is in its place, the accuracy of the work must be carefully tested by diagonal, longitudinal, and transverse measurements. The frames and lines must be in every respect to gauge and dimensions, the whole square, plumb, and level, and the axle-box guide also square with the engine in every direction.

Platform, Foot-plates, &c.—The platforms are to be of $\frac{1}{4}$in. plate. The side platform, from the front of the engine to the cab, is to be in one plate. All the rivets in the foot-plates and platforms are to be countersunk, and a strong angle iron in one piece for the whole length is to be rivetted to the outer edge. There will be two sand-boxes, one on each side of the engine, having a pipe for carrying the sand on to the rail as close to the leading wheel as possible. The boxes must be water-tight, and fitted with valves, which will both be worked by one handle on the foot-plate behind the fire-box. A wrought iron hand rail, 1$\frac{1}{4}$in. in diameter, will run along the boiler and fire-box, at a suitable height from the side platform. All handles of rods and levers on the foot-plate must be brought to a position convenient and near to the driver or fireman, and they must be arranged neatly in by a quadrant or frame. A wooden

grating of teak is to cover the foot-plate. A lamp and holder must be fixed to the stay plate between the frames, to illuminate the valve motion.

Cylinders.—The cylinders are to be of cold blast cast iron, as hard as possible, free from honeycomb, and other defects or blemishes. They are to be 18in. diameter when finished, and suited to a 24in. stroke. The clearance at each end must not be more than $\frac{3}{8}$in. They must be 18$\frac{1}{4}$in. diameter at each end, and the leading piston rings must overrun the end of the barrel $\frac{1}{4}$in. at each end of its stroke. All joints are to be planed or turned, and scraped to a true surface. All the bolts securing the cylinders to the frames are to have cupped heads on the outside. They must be driven in as tight as possible, and have nuts on the inside. All glands and packing rings to be of gun-metal. All the nuts in the smoke-box connected with the cylinders are also to be of gun-metal, and must have solid ends. The cylinders are to be provided with gun-metal lubricators and water cocks, the latter worked by a handle from the foot-plate. Each pair of cylinders must be cast of the same metal, and when finished they must be tested by hydraulic pressure to 250 lb. per square inch. The exhaust pipes are to be of copper, No. 9 B.W.G., and are to have gun-metal flanges, and are to terminate in a gun-metal nozzle, which will also form the steam jet. The slide valves are to be made of gun-metal. The buckle is to be of wrought iron. The pistons are to be of cast iron, of a softer description than the cylinders, and turned $\frac{1}{32}$in. smaller than the cylinder. The rings are to be of gun-metal. They will be turned $\frac{1}{4}$in. larger than the cylinders, and then cut at an angle and sprung into their places. When finished the whole must be an easy but accurate fit in the cylinder, so that the piston and rod can be moved easily backwards and forwards. The piston rods are to be made of steel—carefully annealed—made by some maker approved by the company's engineer. They are to be fixed to the piston by a cone and nut. The coned parts fitting into the crosshead and piston are to be of larger diameter than the body of the piston rod. The connecting rods are to be forged of Lowmoor iron, in one length, without weld, and then machined and finished bright all over. They are to be fitted with gun-metal bearings. The cotters and set screws are to be of the best crucible cast steel—carefully annealed—and the bolts are to be made of Lowmoor iron. These rods, and also the coupling rods, are not to be made of scrap iron; they must be made of new iron, the forgings being made by the Lowmoor Iron Company. The coupling rods are to be of Lowmoor iron, forged solid in one length without weld. They are to be machined and finished bright all over, and to be made with solid circular ends fitted with gun-metal bushes. All keys and set screws are to be of best crucible cast steel. The slide blocks are to be of cast iron perfectly sound and chilled on the bearing surfaces. The crosshead will be of wrought iron, and the pin of steel or of iron case-hardened. The slide bars are to be of steel, of the same quality as the piston rod, machined all over, and made perfectly true. The slide bar brackets are to be planed on both sides, and bolted to the motion plate with turned bolts, or rivetted with cold turned rivets.

Excentrics.—The excentrics are to be in two pieces, the smaller piece being of wrought iron, and the larger piece of cylinder metal, fastened together by wrought iron bolts. The excentrics are to be held on the shaft by steel keys $\frac{3}{4}$in. by lin., and by two $\frac{3}{4}$in. steel set screws. The excentric straps are to be of wrought iron, having a gun-metal liner. The excentric rods are to have butt ends, and be fastened to the straps by bolts. The excentrics and straps are to be faced on the sides, and the straps are to be $\frac{1}{4}$in. narrower than the excentrics. The butts and rods are to be planed, and all bolts and studs are to be turned, and the heads faced and polished. The bolts through the straps are to have the heads shaped to suit the straps.

Valve Motion.—All parts of the link motion, from valve spindle to the sector plates, are to be of Lowmoor iron, machined all over, and got up bright, and the joints case-hardened, and finished in the best manner. All rubbing and wearing surfaces must be as large as possible. The width of the expansion link is not to be less than 2$\frac{1}{2}$in., and the pins must not be less than 1$\frac{3}{4}$in. diameter. All the holes must be perfectly fair and true, all the pins parallel, and all the surfaces true to one another, and there must be no spring or twist upon any part when it is all coupled up. All the separate parts must be, as in all other cases, interchangeable. A test piece of iron, $\frac{3}{4}$in. diameter, must be put with all articles in the furnace to be case-hardened; this, after being hardened, must be broken and submitted to the company's engineer for his approval. The case-hardening of this test piece must be at least 3·32in. deep, or the articles case-hardened with the test piece will be rejected. The reversing screw is to be fixed on the left-hand side of the engine injectors. There will be two injectors, No. 10 size, of the Gresham and Theward pattern, and of gun-metal, the cones being made movable for renewal. The feed, steam, and delivery pipes are to be of solid drawn copper, No. 9 B.W.G. All the flanges must be marked from a template, and the pipes are to be so uniform in length that they may be used in any engine. Care must be taken that they may be so set that the flanges may fairly bed without any spring upon the pipes. All the joints are to be faced and made with boiled oil.

Wheel Bodies.—The bodies of the wheels are to be forged with solid arms and bosses, and neatly finished. The bosses are to be bored out, and the rims rough turned. The wheels are then to be pressed on their axles by hydraulic pressure and keyed. The rims are to be finished on their own axles, and the tires put on and turned. Should any of the rims or bosses be found defective after boring or turning the wheel will be rejected. The outside diameter of the wheel centres are to be turned to a gauge, to ensure all being exactly alike in diameter. The wheels are to be forced on the axles by a hydraulic pressure of 12 tons per inch of diameter of axles.

Tires.—The tires are to be made from steel of the highest repute for locomotive purposes by manufacturers, and in a manner approved by the company's engineer, and they are also to be of the highest quality of their classes made by the approved manufacturers. They are further to stand the following tests:—One tire in every batch delivered, if the batch be less than fifty, or one in every fifty if more than that number be delivered, will be tested in the following manner: The tire being placed in a running position, and resting on a solid foundation, a weight of 20 cwt. will be allowed to fall freely on the rim from a height of 10ft. and upward, until the deflection of the tire amounts to one-sixth of its original diameter on the tread; a piece will then be cut, and machined cold from the tires tested as above, and be tested for tensile strength. Should the tire show signs of cracking when submitted to the falling weight test, or should the piece submitted to a tensile test fail to stand a strain of 45 tons per square inch of original section, or should the percentage of reduction of area at the point of fracture be less than 20 per cent., the batch of tires from which the tested tire was taken shall be rejected, unless it shall appear by such further tests of the same batch as the company's engineer may assent to, that the tire selected did not fairly represent the quality of the batch. The tensile tests are to be conducted by some person approved by the company's engineer, who will report the results of them to him. The falling weight tests are to be conducted at the works of the manufacturers of the engines, after the delivery of the batch from which the tires tested are taken; and he must find all necessary testing machines, which must be constructed in a manner approved by the company's engineer, and be at all cost of the testing, and must return the tires to the firm who made them, if the tested tires should fail to stand the specified tests. All rejected tires will be marked in some easily distinguishable manner, but not so as to render them unsaleable to other parties. The tires must be carefully bored, and turned all over to a thickness of 2$\frac{1}{2}$in. in the middle of the tread, and to a width of 4$\frac{1}{2}$in., and shrunk on at a low heat, one-thousandth part of the diameter being allowed for contraction. They are to be secured to the rims with soft steel stud bolts, tapped into the rims and tires. The balance weights are not to be forged solid with wheels. They must be of cast iron, fitted into the wheels, and held by plates and bolts. The axles are to be of faggotted Yorkshire iron, and made by the Lowmoor Company, or Messrs. Taylor Brothers, and must be turned all over and finished bright. The axles are to be guaranteed to run 150,000 miles for each straight axle, and 100,000 miles for each crank axle, and each axle is to be stamped with the word "guaranteed," and mileage it has to run. Any axle which, before it has run this mileage, shows any defect which, in the opinion of the company's locomotive superintendent, makes it desirable that the axle should be taken out of the engine, is to be replaced by an axle of the same make, and under the same guarantee. The contractor is to accept the statement of the locomotive superintendent as to the mileage run by the axle replacement of which is claimed. The axle to be delivered to the company in any port in England named by the company free of cost.

Crank Pins.—The crank pins are to be of hammered iron, and case-hardened; they are to be forced into the wheels by hydraulic pressure, and carefully rivetted over on the inside. The axle-boxes are to be of cast iron, with gun-metal bearings. The axle-box guides are to be of cast steel, with top and sides in one piece. They are to be hard and close-grained castings, and free from defects of all descriptions. The faces against the frames and axle-boxes are to be planed, the holes are to be drilled perfectly fair, and the guides rivetted to the frames with cold turned rivets countersunk on the guides and on the outside of the frame. The axle-boxes are to fit the backs of the guides, so as to support their own weight.

Bearing Springs.—The steel of which the springs are to be made is to comply, on analysis, with the following conditions. Its carbon must not exceed ·7 per cent., or be less than ·45 per cent. Silicon, phosphorus, sulphur, must not be present in greater proportions than ·06 per cent. each, and the manganese must not exceed ·6 per cent. One plate in every 100 springs will be subject to complete analysis by a metallurgist, selected by the company's engineer. Should the analysis show the carbon, silicon, phosphorus, or manganese in the steel to exceed the specified maximum, or should the carbon fall short of the specified maximum, the lot of springs from which the plate was taken will be rejected. All rejected springs will be marked in some easily-distinguishable manner, but not so as to render them unsaleable to other parties. Each spring is to be tested before being put into its place, by being brought down straight several times, after which it must recover its previous form without damage or permanent set. The spring links are to be provided with screw adjustments of a description satisfactory to the company's engineer. The spring link brackets are to be rivetted to the frames with cold turned rivets. A brake block is to be fixed in front of each of the wheels, the whole to be worked by a steam cylinder placed on the left-hand side of the engine. It must be fitted with a regulating or reducing valve of approved make, so that the brake pressure is easily regulated by the engine-driver. All the working parts are to be case-hardened. The blocks are to be of cast iron, and must clip the flanges of the wheels. The brake is to be arranged so that a screw worked by hand may be fitted in India if desired.

Awning Cab.—An awning is to be provided over the foot-plate, the roof of which will be of wrought iron, No. 16 B.W.G. for the outer, and well-seasoned teak for the inner covering. The sides of the cab are to be formed of sheet iron, with open panels above the handrail level. At the front of the cab, on each side, a glazed window will be placed. A wrought iron weather screen, with two windows 13in. diameter, will be fixed at the top of the fire-box shell.—*Buffer Plank and Buffers:* The buffer plank at the front end is to be of wrought iron 1$\frac{1}{4}$in. thick and 15in. deep. It is to be bolted to 4$\frac{1}{2}$in. angle irons rivetted on each side of each frame plate. The draw hook is to be fitted with a draw spring, consisting of india-rubber cylinders of approved strength. The buffer heads, plungers, and boxes are to be entirely of wrought iron. They are to be fitted with india-rubber cylinders. The whole to be of dimensions and strength to be approved by the company's engineer. The india-rubber springs are to be guaranteed to stand without injury for three years and a-half from the date of the last delivery under this contract; all springs failing within that period are to be replaced by springs under some guarantee. The trailing foot-plate is to be of cast iron of sufficient weight to make an equal load on the three axles. It is to be slotted out at the end to allow the drawbar and safety links to play. The drawbar is to be connected to the engine close up to the fire-box, and is to be at least 2$\frac{1}{2}$in. diameter. The drawbar must be forged in one piece without weld. The safety links are to be of sectional area equal to the drawbar.

Lamps and Brackets.—Two wrought iron brackets are to be fixed on the platform at the front end of the engine. One large head lamp, with a 9in. glass, two side lamps, with 6in. bulls-eye glasses, one red and one white, two gauge lamps, one lamp for valve motion, and two hand lamps to the company's patterns are to be furnished with each engine. Each engine is to be supplied with a teak box with padlock, and containing a complete set of screw keys from $\frac{5}{16}$in. to 1$\frac{1}{4}$in., one large and one small monkey wrench, both worked by a screw, one heavy and one hand hammer, one lead and one copper hammer, and a small assortment of files—12in. and 14in.—chisels, pin, and copper punches, and other useful hand tools. Each engine is to be supplied with the necessary fireirons and tools, viz., rake, pricker, plug rod, dart, tube scraper, long shovel, wire tube brush, foot-plate, brush, and coal shovel; a 20-ton traversing screw jack, a crowbar, an oil can, an oil bottle, and an oil feeder.

General: Means of Lubrication.—All working parts are to be furnished with the most approved fashion, which are to be to the satisfaction of the company's engineer. Oil cups are to be forged or cast on where possible, and in all parts made of wrought iron, unless otherwise specified. The oil cups are to be worked out of the solid, but not in such a way as to diminish the sectional area of the part below its proper strength. When lubricators are forged on solid, the syphon pipes must be also solid. Whenever possible cover must be put on the lubricators and oil cups. Each cylinder is to be provided with a self-acting lubricator to oil the piston when running without steam, and a lubricator on the displacement principle for oiling the slide valves. A lubricator is to be provided for each slide bar; also one above each piston gland and one above each valve spindle gland, with a small pipe from each leading to the rods.—*Bolts, Nuts, and Flanges:* All bolts, heads, and nuts, whether black or polished, are to be made to Whitworth's standard gauges, and screwed to his standard pitch. Articles requiring a screw key are in all cases to be made to one of the standard sizes of nuts. All nuts for cylinders and glands are to be case-hardened.

Painting and Stamping.—Before being cleaded the boiler and fire-box must have two thick coats of red lead and boiled oil, the first coat to be put on when the boiler is hot. The wood cleading is also to have one coat of red lead before the iron plates are put on. The cleading plates, frames, splashers, platforms, and wheels, and all other parts of the engine and tender not got up bright, are, after having been thoroughly filled up and rubbed down to a good surface, to have two coats of lead colour. Every part of the engine is to be marked to its place, to have the number of the engine on it, and the letters E.I.R. The maker's name-plate must not be larger than 6in. by 4in., and must be of cast iron placed as directed by the company's engineer. The woodwork is to be sand-papered and varnished twice, and the outer face of the upper roof is to have three coats of white-lead paint. Each engine is to have fixed in a suitable position a plate with the letters E.I.R., and such other numbers and marks cast on it as the company's engineer may direct. Generally the engines are to be completed in the best style of locomotive work, care being taken that all the parts of any one engine may be interchangeable with the corresponding parts of any of the other engines, and all usual parts and fittings are to be supplied, whether mentioned or not in this specification, without charge beyond the contract amount.

Erection and Testing.—Each engine is to be erected complete, ready for running, on the works of the maker; and it is to be tried in steam in the presence of the company's engineer or his deputy, to whom notice must be given before the trial. The pressure on the boiler during the test is to be kept at 140 lb. per square inch. Should any part of the engine or boiler require alteration, or any defect appear during the trial, the defect must be made good or the alteration completed, and the engine again tried in steam till it shall be perfectly steam-tight, and shall be satisfactory to the company's engineer. The boiler is to be tested when finished, before being mounted on the frames, to 200 lb. per square inch by hydraulic pressure. The weights upon each wheel, when the engine is full and light, are to be carefully ascertained separately by a machine which the company's engineer shall consider satisfactory. Any part of the work which is found to be in any way defective, or not in accordance with the tests or other requirements of this specification, will be rejected. The contractor must provide, free of charge, all tools and labour required by the company's engineer for the inspection of the work.

Preparation for Shipment and Packing.—After each engine has been tested, and the company's engineer, or his deputy, has intimated his approval of them, they are to be taken to pieces and prepared for shipment. The boilers, frames, and other heavy pieces are to have wrought iron rings or hooks rivetted to them, for facility of lifting when being shipped. The boiler, frame, and cylinders, with platform plates and buffer planks, may be shipped in one piece, care being taken to box them up with wood and otherwise protect them from damage in such a manner as shall be satisfactory to the company's engineer. Each pair of wheels, with its axle and cranks, is to be shipped in one piece, the axle journal and cranks being carefully protected by zinc paint and wooden lagging, and the cranks and pins well boxed in with wood. All other parts, including the awning, are to be packed in strong cases lined with tin, well soldered down, the case containing the lamps being further packed with straw in a crate. All parts and cases are to be distinctly marked with their weights, and such descriptive and shipping marks as may be directed. The costs of packing and marking, as well as the costs of delivery, are to be included in the amount at which the contractor tenders to supply the engines.

Drawings.—The contractor is to furnish, with the second engine, three complete sets of detail and general drawings of the engines, exactly as made, on tracing cloth of double elephant size. Each set is to be fastened together with strips of wood and brass thumb-screws, and is to be fitted in a circular tin case marked as may be directed. The cost of these drawings is to be considered included in the amount of the tender.

The engines are to be constructed and delivered as follows:——— weeks from the date of acceptance of tender. The first four engines are to be delivered within —— weeks, and the remainder thenceforward at the rate of one engine every week until the delivery of the whole is completed. The whole contract shall be completed within —— weeks from the date of acceptance of tender. Tenders are to be delivered at the offices of the company, Nicholas-lane, London, E.C., on the the 9th November, before one p.m. They are to be addressed to A. P. Dunstan, Esq., with the words "Tender for Locomotives" on the envelope. The general conditions are as usual in this company's specifications.

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

(*From our own Correspondent.*)

To-day upon 'Change in Birmingham, and yesterday in Wolverhampton, there was much complaining amongst the ironmasters of the low prices which some iron merchants are accepting. These merchants have bought upon terms which permit them to sell at prices only a little in advance of those which makers quoted before the rise of 10s. per ton declared by some of the marked bar houses at the quarterly meetings. It was not therefore easy, either this afternoon or yesterday, to get the full advance for any quality other than that of the marked bar firms, who are quoting upon the basis of £8 per ton as the crucial bar rate.

The business done related largely to hoops and small sections of angles and bars, together with plates for bridge and girder and tank making. There were hoop firms who reported some excellent new business on export account, one firm having booked in the past five days enough work to keep them on for the month. In that case the price named to us was equal to £7 per ton at the works. At £7 also there were sales of good working-up bars, capable of bearing some heavy work on the anvil.

Angles of the usual bridge-building sections were easy to buy at £7 10s. The prices which makers of girder and bridge plates were asking were from £8 10s. to £9. But the higher figure was difficult to secure, notwithstanding that there is more demand for this description of iron this week than last. High-class boiler plates were not to be had at under £9 10s.

The sheet makers reported themselves all full of work for some time ahead in filling orders for the galvanisers and for shipment in the black state, mainly to Russia and Canada. But neither to-day nor yesterday did they do much new business. Nor were galvanised sheets greatly in request. The week's mail from the Cape had brought very few orders and but little money. The reports from Australia, moreover, still testify to the weakening effects of accumulated stocks, for they indicate that prices of galvanised sheets have receded 12s. 6d. per ton on the fortnight. Still the galvanisers reported a better business on home account, mainly for the agricultural shires. Thin stamping sheet orders are keeping the mills of the chief firms fully occupied, mainly on Australian, continental, and United States account. There is plenty of competition, but makers' prices are fully upheld. Sheets of Siemens-Martin steel keep to the fore, and they were being offered to-day at prices quite £3 below those of charcoal iron. At such a figure steel sheets are being rolled by the Hope Company of Tipton from blooms and ingots supplied by Messrs. Tangye, Limited, of Birmingham. The Hope Company are now rolling sheets of 26 gauge, 9ft. by 3ft., and find that the steel will bear rolling to the thinness even of paper.

Messrs. H. P. Parkes and Ross, of Tipton, have recently despatched cables of 2$\frac{1}{2}$in. and 3in. iron, and are now engaged upon some of 2$\frac{3}{4}$in.

The makers of tanks for storing water and oil are mostly busy.

The constructive departments at certain galvanising works are well supplied with roofing orders, mostly upon home account, and during the week some rather good orders have come to hand for ordinary iron roofing for India, one order relating to somewhat over 700 tons.

Makers of iron wire rods were this afternoon unable to report much new business, notwithstanding that in the Australian market fencing wire is worth more by some 7s. 6d. per ton than it was a fortnight ago. Best puddled wire rods were quoted to-day £8 15s. per ton, and second best £7 7s. 6d., delivered equal to Birmingham.

Tin-plate-making is suffering by reason of the competition from South Wales. Owing to the unprofitable prices which rule the market, the Osier Bed Iron Company, Wolverhampton, proposes to close its tin-plate department altogether, and has given a month's notice to terminate its engagements with the men in this branch to the number of eighty. The firm will keep on the sheet business as usual.

Pig iron is quiet, yet prices are upheld. Some makers of Staffordshire all-mine hot-blast sorts are asking as high a figure as £3 15s. per ton; cold-blast keeps firm at £4 10s. A new brand upon the market this week is the "Fenton," made by the North Staffordshire Coal and Iron Company, which is quoted at 55s. for forge sorts.

In the coal trade business is fairly active. The Cannock Chase owners, with the view of giving their men another advance of about 3d. "per day" or stint, were asking to-day a further rise of 1s. per ton. The new quotations were:—"Deep" sorts delivered on truck, best, 11s.; seconds, 10s.; cobbles, 9s. per ton. "Shellow:" best, 10s.; seconds, 9s.; cobbles, 8s. per ton; but realised prices were

generally from 6d. to 1s. under these figures. Steam coal was 6s. to 6s. 6d., which is a rise of 6d.; forge coal was also worth 6d. per ton more than last week. Upon fine slack there was a quoted rise of 6d., and upon rough slack of 1s.

The finished ironworkers of Staffordshire on Monday formally laid their claim for a 10 per cent. advance before the South Staffordshire Mill and Forge Wages Board, meeting in Wolverhampton. They urged that trade had improved, that selling prices of iron had been declared up, and that labour was scarce. They strengthened their claim by stating that the North of England men were already receiving 2½ per cent. more than the Staffordshire men, and were now asking a further advance of 7½ per cent. But the masters refused to advance upon the present rate of 8s. per ton for puddling, short weight, arguing that with marked bars nominally at £8 that was a fair wage. It was ultimately resolved to call in the new president, Alderman Avery, of Birmingham, to arbitrate.

The operatives engaged in the Worcestershire and Staffordshire chain trade have resolved to come out on strike unless their masters concede them an increase of 10 per cent. in wages. During the past eighteen months or so these operatives have, the masters assert, received advances amounting to almost 80 per cent. Owing to the activity in the shipbuilding yards, there is at date a large demand for chains.

The executive of the South Staffordshire and Worcestershire Operative Nailmakers' Association resolved on Monday to give the employers fourteen days' notice for an advance in wages to the extent of 10 per cent. on wrought nails, and 3d. per 1000 on horse nails. This decision affects some 30,000 workpeople.

The Darlaston nut and bolt makers have granted to the operatives an average advance of 10 per cent. upon all swaged bolts, cap, cheese, countersunk, and American, from ¼in. to ½in. bolts, both inclusive, and a similar advance on ⅛in. to ⅜in. swagged square and hexagon head bolts and round necks. The concession is to take effect upon all work made after October 26th, 1882, and to remain in force until June 1st, 1883, subject to a calendar month's notice on either side.

Several of the difficulties that surround the Electric Lighting Act were cleared up on Tuesday. A numerous deputation from the various local boards and other authorities in the neighbourhood of Birmingham waited upon Mr. Chamberlain, as President of the Board of Trade. They asked that the Board would postpone for a reasonable time the granting of provisional orders authorising companies or individuals to supply the electric light within the districts represented by the deputation. The President declared it impossible to grant the request. The deputation were informed that the last clause of Section 4 of the Bill did not deprive them of the right of appearing before the Board of Trade and obtaining provisions to protect themselves just as they could do in the case of tramway orders. Although the Board had power to issue more than one provisional order for the same area, it was not at all likely, said the right hon. gentleman, that they would do so. In the event of a company having secured a provisional order for a system which soon became obsolete in consequence of further discoveries in the science, the local authority could apply for a second order from the Board, and its case would be dealt with upon its merits. But if it was found that the existing undertakers had faithfully discharged their work and spent large sums of money, their interests could certainly not be overlooked by the Board of Trade. The President warmly approved a suggestion that the provisional orders granted to companies for local board districts should allow the company to light only restricted areas. If this were done the local authority could more readily become purchasers of the undertaking than as though the license were extended over a considerable area.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—In the iron market here there is a continued absence of animation. Makers both of pig and manufactured iron are well sold, consumers are mostly well covered for the remainder of the year, and there is a disposition, at least for the present, to work off contracts before entering into further transactions, except for such small odd lots as buyers are compelled to place out. The market may be said to be firm, because makers, having but little iron to offer, are not pressing sellers; but where inquiries are made by buyers for anything like quantities they are not disposed to come up to the full present prices. Just now it seems to be a question of waiting on both sides for any possible turn the market may take.

The Manchester iron market on Tuesday was well attended, but the actual business stirring was very limited. In Lancashire pig iron a few small sales are reported on the basis of 49s. to 50s., less 2½ per cent. for forge and foundry qualities delivered equal to Manchester, and at these figures, which are slightly below the full advance at first asked, local makers are firm. District brands in some cases are a trifle easier to buy. Lincolnshire forge iron could now be got at about 49s. 6d. to 50s., and foundry qualities at 50s. 6d. to 51s., less 2½, delivered here. Derbyshire brands are being offered at 6d. to 1s. per ton above these figures, although one or two makers who are fully sold still quote 53s. to 54s., less 2½.

The Lancashire forges continue busily employed on orders in hand, and in some cases buyers find it difficult to get full deliveries on account of their contracts. In some quarters, however, I hear reports of a slackening off in the quantity of new orders coming in, and although there is still a large quantity of iron going away for export, the shipping trade is not quite so brisk as it was. One or two of the local makers of bars quote £6 12s. 6d. to £7 for delivery into the Manchester district, but these figures are little more than nominal, £6 15s. representing about the average price for good qualities, but inferior brands are to be bought as low as £6 10s.

In the coal trade the month has opened with a general advance in prices, ranging from 3d. to 6d. per ton on engine classes of fuel to 1s. per ton on round coals. So far the demand has been good, and colliery proprietors, largely as the result of the restriction of the output recently enforced by the men, have an accumulation of non-executed orders on hand which will take them some time to work off. The actual pressure of demand, however, shows indications of decreasing, and very general doubts are expressed as to whether the advanced prices can be long maintained. If the men abandon the restriction of the get and the pits return to their full ordinary output, there is little doubt that supplies will again very soon overtake the demand. The present quotations at the pit mouth are about as under:—Best coal, 11s.; seconds, 8s. 6d. to 9s.; common house coals, 7s. 6d. to 8s.; steam and forge coals, 6s. 6d. to 7s. 3d.; burgy, 4s. 9d. to 5s. 3d.; and good slack, 3s. 9d. to 4s. 3d. per ton.

Accompanying the advance in prices there has been an advance in wages equal to about 10 per cent., which is regulated in different districts according to the varying methods of payment. In the Manchester district, where the men do not pay their own drawers, the advance is 2d. per ton, and 2d. per yard on straight work, the underground daymen receiving an advance of 1s. per week, but no change is made in the wages of the topmen. In the West Lancashire districts, where the men are paid so much per ton, the advance will vary in different seams from 2½d. to 4d. per ton, and the average for ordinary work may be given at about 3d. per ton. This is the second advance the men have received within a period of about twelve months, the last advance being given towards the close of 1881, and in represents a total recovery of from 20 to 22 per cent. from the lowest wages ruling during the period of depression following the inflation of nine years ago.

Barrow.—There is no change to note in the hematite iron trade, the demand remaining steady and the business doing being very large. The demand for Bessemer descriptions of iron is especially strong, owing to the large requirements of steel makers in this and other districts. There is also a steady trade in forge qualities of metal. The price of Bessemer iron may be quoted for mixed parcels at 57s. 6d., and large consignments for three months' delivery are reported at this figure. The output of both iron and steel is very large, and it is not probable that it will be necessary to reduce it in face of the fact that during the last few days the stocks of metal on hand have been considerably reduced.

The steamer Normandy for a French firm, 6000 tons burthen, the largest mercantile steamer in the French shipping trade, was launched at Barrow on Saturday. She was alongside the City of Rome in the docks at Barrow. The latter steamer is about to undergo certain alterations which will give greater accommodation for saloons, and give her greater speed at the same time. I will send you particulars of the proposed alterations in an early report.

The rumour that the Midland Railway Company is likely to purchase the Furness railways is confirmed. The docks at Barrow will doubtless receive a great impetus so far as inland trade is concerned if a transfer takes place.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

"ALL these concessions—in Derbyshire and Lancashire—embolden the South Yorkshire delegates to stand out for 10 per cent. at least, and on this basis I anticipate an advance will have to be given if a strike is to be averted." The result has justified these words, which are an extract from last week's letter. At the adjourned conference of miners' delegates, held at Rotherham last Monday, the advance of 15 per cent. was advocated as right and just; but a resolution was passed agreeing to accept 10 per cent., and to reserve the balance—5 per cent.—till some convenient season. Next day the South Yorkshire coalowners met at Sheffield. At the previous meeting, it will be remembered, they offered as their final concession an immediate advance of 5 per cent. coupled with the sliding scale. This was altogether rejected by the men. On Tuesday a resolution was carried declaring that the coalowners still considered that the present price of coal was not a sufficient ground for the advance asked for by the workmen; but with the view of avoiding a strike in the district it was decided to concede an advance of 10 per cent. to the underground workmen from November 2nd, "with the hope that it may be found that such an increase in the price of coal can be obtained as will warrant this increase in wages."

Thus the crisis in the coal trade is past, and a strike is averted. The notices would have expired this week, and a compromise has just been effected in the nick of time. Elaborate arrangements had been made for a strike. The officials of the Yorkshire Miners' Association looked forward to that calamity with a light heart, so far as support to the men was concerned. They said that 164,000 miners were actually getting the advance, and had promised assistance. The districts from which levies would have been drawn, and the number of miners who would have contributed, were:—North and East Lancashire, 23,394; West Lancashire, 21,342; West Yorkshire, 20,000; Derbyshire, 19,161; Leicestershire, 2898; Nottinghamshire, 9896; North Staffordshire, 12,338; South Staffordshire, 14,351; Worcestershire, 2375; Scotland (East), 26,926; Scotland (West), 12,825. An arrangement has not yet been made at the Barrow Collieries, at Worsbro', where the men brought out their tools on Tuesday. Hopes are entertained that the masters will give the 10 per cent., and it is expected that a similar arrangement will be made at Thorncliffe and other collieries. Messrs. Clark, of East Gawber Hall Collieries; Strafford Collieries, near Barnsley; Ollerton Bywater, in the West Riding, have followed suit, and the 10 per cent. is certain to become general. The immediate effect in the Sheffield district has been to raise the price of coal 1s. to 1s. 3d. per ton, which makes an advance, including the 10d. obtained on the 1st of October, of 1s. 10d. to 2s. 1d. per ton.

A deputation from the Town Council of Sheffield, headed by the Mayor, Mr. Michael Hunter, had an interview with the President of the Board of Trade, at Whitehall, on Tuesday. The deputation was accompanied by Mr. Conrad Cooke, consulting engineer. The object of the interview—to which representatives of the press were not admitted—was to consult the President of the Board of Trade as to the position in which corporations like Sheffield were placed by the Electric Lighting Act, and by the rules of the Board for the application for power to use the electric light. The Sheffield Corporation has resolved to oppose the granting of powers to break up the streets or to create a monopoly that would pass into the hands of any person or company, but the local authorities had a difficulty in preparing a scheme to submit to the Board of Trade for themselves obtaining a provisional order. A chief object of the deputation was to see whether they could not have the conditions so relaxed as to give them more time to accomplish what would devolve upon them in the matter. Mr. Chamberlain held out no hope of postponing or materially modifying the operation of an Act so recently passed as that on the subject of electric lighting. A deputation representing Birmingham waited upon Mr. Chamberlain for a similar purpose.

At the London sales, which closed last Thursday, Sheffield cutlery manufacturers and ivory cutters found all descriptions suitable for their purposes very scarce, owing, no doubt, to quantities being still locked up in Egypt in consequence of the late war. There were only sixty-six tons on offer, being about half of the weight usually put up, and making the smallest sale on record. Last year there were 127 tons at the corresponding sale. The highest prices ever realised were paid at the present sale, being no less than £100 a ton advance on the prices at the previous sale. Sheffield ivory has advanced 120 per cent in four years, and the stocks in the country were never known to be so low as they are now. Large African teeth advanced £4, small teeth, £3; East Indian, £4; and Egyptian, £7. Hard Egyptian ivory fetched £1000 a ton, and soft Egyptian about £1150, West Coast African, £1200; and several parcels of Angola realised no less than £1360 a ton. In consequence of these repeated advances, the ivory cutters are raising quotations for handles for the fourth time this year.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

SINCE last week scarcely anything fresh has transpired in connection with the Cleveland iron trade. At the market held at Middlesbrough on Tuesday both makers and merchants adhered steadfastly to the prices they have recently been quoting, in spite of the reported fluctuations of the Glasgow market. Very little business was done, as makers have not much iron to dispose of for delivery during this year, and they are not inclined to accept what is being offered by consumers for next year's requirements. Merchants find difficulty in getting their present needs supplied, and cannot therefore accept many additional orders. Producers in the combination will not take less than 45s. per ton for No. 3 g.m.b., whilst merchants and the other makers ask 44s. 6d. per ton. Buyers are offering 44s. 3d. for the spring of next year, but cannot find anyone willing to book at that figure. The quantity of Cleveland iron in Messrs. Connals' store on Monday night was 102,848 tons, being a decrease of 1048 tons since the previous Monday.

Owing to the stormy weather, shipments from the Tees fell off during the last few days of October. The total, however, amounted to 99,645 tons. In September the quantity exported was 100,838 tons, and in August, 95,861 tons. The total for the three months was therefore 296,344 tons. This eclipses anything that has ever been done before in three consecutive months.

In the manufactured iron trade prices are firm, but very few orders are being placed. Inquiries are numerous, but consumers do not at present seem inclined to pay the higher rates quoted. There is little likelihood of these being reduced, considering that the cost of production has been increased. Ship plates are £6 12s. 6d. to £7 per ton; angles, £6; and common bars, £6 5s., all less 2½ per cent. discount, and free on trucks at makers' works. Puddled bars are £4 2s. 6d. per ton net.

No change has taken place in the steel rail trade. Prices are very low, and little business is being done.

Orders have been received by Mr. C. Wood, of the Tees Ironworks, Middlesbrough, for large quantities of his wrought iron railway sleepers, to be sent out to Fiji and South Africa.

It is reported that a new ship-yard will be started at Walker-on-Tyne in a short time. The gentlemen who are taking the matter up are already connected with the shipbuilding trade on the Tyne. The necessary land has been obtained. It is believed that from 800 to 1200 men will be employed in the yard.

A meeting of the ironworkers employed at the Consett Ironworks was held on Saturday last, when addresses were delivered as to the advantage and benefits to be derived from unionism and submitting disputes to arbitration. Only about one-half of the men at these works are connected with the union. The non-union men were strongly urged to join and give their support to the union and Board. The following resolution was unanimously carried:—"That it having been proved that the principles of unionism are beneficial to the working men, we, the ironworkers at Consett, do hereby pledge ourselves to rally round and support the Board of Arbitration." The appointment of Sir J. W. Pease as arbitrator was cordially endorsed.

The President of the Board of Arbitration received a reply on Friday last from Sir J. W. Pease in reference to his reappointment as arbitrator in the present wages dispute. The hon. baronet says that if both parties think his services will be of use in the settlement of the questions arising in so large and important an industry, he feels that he ought not to decline, provided that the time for taking the evidence can be settled so as to meet mutual conveniences. It is probable that the arbitration will take place at an early date.

The official returns of the metal shipments from the Tees for October show that 43,219 tons of pig iron and 12,097 tons of manufactured iron and steel were sent to English ports. Scotland alone took 27,140 tons of pig iron. To foreign ports the quantity of pig iron exported was 57,426 tons, and manufactured iron and steel 13,530 tons. The bulk of the pig iron was shipped as follows:—Germany, 23,478 tons; Holland, 9827 tons; France, 9297 tons; Spain, 4240 tons; Belgium, 2760 tons; United States, 2075 tons; Norway and Sweden, 2774 tons; and Italy, 1200 tons.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE iron market has been dull almost during the entire week, with comparatively little business doing in warrants, the prices of which have been slightly on the decline. The amount of the shipments compares favourably with that last year, but falls short of general expectation; and this fact has helped to depress the market. Some merchants report that they have purchased pig iron on somewhat easier terms; but the demand still continues good both for home consumption and export. The withdrawals of pigs from Messrs. Connal and Co.'s stores in the course of the week amount to 2000 tons. There are some changes in the number of furnaces in blast, but they are not so great as to very materially alter the amount of the production. The week's shipments amounted to 12,116 tons, as against 13,058 in the preceding week, and 11,981 tons in the corresponding week of last year. The arrivals of pig iron from Middlesbrough are rather heavier than for some weeks, but these imports are still very much behind what they were twelve months ago.

Business was done in the warrant market on Friday forenoon at 50s. 11d. to 50s. 10d. and 51s. cash, and 51s. 1½d. to 51s. 2½d. one month; the afternoon quotations being 50s. 11d. to 50s. 9½d. cash, and 51s. 2½d. to 51s. 0½d. one month. On Monday morning transactions were effected at 51s. 1d. to 50s. 11d. one month, and 50s. 10½d. to 50s. 8d. cash. The same afternoon business was done at 50s. 8d. to 50s. 5½d. cash, and 50s. 10½d. to 50s. 8½d. one month. Tuesday's market was flat, with business in the forenoon at 50s. 5½d. to 50s. 3½d. and again 50s. 5½d. cash, and 50s. 8d. to 50s. 6½d. and again 50s. 8d. one month, the afternoon prices being down to 50s. 2½d. cash, and 50s. 5½d. one month. The market was flat on Wednesday, with business down to 50s. 2d. cash, while today—Thursday—there was a further decline to 49s. 11½d.

There is not much change in the quotations of makers' iron, which are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 65s.; No. 3, 55s.; Coltness, 69s. 6d. and 56s.; Langloan, 68s. and 56s. 6d.; Summerlee, 64s. 6d. and 54s. 9d.; Calder, 64s. and 54s.; Carnbroe, 58s. 6d. and 52s. 6d.; Clyde, 55s. and 52s. 6d.; Monkland, 52s. 3d. and 50s. 3d.; Quarter, 52s. and 50s.; Govan, at Broomielaw, 52s. and 50s.; Shotts, at Leith, 66s. and 56s. 6d.; Carron, at Grangemouth, 53s. and 52s. (specially selected, 57s. 6d.); Kinneil, at Bo'ness, 51s. and 49s. 6d.; Glengarnock, at Ardrossan, 58s. 6d. and 52s.; Eglinton, 53s. and 51s.; Dalmellington, 53s. 6d. and 51s. 6d.

The malleable trade continues active, and so does almost every branch of the manufactured iron trade.

There has been some difficulty in the way of floating the Caledonian Steel and Iron Company, the object of which was to introduce the Thomas-Gilchrist process of steel-making into Scotland. For reasons best known to themselves, the directors have agreed not to allot the shares. But although the formation of the company is not to be proceeded with, the basic system will, it is believed, be introduced by the Glasgow Iron Company, which holds a licence for the purpose, and it is expected that its ironworks at Wishaw will be converted for the new manufacture. There is some talk of another effort being made to form a limited company under the auspices of the syndicate that had in hand the formation of the Caledonian Steel and Iron Company. It may be noted that in iron circles in Scotland there does not appear to be much enthusiasm on behalf of the "basic" process. The steel manufactured on the Siemens principle has given unqualified satisfaction, and there does not seem to be any objection to it even on the score of economy.

There is much activity in the coal trade. Both on the east and west coast the shipping inquiry has been very brisk, and at several of the ports the facilities for transit and shipment are not equal to the prompt supply of nearly the whole of the vessels seeking cargoes. Loud complaints are made against the railway companies for the inadequate service of trucks available for carrying the coals from the pits to the ships' sides The clearances at the different ports have at the same time been extensive. Prices are advanced 1s. per ton at the pits, and f.o.b. they are again somewhat higher. Free on board at Glasgow, per ton, they are as follows:—Main coal, 7s. 3d. to 7s. 9d.; ell, 8s. to 9s.; splint, 7s. 9d. to 8s. 9d.; and steam, 8s. to 9s. 3d.

The coalmasters of Lanarkshire are prepared to concede an advance of 6d. per day to the miners in a week hence, provided that in the interval they succeed in establishing an advance of 1s. per ton in the price of coals. It is not at all certain that they will be able to secure such an advance all over, but in any case it is not believed that the wages difference in the West will lead to a strike. The fact is that at a number of the collieries the miners are gradually having their wages advanced by 1d. and 2d. at a time; and if trade continues active they are likely soon to be in possession of all they have asked, as the natural result of the keen competitive demand for their labour. The colliers in Fife and Clackmannan are dissatisfied with the offer of 10 per cent. increase, arguing that it will not bring them up to the wages paid in June last. They urge that the employers ought to concede 15 per cent., but at the same time they are prepared to take what they can get, in the meantime restricting their labour until they obtain what they desire. It is doubtful, however, whether such an arrangement will be satisfactory to the employers.

During the past month seventeen vessels, with an aggregate tonnage of 25,220, were launched from the Clyde Shipbuilding yards, as compared with fifteen vessels, of 15,100 tons, in October, 1881. The ten months' launches are 225 vessels, with a total of 294,071 tons, as against 168 vessels of 257,708 tons in the corresponding period of last year.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

THE prospectus of the Rhondda and Swansea Bay Railway is now before the public; capital, £450,000; borrowing powers, £150,000; shares, £10. This promises to be quickly floated. The connection between so rich a colliery district as the Rhondda with a great industrial quarter like Swansea must be a paying one. Swansea in a radius of four miles has 100 works, in which thirty-eight varied industries are carried on, and 20,000 persons employed.

I note in a return lately made that last year 21,000 tons of copper, valued at over a million and a half, were smelted at Swansea; the gold, silver, and yellow metal produced in the town realised £237,000. Add to this the results of other industries and its important anthracite coal field, and we have a tolerably good safeguard for a paying railway. The Taff Vale, too, with its great resource and its new lines, need not fear. I fully expect to see it opening fresh ground shortly in a Rhondda direction, and there is a strong impression on foot that the line now forming from Rhondda to Newport will become Taff Vale property.

The coal and iron industries are in excellent condition, and in every direction there is the fullest activity. The shipping has been somewhat retarded by storms of late, and a slight falling off in coal exports may be noticed. Prices for best coals are firm at from 10s. 6d. to 12s., f.o.b.; some classes of coal at 9s. 6d., f.o.b. The tendency is decidedly upwards, good and long contracts being in hand. The house-coal trade is particularly brisk, and house-coal collieries are sought for in the market. I expect, in the course of a few weeks, that one or two important sinkings will take place in the Monmouthshire house-coal district. One of these would be by the Powell Duffryn, of which Sir George Elliot is now the principal.

There is a good deal of life and hopefulness in most of the Welsh industries, saving that of tinplate, which maintains a sluggish condition; and though an occasional spurt takes place, it is followed speedily by a reaction.

Iron ore, principally from Spain, maintains a fair trade, though of late the cargoes arriving have been meagre.

A good deal of interest has been excited at Cardiff by the inspection of the double-bottomed iron sailing ship the Milton Park, now loading coal for Algoa Bay. She is a Clyde vessel with double bottom, constructed on the longitudinal girder principle, and made to contain 300 tons of water ballast. Cardiff owners are beginning to regard this mode of ballasting with favour. She is a fine specimen of marine architecture.

Several minor disputes have taken place of late in the coal trade, but instead of tending to the protracted length of the North Walian disputes, all have been amicably settled. One dispute with the Aberdare Rhondda men was referred to the arbitration of Mr. Rhys, J.P., Aberdare. Another in the Maesteg district, relative to arrangements with medical officers, has been arranged after a brief strike, and work was resumed this week. I have known times when such matters would not so easily be settled. The question of the appointment of a director for a colliery should, as the miners' delegate pointed out, be decided by the majority of the colliers, and not by a minority, or, in other words, the owner and officials of a colliery. There is a likelihood of the demand of the North Wales colliers for 15 per cent. advance ending in a compromise.

I see that 100 of the Wrexham colliers, North Wales, have been sent to Assam to develope the coal of that country.

The Neath Harbour Commissioners are issuing fresh debentures at 5 per cent. New and important works are in contemplation.

The shipment of iron during the past week has been satisfactory, and important cargoes have left for Norway, India, Africa, Egypt, and New York. Most of the railway enterprises are at a stand on account of the weather. The Newport and Rhondda is now a certainty for next year, the principal bridge, that over the Taff, being in a very backward state. This property should have been the first work not the last. During the summer months bridgework over the impetuous Welsh streams is simple enough, but in autumn and winter there is no work more difficult.

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.

24th October, 1882.

5052. RADIAL AXLE-BOXES, F. W. Webb, Crewe.
5053. BEDSTEADS, M. Lawson, Ayr, N.B.
5054. RETORTS for OBTAINING from COAL, &c., OIL, COKE, &c., J. Hislop, Glasgow.
5055. GENERATING, &c., ELECTRICITY, &c., F. H. Varley, London.
5056. STANDS for LIQUOR BOTTLES, &c., J. Hall, Sheffield.
5057. MACHINES for SERVING ROPE with YARN, J. H. Nute, New Glasgow, Nova Scotia.
5058. CONSTRUCTING BATHING and PROMENADE PIERS, G. G. Page, London, and R. Nun, Salisbury.
5059. APPLYING ELECTRICITY to ROTARY HAIR BRUSHES, N. J. Holmes, London.
5060. PRODUCING, &c., ELECTRIC and MAGNETIC CURRENTS or FORCES, J. S. Fairfax, London.
5061. INJECTOR for WATER, &c., W. H. Beck.—(*P. H. and F. A. Michaux, and A. C. Raingeard, Paris.*)
5062. SEWING MACHINES, S. Pitt.—(*L. B. Miller and P. Diehl, Elizabeth, New Jersey, U.S.*)
5063. CONTINUOUS FLEECE-DIVIDING MACHINES, L. A. Groth.—(*J. H. Gilljam, Laurensberg, Germany.*)
5064. PARALLEL VICES for MACHINISTS' USE, H. F. Read, Brooklyn, U.S.
5065. APPARATUS for SOLDERING, A. J. Boult.—(*A. Leguay, Le Mans, France.*)
5066. RATCHET WRENCHES, L. Bagger.—(*G. W. Hight, and D. H. Bailey, Nashville, U.S.*)
5067. TREATING CERTAIN WASTE MATERIALS, E. Davies, London.
5068. LIQUID METERS, J. C. Mewburn.—(*A. S. St. Albin, Paris.*)
5069. SHOEHORN and BUTTONHOOK, S. Pulzer, London.
5070. REFRIGERATING MACHINES, J. K. Kilbourn, Brixton.
5071. MANUFACTURE of SUGAR, W. R. Lake.—(*L. May, Ungarisch, Ostra, Austria.*)
5072. PLAYING CARDS, W. R. Lake.—(*B. Dreyfuss, New York, U.S.*)
5073. VELOCIPEDES, E. R. Settle, Coventry
5074. MANŒUVRING and STEERING SHIPS, W. M. Walters, Bristol.
5075. MANUFACTURING COKES, P. Jensen.—(*Messrs. Beatus, Petersen, and Company, Copenhagen.*)
5076. MANUFACTURE of COKE, J. Jameson, Newcastle-upon-Tyne.
5077. PNEUMATIC ELEVATORS for RAILWAYS, A. W. L. Reddie.—(*C. A. Needham, New York, U.S.*)
5078. SECONDARY BATTERIES, A. F. Hills, Penshurst.
5079. MOTIVE-POWER APPARATUS, W. H. Avis, Polegate, Sussex.
5080. WATCHES, W. Clark.—(*J. W. Bell, Conowingo, Cecil, U.S.*)
5081. RAILWAY SIGNALLING APPARATUS, J. Boustead H. Neville, London, and J. Holt, Forest Gate.
5082. BIT STOCKS, G. F. Redfern.—(*J. P. Lawrence, London.*)

25th October, 1882.

5083. GLASS and METAL PLATES, &c., A. A. Hely, London.
5084. TREATING COAL, &c., W. Young, Peebles, and G. T. Belby, Midcalder, N.B.
5085. FEEDING WOOLLEN MATERIALS to CARDING MACHINERY, E. Wilkinson, Marsden.
5086. PRODUCING PRINTING SURFACES from GELATINE RELIEFS, R. Brown, R. W. Barnes, and J. Bell, London.
5087. VELOCIPEDES, R. C. Fletcher, Preston.
5088. APPARATUS for MOULDING and CASTING, J. and T. A. Boyd, Shettleston.
5089. CONSTRUCTING MANHOLES in STEAM BOILERS, A. Watkins, Greenwich
5090. PRESERVING SHIPS, &c., at SEA, R. Rose, London.
5091. APPARATUS for CLEARING, &c., TRAMWAY RAILS, T. P. Evans, East Greenwich.
5092. ELECTRIC GENERATORS, E. Jones, Battersea.

26th October, 1882.

5093. GAS APPARATUS for AUTOMATICALLY GIVING an ALARM at any REQUIRED HOUR, H. and T. A. Greene, London.
5094. USING ORDINARY ARGAND BURNERS, H. and T. A. Greene, London.
5095. GOVERNORS, &c., for REGULATING the SUPPLY of GAS, &c., H. and T. A. Greene, London.
5096. APPARATUS for CUTTING CIGARS, &c., G. Weston, Sheffield.
5097. SECONDARY BATTERIES, R. Hammond and L. Goldenberg, London.
5098. ELECTRIC LAMPS, A. Mackean.—(*A. Kryszat, Moscow.*)
5099. "COSMIE," R. Arentz, New Britain, U.S.
5100. SECURING WINDOW CURTAINS, H. M. Tarratt, London.
5101. ROTARY ENGINES and PUMPS, T. S. Greenaway and A. Kitt, London.
5102 CABLE CHAINS, T. H. Ward, Tipton.
5103. VELOCIPEDES, &c., G. H. C. Hughes, Birmingham.
5104. PREPARATION of MATERIALS for USE in ELECTRIC INSULATION, M. Bauer, L. Brouard, and J. Ancel, Paris.
5105. ELECTRIC LIGHTING, P. Cardew, Chatham.
5106. WINDOW SASHES, W. H. Lindsay, London.

27th October, 1882.

5107. INDICATING TEMPERATURE in BUILDINGS, W. T. Goolden and C. F. Casella, London.
5108. GALVANIC BATTERIES, P. R. de F. d'Humy, Clapham Rise.
5109. BRUSHES for CURATIVE PURPOSES, E. Parr and J. R. Gibson, London.
5110. PRINTING UPON BLANKS for BOXES made from PAPER, &c., S. Cropper.—(*Messrs. Cornell and Shelton, Birmingham, U.S.*)
5111. TIMEPIECES, C. D. Abel.—(*F. Reuleaux. Berlin.*)
5112. SEPARATING GLYCERINE from FATTY MATTERS, J. Imray.—(*C. F. E. Poullain, E. F. and E. N. Michaud, Paris.*)
5113. BRAKE for CARRIAGES, E. Edwards.—(*M. Dirat, Paris.*)
5114. TILTING CASKS, E. Hogg, Gateshead-on-Tyne.
5115. MANHOLE DOORS, &c., T. H. Collins, Winchester.
5116. FIRE-ESCAPES, J. Wetter.—(*C. H. Höhmann, Cassel, Germany.*)
5117. RAILWAY CARRIAGE, &c., COUPLINGS, T. Smith, Brockley.
5118. LOOM PICKERS, J. Challinor, Manchester.
5119. CABLE TRACTION RAILWAYS, &c., J. Wright.—(*C. F. Findlay, Chicago, U.S.*)
5120. GETTING or DIGGING POTATOES, T. Hodgkinson, Netherton.
5121. MACHINERY for WINDING LINEN, &c., J. H. Pickles, Burnley.
5122. ELECTRIC CURRENT GENERATORS, S. P. Thompson, Bristol.
5123. DRILLING, &c., MACHINES, J. Morris, Poplar.
5124. ALARM BELLS for DOORS, &c., A. W. L. Reddie.—(*E. J. Masseron, Paris.*)
5125. DOOR CHECKS, &c., A. J. Boult.—(*The Elliott Pneumatic Door Check Company, Boston, U.S.*)
5126. TELEPHONIC APPARATUS, &c., H. G. Ellery and J. T. Gent, Leicester.
5127. BOTTLE ENVELOPES, &c., A. Abrahams, London.
5128. MACHINES for CRUSHING STONES, &c., G. Dalton, Leeds.
5129. INSULATING CONDUCTORS of ELECTRICITY, C. W. Torr, Birmingham.
5130. CARBURETTING AIR, &c., H. H. Lake.—(*L. F. A. Lascols, Paris.*)
5131. PRODUCING COLOURED PHOTOGRAPHS, H. H. Lake.—(*J. Chaine, A. Durand, and S. de Chaligny, Lyons, France.*)
5132. KILNS for BURNING LIME and BRICKS, S. de la G. Williams, Birmingham.
5133. TRAVELLING TRUNK, D. Vinall, Brighton.
5134. ADMITTING, &c., BLAST of AIR in CUPOLAS, C. Landreth and I. Renis, Valencia, Spain.

28th October, 1882.

5135. SADDLES for BICYCLES, J. Brooks, Birmingham.
5136. WATCHMAN'S TIME DETECTORS, &c., J. Wetter.—(*G. F. Ransom, Cleveland, U.S.*)
5137. VELVETS or VELVETEENS, D. J. Crossley, York, and B. Cooper, Manchester.
5138. SELF-ACTING LUBRICATORS, G. Delettrez.—(*I. Duballe, Paris.*)
5139. "PLAQUE" for ARTISTS' USE, S. H. Sharp, Leeds.
5140. DOOR FASTENINGS for RAILWAY CARRIAGES, P. M. Justice.—(*J. W. Krepps, New York, U.S.*)
5141. SIGNALLING APPARATUS, J. Battye, Churwell.
5142. ELECTRIC LAMPS, W. R. Lake.—(*B. Egger, Vienna.*)

30th October, 1882.

5143. TAKING UP or ADJUSTING the BRASSES of LOCOMOTIVE ENGINE CONNECTING RODS, W. L. Hunt, Westminster.
5144. COCKS or VALVES, W. H. Moseley, Derby.
5145. STRAIGHTENING RAILS for RAILWAYS, L. Richards, Dowlais.
5146. WASHING FABRICS, J. Patterson, Belfast.
5147. ELASTIC FABRICS APPLIED to BOOTS and SHOES, A. C. Henderson.—(*H. Suser, Nantes.*)
5148. ORGANS of DYNAMO, &c., MACHINES, B. J. B. Mills.—(*T. Chutaux, Paris.*)
5149. INCREASING the CONDUCTIBILITY of ROUND or FLAT CABLES, B. J. B. Mills.—(*T. Chutaux, Paris.*)
5150. DRAWING CORKS from BOTTLES, A. Olsson, Sandviken, Sweden.
5151. IRON and STEEL, E. F. Goransson, Stockholm.
5152. MAKING PAPER TUBES, J. C. Mewburn.—(*M. Schaffhauser, Cornay, Alsace.*)
5153. PRESERVING ALIMENTARY SUBSTANCES, C. M. Pielsticker, London.
5154. NOISELESS MOTION, &c., to COMMON FLAT STRAINERS, W. Muirhead, Linwood, N.B.
5155. BUTT HINGES, J. Dyer, Birmingham.
5156. WIRE FENCING, E. A. Brydges.—(*C. Klauke, Müncheberg, Germany.*)
5157. WINDING YARN and THREAD, J. Liddell, J. S. and S. H. Brierley, F. W. Hirst, and D. Hamer, Huddersfield.
5158. PRODUCING, &c., ELECTRICITY, J. D. F. Andrews, Glasgow.
5159. RECOVERING TAR and AMMONIA, J. Wetter.—(*J. F. G. Hornig, Dresden.*)
5160. ROLLER MILLS for GRANULATING, &c., GRAIN, E. Fiechter.—(*J. Weber and Co., Uster, Switzerland.*)
5161. ROLLING CYLINDERS of IRON, &c., B. Walker, Leeds.
5162. REMOVING SMOKE, &c., from TUNNELS, J. N. Moerath, London.
5163. MACHINES for SAWING WOOD, W. Palmer, Bath.
5164. TELEPHONIC APPARATUS, J. G. Lorrain, Westminster.
5165. GAS-COOKING STOVES, A. M. Clark.—(*W. W. Goodwin, Philadelghia, U.S.*)
5166. CIRCUITS for TELEPHONIC COMMUNICATION, H. Alabaster, South Croydon, and T. E. Gatehouse, Camberwell.
5167. TELEPHONIC RECEIVERS, H. Alabaster, South Croydon, and T. E. Gatehouse, Camberwell.
5168. STEAM BOILERS, S. P. Wilding.—(*Stollwerck Brothers, Cologne, Germany.*)
5169. DECORATING DRY &c., EARTHENWARE, C. Barlow, Hanley.
5170. ELECTRIC BATTERIES, F. Wirth.—(*G. Leuchs, Nürnberg, Germany.*)
5171. LOADING, &c., MERCHANDISE, &c., Sir H. Bessemer, London.

Inventions Protected for Six Months on Deposit of Complete Specifications.

5020. MECHANICAL MUSICAL INSTRUMENT MOTORS, G. D. Garvie and G. Wood, New York, U.S.—*21st October*, 1882.
5037. GOVERNORS for GOVERNING STEAM ENGINES, W. P. Thompson, High Holborn, London.—A communication from F. D. Cumnver, Detroit, U.S.—*23rd October*, 1882.
5048. DEVICE for FASTENING UMBRELLAS, &c., H. H. Lake, Southampton-buildings, London.—A communication from A. Iehl, Mazamet, France.—*23rd October*, 1882.
5062. SEWING MACHINES, S. Pitt, Sutton.—A communication from L. B. Miller and P. Diehl, Elizabeth, New Jersey, U.S.—*24th October*, 1882.
5064. PARALLEL VICES for MACHINISTS' USE, H. F. Read, Brooklyn, U.S.—*24th October*, 1882.
5066. RATCHET WRENCHES, L. Bagga, Washington, U.S.—A communication from G W. Hight and D. H. Bailey, Nashville, U.S.—*24th October*, 1882
5089. CONSTRUCTION of MANHOLES, &c., in STEAM BOILERS, A. Watkins, South-street, Greenwich.—*25th October*, 1882.

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

4414. GAS-BURNERS, T. Heron, Manchester.—*29th October*, 1879.
4318. DATING, &c., STAMPS, G. E. Emerson, San Francisco, U.S.—*23rd October*, 1879.
4325. FASTENING HOOPS, W. Stanley, Manchester.—*23rd October*, 1879.
4350. SAIL HANKS, V. Coombe, Liverpool.—*25th October*, 1879.
4351. STEAM ENGINES, G. and J. Weir, Glasgow.—*25th October*, 1879.
4678. MAKING PILE FABRICS, J. Worrall, Manchester.—*17th November*, 1879.
4744. COVERING SELVAGES of FINISHED FABRICS, J. Worrall, Manchester.—*21st November*, 1879.
4362. CONSTRUCTING CYLINDERS for BREAKING UP FIBROUS MATERIALS, W. Tatham and W. T. Heap, Rochdale.—*27th October*, 1879.
4379. VALVES for CONTROLLING STEAM, &c., W. Murdoch, Glasgow.—*28th October*, 1879.
4402. EXTRACTING AMMONIACAL SALTS from ANIMAL EXCREMENT, &c., W. F. Nast, London.—*29th October*, 1879.
4479. SEPARATING SOLID MATTER from SEWAGE, G. Barnard, Edinburg.—*3rd November*, 1879.
4367. HYDRAULIC MOTIVE POWER and PUMPING APPARATUS, J. Hastie, Greenock, N.B.—*27th October*, 1879.
4370. DRAW GEAR of RAILWAY ROLLING STOCK, J. Wallace, Wigan.—*27th October*, 1879.
4393. CONSTRUCTING SHEET METAL CANS, &c., J. S. Macarthur, Glasgow.—*29th October*, 1879.
4400. GENERATING, &c., ELECTRICITY, W. R. Lake, London.—*29th October*, 1879.
4412. VALVE for SINGLE-ACTING ENGINES, R. Whitehead, London.—*29th October*, 1879.
4514. WATER or FLUID METER, D. Johnston, Glasgow.—*5th November*, 1879.
4624. SEGMENT WHEELS, J. Barbour, Belfast.—*13th November*, 1879.
4411. FOUNTAINS, J. Storer, Hammersmith.—*29th October*, 1879.
4397. MAKING PAPER, W. F. Nast, London.—*29th October*, 1879.
4436. PRUDUCING ALUMINIUM BRONZE, J. Webster, Birmingham.—*31st October*, 1879.
4798. MANUFACTURE of GAS, T. N. Kirkham and T. Hersey, Westminster.—*25th November*, 1879.

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

3715. MACHINES for PRINTING MEASURING TAPES, W. Chesterman, Sheffield.—*26th October*, 1875.
3747. SYPHONS, R. Field, Westminster.—*28th October*, 1875.
3704. MAKING GAS from COAL, &c., W. Cleland, Lincacre.—*26th October*, 1875.
3728. STEAM BOILERS, &c., J. Twibill, Manchester.—*27th October*, 1875.
3719. MUSICAL INSTRUMENTS having KEYBOARDS, C. Brown, Glasgow.—*27th October*, 1875.
3771. HEATING FURNACES, &c., H. E. Newton, London.—*29th October*, 1875.
3770. MAKING PROTECTIVE PAPER, F. D. Ward, London.—*29th October*, 1875.
3838. DISTRIBUTING GAS, W. White, Abersychan.—*4th November*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 17th November, 1882.

2945. PLATES for SECONDARY BATTERIES, C. Sorley, London.—*21st June*, 1882.
2948. VALVES and PACKING for SAME, W. Lake, London.—A com. from F. F. Raymond.—*21st June*, 1882.
2950. NAILING HEELS on BOOTS, W. R. Lake, London.—A com. from F. F. Raymond.—*21st June*, 1882.
2955. TREATING NITROGENOUS MATTERS, J. Mewburn, London.—A com. from L. Fouque.—*21st June*, 1882.
2961. FLUSHING URINALS, J. Harsant, Wandsworth.—*22nd June*, 1882.
2969. COMPOSITION for PREVENTING SEDIMENT in STEAM ENGINES, E. Edwards, London.—A communication from J. Vernanchet.—*22nd June*, 1882.
2970. TREATING SEWAGE, &c., E. Edwards, London.—A com. from L. de Soulages.—*22nd June*, 1882.
2985. THRASHING MACHINES, E. Foden, Sandbach.—*23rd June*, 1882.
2995. SOLUTION for BREWING BEER, E. R. Moretz, London.—*24th June*, 1882.
2998. WEIGHING MACHINES, C. D. Abel, London.—A communication from H. Gerike.—*24th June*, 1882.
3000. KITCHEN RANGES, G. Dawson and C. Butcher, Thorncliffe.—*24th June*, 1882.
3003. TELEPHONIC WIRES, &c., A. Wilkinson, London.—*24th June*, 1882.
3017. MACHINES for SORTING GRAIN, &c., A. J. Boult, London.—Com. from L. Rappaport.—*26th June*, 1882.
3030. FLOATING LIGHTS, C. D. Abel, London.—A communication from L. A. Brasseur.—*27th June*, 1882.
3053. BREECH-LOADING SMALL-ARMS, T. Webley and T. Brain, Birmingham.—*28th June*, 1882.
3056. REMOVING INGOTS from MOULDS, T. Hampton, Sheffield.—*28th June*, 1882.
3061. MAGNETIC COMPASSES, F. Betbeder, London.—A com. from E. Bourse.—*28th June*, 1882.
3065. MACHINERY for OPENING FUR, J. Woodrow, Stockport.—*29th June*, 1882.
3075. FURNACES of STEAM BOILERS, W. Bell, Lancaster.—*29th June*, 1882.
3090. SELF-ACTING MULES, C. A. Barlow, Manchester.—A com. from V. Lenoir.—*30th June*, 1882.
3091. UTILISING CERTAIN DEPOSITS, J. C. W. Stanley, London.—*30th June*, 1882.
3182. SECURING, &c., MAIL BAGS, A. M. Clark, London.—A communication from T. A. Platt, W. Man, and W. O. Platt.—*5th July*, 1882.
3224. TACK-MAKING MACHINE, R. H. Brandon, Paris.—A communication from F. Huré.—*7th July*, 1882.
3233. ELECTRIC CLOCKS, J. P. A. Schlaefli, Switzerland.—*7th July*, 1882.
3288. BRAIDING MACHINES, W. R. Lake, London.—A communication from F. L. Verkamp, C. F. Leopold, and W. Darker.—*11th July*, 1882.
3372. COCKS or VALVES, J. W. Restler, Nunhead.—*15th July*, 1882.
3974. DYNAMO-ELECTRIC POWER CREATING MACHINES, J. E T. Woods, London.—*19th August*, 1882.
4046. ELECTRIC ARC LAMPS, J. K. D. Mackenzie, Halifax.—*23rd August*, 1882.
4140. SPINNING FLAX, J. S. Coey and J. McArthur, Leeds.—*30th August*, 1882.
4152. APPARATUS for SUPPLYING INK, G. R. Hughes and T. Carwardine, London.—*31st August*, 1882.
4240. LIFTS and HOISTS, &c., J. Stevens, C. G. Major, and D. P. Edwards, Battersea.—*6th September*, 1882.
4250. DYNAMO-MAGNETIC ELECTRIC MACHINES, T. Donnithorne, London.—*6th September*, 1882.
4281. TREATING PEAT, S. Heimann, London.—*8th September*, 1882.
4290. WORKING VALVES, W. G. Stuart, London.—*9th September*, 1882.
4291. GAS BURNERS, J. J. Shedlock, Barnet.—*9th September*, 1882.
4294. RAISING, &c., SUBSTANCES, F. J. Harris, Rock Ferry.—*9th September*, 1882.
4438. BLIND ROLL FURNITURE, J. W. Andrews, Whittlesea.—*19th September*, 1882.
4460. BATTERIES for GENERATING ELECTRICITY, G. G. Skrivanow, Paris.—*19th September*, 1882.
4464. DRIVING SCREW PILES, T. Wrightson and W. Clark, Stockton-on-Tees.—*19th September*, 1882.
4565. BOTTLES and STOPPERS, A. Pullan, London.—*25th September*, 1882.
4653. CHECKING ARRIVAL of EMPLOYES, W. Llewellin, Bristol.—*30th September*, 1882.
4655. METALLIC STAIRCASES, R. Hudson, Gildersome.—*30th September*, 1882.
4665. ELECTRO MOTOR, M. Immisch, London.—*30th September*, 1882.
4721. STEAM BOILERS, &c., G. F. Redfern, London.—A com. from C. P. G. Sack.—*4th October*, 1882.
4992. MANUFACTURE of FATTY MATTER, F. C. Glaser, Berlin.—A communication from O. Braun and O. Liebrich..—*20th October*, 1882.

Last day for filing opposition, 21st November, 1882.

3009. DOMESTIC FIREPLACES, W. S. Morton, Edinburgh.—*26th June*, 1882.
3010. ELECTRIC LAMPS with INCANDESCENT CONDUCTORS, W. E. Debenham, Haverstock Hill.—*26th June*, 1882.
3012. STEAM STEERING APPARATUS, J. Saunders, Liverpool.—*26th June*, 1882.
3022. INDIA-RUBBER TIRES, A. J. Wyley and B. Collins, Manchester.—*27th June*, 1882.
3023. VELOCIPEDES, G. Moss, Barbican, London.—*27th June*, 1882.
3027. FITTING for HORSESHOES, J. Vernon, Newton Stewart, N.B.—*27th June*, 1882.
3032. SAFETY LAMPS, W. Jenkins and D. Morgan, Treorky.—*27th June*, 1882.
3037. MACHINE for SYRINGING LEAVES, J. A. Drake and R. Muirhead, Maidstone.—*27th June*, 1882.
3045. SLICING MATERIAL APPARATUS, J. B. Whytehead, Ilkley.—*28th June*, 1882.
3060. SECURING BUTTONS, &c., to BOOTS, E. C. Barron, London.—*28th June*, 1882.
3067. SCREW PROPELLERS, J. Carr, Heaton.—*29th June*, 1882.
3080. STOP VALVES, J. A. and J. Hopkinson, Huddersfield.—*30th June*, 1882.
3086. PRINTING INK, F. Wirth, Germany.—A communication from G. Schmidt.—*30th June*, 1882.
3113. RENDERING PEAT SUITABLE for LITTER, S. D. Cox, New Charlton.—*1st July*, 1882.
3120. GALVANIC BATTERIES, J. H. Davies, Ipswich.—*1st July*. 1882.
3122. COATING METAL SURFACES with ALLOYS, A. Clark, London.—Com. from C. Haegele.—*1st July*, 1882.
3149. PLOUGHS for CUTTING OPEN DITCHES, T. T. Mallett, Street.—*4th July*, 1882.
3251. OVENS for BAKING BREAD, A. M. Clark, London.—A com. from J. E. J. L. Mounié.—*8th July*, 1882.
3255. INCANDESCENT ELECTRIC LAMPS, J. H. Gardiner, London.—*8th July*, 1882.
3306. SCRAPERS, A. Lowcock, Shrewsbury, and J. Taylor, Salford.—*12th July*, 1882.
3316. UNDERGROUND CONDUITS, W. R. Lake, London. A com. from A. Knandt.—*12th July*, 1882.
3320. SAFETY APPARATUS for LIFTS, A. M. Clark, London.—A com. from V. W. Mason.—*12th July*, 1882.
3334. DYNAMO-ELECTRIC, &c., MACHINES, R. Matthews, Hyde.—*14th July*, 1882.
3377. VELOCIPEDES, &c., T. Smallwood and E. W. Cooper, Coventry.—*17th July*, 1882.
3499. ELEVATORS, &c., J. McAuley, Bootle.—*22nd July*, 1882.
3540. THERMO-DYNAMIC ENGINES, J. Hargreaves, Widnes.—*26th July*, 1882.
3620. HORSESHOE, F. H. F. Engel, Germany.—A communication from O. Lampe.—*31st July*, 1882.
3733. PROPELLERS for VESSELS, G. C. Parini, Italy.—*5th August*, 1882.
3746. DYEING, &c., HANKS, G. Heywood and S. Spencer, Radcliffe Bridge.—*5th August*, 1882.
3801. CUTLERY, D. Hummel, jun., London.—A communication from H. Halström.—*9th August*, 1882.
3807. CONVEYING STEEL INGOTS in HEATED STATE, J. Riley, Glasgow.—*10th August*, 1882.
4184. METAL FENCING, W. Bailey, Wolverhampton.—*2nd September*, 1882.
4256. ORNAMENTING GLASS, &c., W. H. R. Toye, London.—*7th September*, 1882.
4332. PREPARING LINOLEUM, &c., D. Hendry and J. Melville, Kirkcaldy.—*12th September*, 1882.
4399. TREADLES of BICYCLES, J. Buckland, Taunton.—*15th September*, 1882.
4407. GALVANIC ELEMENTS, J. H. Johnson, London.—A com. from A. Bernstein.—*16th September*, 1882.
4525. SECONDARY BATTERIES, F. M. Lyte, London.—*22nd September*, 1882.
4545. PURIFYING, &c., GAS, J. Coley-Bromfield, Hove, and G. Symes, London.—*23rd September*, 1882.
4637. STEERING GEAR, E. J. Harland, G. W. Wolff, W. Wilson, & W. Pirrie, Ireland.—*29th September*, 1882.
4647. FASTENERS for SHIPS' SIDE-LIGHTS, &c., R. C. Thompson, Sunderland.—*29th September*, 1882.
5062. SEWING MACHINES, S. Pitt, Sutton.—A com-from L. B. Miller and P. Diehl.—*24th October*, 1882.

Patents Sealed.

List of Letters Patent which passed the Great Seal on the 27th October, 1882.)

1740. STOVE, A. Browne, Southampton-buildings, London.—*12th April*, 1882.

2029. Process for Treating Fabrics, &c., D. T. Gardner, London.—28*th April*, 1882.
2040. Combing Wool, J. W. Harding, Leeds.—29*th April*, 1882.
2059. Paper Cutting Machines, H. J. Haddan, London.—1*st May*, 1882.
2060. Operating Fog Horns, A. L. Wharton, Great Grimsby.—1*st May*, 1882.
2061. Breech-loading Fire-arms, J. Williams, Birmingham.—2*nd May*, 1882.
2070. Mechanical Separation of Ores, H. J. Haddan, London.—2*nd May*, 1882.
2071. Smelting Furnaces, H. J. Haddan, London.—2*nd May*, 1882.
2077. Refining Petroleum Oils, E. W. Bell, Liverpool.—2*nd May*, 1882.
2090. Looms for Weaving, J. Brownlie, Glasgow.—3*rd May*, 1882.
2101. Railway, &c., Wheels, R. Hadfield, London.—4*th May*, 1882.
2174. Tricycles, C. Harvey and W. Paddock, Birmingham.—9*th May*, 1882.
2186. Incandescent Electric Lamps, H. Lea, Birmingham.—9*th May*, 1882.
2246. Differential Pulley Apparatus, W. R. Lake, London.—12*th May*, 1882.
2265. Lamps for Burning Light Oils, J. Hinks, Birmingham.—13*th May*, 1882.
2271. Heating Railway Carriages, J. Imray, London.—15*th May*, 1882.
2286. Arc-type Electric Lamps, R. Kennedy, Glasgow.—16*th May*, 1882.
2353. Water Conductors, J. T. King, Liverpool.—19*th May*, 1882.
2398. Compound Pumps, H. Egells and W. A. Kux, Berlin.—2*nd May*, 1882.
2419. Electric Arc Lamps, W. H. Akester, Glasgow.—23*rd May*, 1882.
2429. Water Meters, B. D. Healey, Brighouse.—23*rd May*, 1882.
2445. Stopping Tramway Cars, &c., J. H. Betteley, London.—24*th May*, 1882.
2559. Treating Fatty Substances, R. H. Brandon, Paris.—31*st May*, 1882.
2580. Fence Posts, S. Pitt, Sutton.—31*st May*, 1882.
2799. Machinery for Spinning Fibres, S. Tweedale, Accrington.—14*th June*, 1882.
2953. Making Boots, P. Lehany, London.—21*st June*, 1882.
3020. Weighing Machines, H. E. Newton, London.—26*th June*, 1882.
3272. Shooting Seats, H. F. Beaumont, Huddersfield.—10*th July*, 1882.
3301. Preserving Ships, &c., from Corrosion, T. S. Webb, London.—12*th July*, 1882.
3501. Wool-carding Engines, E. G. Brewer, London.—22*nd July*, 1882.
3509. Drawing Rollers, A. J. Boult, London.—24*th July*, 1882.
3799. Steam Steering Gear, J. H. Smiles, Stockton-on-Tees.—9*th August*, 1882.
3831. Extracting Precious Metals, A. K. Huntington and W. E. Koch, London.—11*th August*, 1882.
3839. Breaking up Ground, &c., J. H. Johnson, London.—11*th August*, 1882.
3899. Cutting Machinery for Forming Teeth of Toothed Wheels, W. R. Lake, London.—15*th August*, 1882.
4133. Pencil Cases, W. R. Lake, London.—29*th August*, 1882.
4249. Removing Bone Black from Filters, A. M. Clark, London.—6*th September*, 1882.

(*List of Letters Patent which passed the Great Seal on the 31st October*, 1882.)

2051. Washing Wool, &c., T. J. Mullings, London, and W. Whiteley, Lockwood.—1*st May*, 1882.
2056. Controlling Distribution of Sewage, J. H. Shipway, Birmingham.—1*st May*, 1882.
2062. Stoppers for Bottles, J. Bussey, London.—2*nd May*, 1882.
2067. Preparing Coffee, G. W. von Nawrocki, Germany.—2*nd May*, 1882.
2069. Connecting Healds in Looms, J. Aspinall, Ravensthorpe.—2*nd May*, 1882.
2079. Preparing Wool, H. H. Lake, London.—2*nd May*, 1882.
2085. Screw Propellers, A. J. Davison, Sunderland.—3*rd May*, 1882.
2086. Deodoriser, &c., O. Bowen and A. Miller, London.—3*rd May*, 1882.
2097. Producing Artificial Marble, R. Guelton, Brighton.—4*th May*, 1882.
2103. Irons, G. W. von Nawrocki, Germany.—4*th May*, 1882.
2106. Coating Metal Plates, H. F. Taylor, Neath, and G. Leyshon, Tividale.—4*th May*, 1882.
2107. Electric Safety Apparatus for Theatres, &c., P. Jensen, London.—4*th May*, 1882.
2123. Collapsible Boxes, H. J. Haddan, London.—5*th May*, 1882.
2127. Mechanical Playing of Pianos, &c., R. H. Bishop and W. Down, London.—5*th May*, 1882.
2132. Compositions to Act as Non-conductors of Heat, E. C. C. Stanford, Glasgow.—6*th May*, 1882.
2140. Safety Pins, G. F. Redfern, London.—6*th May*, 1882.
2166. Utilising Heat, &c., T. Charlton and J. Wright, London.—9*th May*, 1882.
2199. Steamship Screws, G. W. von Nawrocki, Germany.—10*th May*, 1882.
2205. Curing Gapes in Pheasants, J. H. Clark, Tardebigge.—10*th May*, 1882.
2261. Ferules for Umbrellas, W. H. Beck, London.—13*th May*, 1882.
2343. Sewing Heavy Fabrics, W. R. Lake, London.—18*th May*, 1882.
2433. Reciprocating Shuttle Sewing Machines, A. Greenwood, Leeds.—23*rd May*, 1882.
2536. Securing Scales to Blades, H. H. and G. H. Taylor, Sheffield.—27*th May*, 1882.
2617. Sewing Machinery, A. Greenwood and J. W. Ramsden, Leeds.—3*rd June*, 1882.
2667. Portable Soles for Boots, G. H. Ellis, London.—7*th June*, 1882.
2668. Portable Chaff Engines, R. Maynard, Whittlesford.—7*th June*, 1882.
2919. Form of Cable Traction Tramways, J. Wright, London.—20*th June*, 1882.
2979. Ball, &c., Joints, H. J. Haddan, London.—23*rd June*, 1882.
3344. Self-acting Window Blind, W. S. Laycock, Sheffield.—14*th July*, 1882.
3435. Gas Motor Engines, C. D. Abel, London.—19*th July*, 1882.
3762. Utilising Force of Liquids, E. E. H. Rousseau, Paris.—8*th August*, 1882.
3835. Alum, &c., P. and F. M. Spence, Manchester.—11*th August*, 1882.
3911. Simultaneous Ignition of Fuses, W. Bickford-Smith & G. Smith, Tuckingmill.—16*th August*, 1882.
4095. Umbrella, &c., Mountings, A. C. Henderson, London.—26*th August*, 1882.

List of Specifications published during the week ending October 28th, 1882.

5387, 6d.; 920, 2d.; 938, 2d.; 1046, 6d.; 1103, 6d.; 1109, 4d.; 1146, 6d.; 1191, 6d.; 1193, 2d.; 1315, 4d.; 1322, 2d.; 1323, 4d.; 1328, 6d.; 1335, 6d.; 1331, 6d.; 1344, 2d.; 1345, 2d.; 1347, 4d.; 1350, 6d.; 1351, 4d.; 1352, 4d.; 1353, 2d.; 1354, 4d.; 1357, 2d.; 1360, 6d.; 1363, 4d.; 1364, 6d.; 1366, 6d.; 1367, 6d.; 1368, 6d.; 1370, 6d.; 1371, 2d.; 1372, 2d.; 1373, 6d.; 1374, 6d.; 1375, 2d.; 1376, 2d.; 1377, 1s. 8d.; 1378, 6d.; 1382, 2d.; 1383, 2d.; 1384, 2d.; 1385, 6d.; 1386, 2d.; 1389, 6d.; 1390, 6d.; 1392, 2d.; 1393, 8d.; 1394, 2d.; 1395, 2d.; 1396, 4d.; 1397, 4d.; 1398, 6d.; 1399, 6d.; 1400, 2d.; 1401, 2d.; 1403, 6d.; 1405, 2d.; 1406, 2d.; 1407, 6d.; 1408, 4d.; 1409, 6d.; 1410, 4d.; 1411, 2d.; 1412, 6d.; 1413, 6d.; 1414, 6d.; 1415, 6d.; 1416, 6d.; 1418, 6d.; 1419, 6d.; 1420, 6d.; 1421, 2d.; 1422, 6d.; 1423, 2d.; 1424, 4d.; 1425, 8d.; 1426, 6d.; 1427, 6d.; 1428, 6d.; 1429, 6d.; 1430, 6d.; 1431, 6d.; 1433, 4d.; 1434, 6d.; 1435, 2d.; 1436, 6d.; 1438, 6d.; 1440, 6d.; 1441, 6d.; 1442, 4d.; 1443, 6d.; 1444, 6d.; 1445, 2d.; 1446, 6d.; 1447, 2d.; 1448, 2d.; 1449, 2d.; 1450, 6d.; 1452, 6d.; 1454, 8d.; 1456, 6d.; 1460, 6d.; 1461, 4d.; 1462, 2d.; 1463, 4d.; 1464, 4d.; 1465, 4d.; 1467, 2d.; 1468, 4d.; 1469, 6d.; 1470, 8d.; 1471, 6d.; 1443, 2d.; 1476, 2d.; 1477, 6d.; 1484, 2d.; 1487, 6d.; 1488, 6d.; 1498, 4d.; 1506, 6d.; 1512, 2d.; 1518, 6d.; 1536, 6d.; 1541, 4d; 1554, 4d.; 1567, 4d.; 1645, 4d.; 3383, 6d.; 3519, 4d.

*** 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.*

920. Making and Utilising the Gases arising from the Distillation of Coal, *R. and J. Dempster.*—25*th February*, 1882.—(*Provisional protection not allowed.*) 2*d.*

The gas retorts are erected in the immediate neighbourhood of the boilers and furnaces, and the gases, after passing through the condensers and scrubbers, are conveyed to the furnaces and consumed by suitable burners.

938. Prevention of Railway Accidents caused by Breakage of Draw-bars, *W. H. Turnbull, Stafford.*—27*th February*, 1882.—(*Provisional protection not allowed.*) 2*d.*

This consists in the use of a draw-bar with eye-holes on each side of the head to receive chains, which are fastened to the headstock.

1046. Cutting Holes in and Shaping Metal Plates, *J. Rowland, Sunderland.*—4*th March*, 1882. 6*d.*

This relates to appliances to cut circular, oval, or other shaped holes in plates, or by which the plate may be cut to any desired shape externally; and it consists, First, in the application to shearing machines for straight cutting of two fixed blades, either fitted separately, or forming together the jaws of a die, into the space between which the moving shear blade enters; and Secondly, in the use of a curved moving shear blade in combination with two curved fixed blades, between which the moving blade enters to make the cut.

1108. Carding Engines, *A. Holden, Gorton.*—7*th March*, 1882. 6*d.*

This relates to machinery for cleaning cotton and other fibre, a main cylinder with roller and clearers of ordinary construction being employed. A clearer roller is placed over the licker-in, which is set to the main cylinder, and is cleaned by the clearer, in front of which is a roller for catching motes and other impurities from the clearer. Over the spaces between the ordinary clearer rollers and the preceding working rollers are placed plates or doctors, the edges of which are close to the front of the clearers, and extend back to the preceding working rollers. A card roller or clearer is placed over the junction of the main cylinder and doffer.

1109. Securing on to Buildings Sheets of Zinc, Metal, &c., *T. W. Helliwell, Brighouse.*—7*th March*, 1882. 4*d.*

The edge of each sheet is turned up at right angles to the sheet, and the turned-up parts of two adjoining sheets are placed together, with a small space between them to allow for expansion and contraction, and over the tops of the flanges a cap is placed, and a screw, nail, or bolt passed through its top between the turned-up edges, and enters the wood or ironwork supporting the sheets.

1146. Actions of Pianofortes, &c., *A. Squire, Camden-road.*—9*th March*, 1882. 6*d.*

This relates particularly to check repetition actions, and consists in the combination of a bevel on the top of the jack or hopper, and a strap of leather fixed to the butt, the other end being hooked to a spring regulated by a screw, wedge, band, bent wire, or stiff joint. The invention further relates to the use of bars brought to bear on the back or front of the sounding board, so as to force the same out and cause it to become rigid or otherwise at will, and thereby increase the power and tone of the instrument. Electro-magnetic or magnetic steel wires are used, and the names of the notes are lettered on the rails or beam.

1191. Improvements Relating to Dynamo or Magneto-electric Machines for Regulating the Generative Capacity of such Machines, *T. J. Handford, London.*—11*th March*, 1882.—(*A communication from T. A. Edison, Menlo Park, New Jersey, U.S.*) 6*d.*

This relates to means for automatically regulating the generative capacity of a machine according to the lights in circuit. In connection with each group of lamps this device is provided. One method is to place an electro-magnet in one of the branch conductors, having an armature lever retracted by a spring, and making and breaking a circuit, which may be a shunt around a definite resistance in the field circuit or an additional field circuit, the result in either case being an increase in energy of the field magnet by the closure of the circuit controlled by each of these electro-magnets. Each of these magnets is so constructed with relation to its armature that it will not draw the lever to its front contact until a number of the lamps of the groups have have been turned on, so that the additional energy given to the field magnet by the operation of the devices connected with each group will be sufficient for the supply of all the lamps of the group.

1193. Crushing or Breaking Stone, Ore, &c., *W. R. Lake, London.*—11*th March*, 1882.—(*A communication from T. A. Blake, New Haven, U.S.*)—(*Not proceeded with.*) 2*d.*

This relates to "Blake crushers," and it consists in the introduction of hanging jaws between the ordinary fixed jaw and the movable jaws, the object being to prevent the clogging of the jaws.

1315. Condensed Milk, &c., *W. F. Sweetland, Hendon.*—18*th March*, 1882. 4*d.*

The object is to manufacture condensed milk without the use of additional sugar, and it consists in concentrating the milk in a vacuum pan, and then adding a concentrated watery solution of a gelatinous substance.

1322. Drying by Cold Process Printing on Tin, Zinc, Brass, &c., *H. Mathieson, Mile End.*—18*th March*, 1882. 2*d.*

Hitherto lead has been the dryer of ink used for printing on metal. According to this invention, 2 oz. of borate of manganese and 2 drachms of sulphide of manganese are boiled for two hours in one gallon linseed oil, the scum being removed during the process. When cool the dregs are mixed with Frankfort-black, so as to form a thick paste, which is rendered fit for printing by the addition of a suitable quantity of the boiled oil.

1323. Transferring Printed Designs from Paper, &c., to Sheets of Tin, Zinc, Brass, &c., *H. Mathieson, Mile End.*—18*th March*, 1882. 4*d.*

A sheet of ordinary paper is dipped into a solution of sugar, water, gum, and glue, after which it is varnished on one side. The paper then receives its impression from a lithographic stone, and a varnish tint is applied, the impression being transferred to the metal sheet in a lithographic press, the bed of which is heated to about 200 deg. Fah. The paper itself can be removed by saturating the sheet with cold water.

1328. Improvements in Electric Signalling Apparatus, Applicable also to other Purposes, *L. J. Crossley, Halifax, J. F. Harrison, Bradford, and W. Emmoth, Halifax.*—18*th March*, 1882. 6*d.*

This invention relates to improvements in magneto-electric signalling apparatus, and also to a means for connecting and disconnecting telephonic wires. The inventors claim (1) the application to the axis of the revolving coil of a magneto-electric call bell of one or more cams, whereby, in addition to the ordinary call signal, a distinct and separate one may be transmitted. (2) The employment in combination with the above apparatus of relays in the central exchange office, whereby a subscriber will be enabled to disconnect his wire from that of the last subscriber with whom he spoke, and place both lines in connection with the switchboard without the intervention of the operator.

1335. Springs for Railway Vehicles, &c., *A. J. Boult, London.*—18*th March*, 1882.—(*A communication from J. D. Thomas and L. F. Requa, New York.*) 6*d.*

This relates to the use of an improved form of air spring for buffers, or for supporting the bodies of carriages, and it consists of a hollow vessel of rubber charged with a mass of compressed air, and held at its opposite ends only, with its sides free to expand and contract, a suitable web or frame of canvas or other fabric being imbedded in the rubber walls of the vessel.

1341. Thrust Bearings for Screw Propeller Shafts, &c., *J. Wills, Leicester.*—20*th March*, 1882. 6*d.*

This consists of a bearing in which a series of balls or rollers are arranged to freely rotate between the end of the shaft, or a disc on the end of same, or fixed at any convenient part thereof, and a corresponding stationary disc. The balls are kept in position by being inserted in recesses in a plate or cage, which will revolve with the rollers independently of the shaft, and placed between the rotating shaft and the fixed disc, or they may be placed in recesses in the disc on the shaft, and bear against and travel on the stationary disc.

1344. Supporting and Adjusting the Back Rests of Bassinette Perambulators, &c., *H. S. Whitehouse, Birmingham.*—20*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in supporting and adjusting the guide rods and a screw rod, on which works a screw-box capable of being rotated.

1345. Coupling for Joining Lengths of Wire, *D. Brenner, Brixton.*—20*th March*, 1882.—(*Not proceeded with.*) 2*d.*

The ends of the wires to be joined are each inserted into a metallic piece, and the extreme end turned at an angle to prevent it slipping out. The two pieces of metal are shaped so as to interlock, and the longitudinal strain on the wires tends to increase the grip of the coupling.

1347. An Improved Machine for Generating Electric Currents, &c., *S. E. Phillips, Charlton.*—20*th March*, 1882.—(*Partly a communication from W. C. Johnson, Mentone, France.*) 4*d.*

This relates to an improved construction of machine for generating electric currents, whereby a given weight of metal, as wire, preferably of square or angular shape, can be wound into a smaller space than at present known.

1350. Looms, *A. Priestman and J. Ackroyd, Bradford.*—20*th March*, 1882. 6*d.*

The object is to arrange the warp brake apparatus so as to let off the warp from the beam with more regularity, and consequently to weave fabrics more uniformly than at present. The brake ropes are placed round the ends of the warp beams in the usual way, but their ends are secured to a bearing bar placed right across the loom parallel with the beam. To this bar weighted levers are attached, so as to be easily adjusted. The warp passes from the beam round the bearing bar, over the back rail of the loom to the sley and healds.

1351. Binding for Scaffoldings, *J. Rettie, Hatton-garden.*—20*th March*, 1882. 4*d.*

A chain is used to bind two poles together, one end having a hook to take into any link after passing round the poles. On the chain is a loose piece of tubing, which is placed in position in a line with the junction of the poles, and a triangular or other wedge-shaped piece is forced in between it and the poles.

1352. Apparatus for Receiving Money, &c., *H. T. Davis, Newington.*—20*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to apparatus for receiving fares on tram-cars, &c., the object being to enable the passenger to insert his fare in the apparatus and see that the amount is correctly registered.

1353. Hoisting Crabs and Lifts, *A. Clark, Oxford-street.*—20*th March*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to dispense with the drum on which the lifting chain is usually wound, and it consists in the use of a toothed pulley mounted on the main axis in place of the drum, in combination with a pair of guide pulleys for the chain placed at either side of the toothed pulley. The lifting chain is led over the guide pulleys, and beneath the toothed pulley, with which it is kept in contact, one end of the chain being attached to the weight to be raised and the other end falling in a heap on the ground.

1354. Treatment of Flour, &c., *H. F. Engel, Hamburg.*—20*th March*, 1882.—(*A communication from F. Lange, Prussia.*) 4*d.*

The object is to treat the flour of cereals so as to form moulded or rolled articles, which are of very hard structure, can be polished and resist moisture, while at about 100 deg. C. they again become plastic; and it consists in mixing the flour with water, glue, plaster of Paris, and any suitable colours to form a paste, which is shaped to the required form by heated moulds or rollers.

1357. Securing Door-knobs to Spindles, *J. Thom, Wolverhampton.*—21*st March*, 1882.—(*Not proceeded with.*) 2*d.*

The spindle is square and formed with a screw thread on its angles, and on it works a collar or nut with an externally screwed end. The end of the knob has a screwed recess to fit the collar or nut, the threads on the spindle and the collar or nut being in opposite directions.

1364. Wheels, *J. Taylor, Wigan.*—21*st March*, 1882. 6*d.*

The rim may be in segments or in one piece, and at the outer part is placed a metal cap with a projection to fit a recess formed in the under side of the tire, which is shrunk on to the rim. The ends of the spokes are capped with metal and screw into the cap, while the other ends have square taper heads and fit recesses in the boss or nave.

1465. Improvements in Carbons for Electric Lamps, *A. Smith, Brockley, Kent.*—27*th March*, 1882. 4*d.*

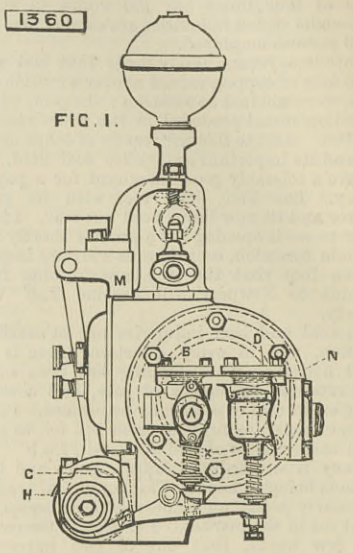
To produce carbon filaments the inventor passes through the liquid furfurol or fucusol hydrochloric acid gases in excess. The reaction produces a black liquid, which is enclosed between two glass plates. After the material is set the plates are wedged apart, and the one to which the film adheres placed in cold water to detach the carbon sheet. Subsequent processes of stamping, &c., produce the required filament. Carbons for arc lamps are also included in this invention.

1366. An Improved Method of and Means for Working Telephonic and Telegraphic Apparatus, *A. E. Dolbear, Somerville, Massachusetts, U.S.*—21*st March*, 1882. 6*d.*

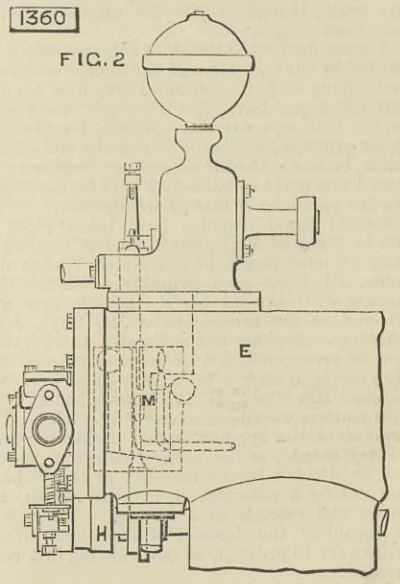
This relates to a means for working telephonic receivers by the varying strength of an electric field, when such instruments are not in or connected with a circuit. The invention is carried into practice by means of telephonic receivers or other delicate instruments provided with suitable inductors which connect two surfaces of different potentials in the electric field of a charged body, which is in communication with the transmitting instruments.

1360. Gas Motor Engines, *H. Sumner, Manchester.*—21*st March*, 1882. 6*d.*

Combustible gas or vapour and air are drawn together by an outstroke of the engine into chamber A, the gas entering by small holes so as to break up the current and mix intimately with the air. The mixture passes to



the cylinder E, through valve B, and passage D, the former opening against spring X, and actuated by a cam. After the charge has been compressed and ignited and has performed its office in propelling the piston, the products of combustion are emitted through valve N, placed beside the inlet valve on the back cover, so as to be easily removable and capable of being worked from one set of cams C placed side by



side on a revolving piece H, and adjustable one to the other. The piece H is carried on a side shaft driven from the crank shaft. The charge is ignited by slide M, operated by an excentric on the side shaft, and which can be set to bring the slide into operation at the proper instant, whether the engine be running in one direction or the other.

1367. An Improved Method of and Means for Providing Ground or Earth Connections for Electric Circuits, *A. E. Dolbear, Somerville, Massachusetts, U.S.*—21*st March*, 1882. 6*d.*

The object of this invention is to render all "earths" of the same potential, and so avoid currents caused by the difference of potential between two earths in circuit. The invention consists in conductors leading from various "earths" to some large body of water, such as the sea, so as to ensure a like potential for each "earth."

1368. Improvements in Electrical Cables, *A. E. Dolbear, Somerville, Massachusetts, U.S.*—21*st March*, 1882. 6*d.*

The inventor surrounds the conductors of his cables with an air space, instead of imbedding them in a non-conducting material, as is usually done.

1370. Spinning Machinery, *J. M. Howson, near Bradford.*—21*st March*, 1882. 6*d.*

The object is to adapt frames now used for spinning long stapled fibre to spin short stapled fibre, and for the better spinning of long stapled fibre, and it consists in the arrangement of the draughting part of the machine so that the thread or yarn that is being spun is brought into direct line from the nip of the rollers with the vertical spindles. Two modes of effecting this are described.

1371. Taking Measurements for Cutting Cloth, *J. Baier, New North-road.*—21*st March*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the construction of an adjustable pattern, the body of which is elastic so as to enable it to fit different people, and provided with flexible rods, by means of which the edges of the pattern can be brought to any desired points to give the desired configuration, when the whole of the rods are secured by clamps.

1372. Coffins, &c., *H. R. Allen, Indianapolis, U.S.*—21*st March*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in the construction of coffins and other articles from paper pulp shaped in suitable press or dies. To render the pulp impervious to water, rosin, pitch, or other suitable material may be added.

1373. Railway Chairs, *H. Bridgewater, Watford.*—21*st March*, 1882. 6*d.*

This relates to improvements on patent No. 2599, A.D. 1869, in which the face of the jaw of the chair, against which the wedge was to be brought in contact, was formed with horizontal ribs which prevented a vertical movement of the wedge but offered no obstruction to the movement of the wedge endwise. To remedy this the face is now cast with horizontal or vertical recesses which allow of the wedge, when driven home, expanding from its compressed state, and, by entering the recess, prevent endwise motion.

1374. Looms for Weaving, *J. Stansfield, Colne.*—21*st March*, 1882. 6*d.*

This relates to simple means of changing the order of succession in which the healds are actuated in weaving, so as to give a positive steady action in the upward and downward movement of the healds or

heddles and allow of the working of three, four, five, or more shafts with tappets, besides reducing the cost of the shedding motion. On the low shaft of the loom is a bevel wheel actuating another wheel on a cross shaft fitted with tappets to work the healds, and each of which has a surface plate with projecting rims, between which works a friction pulley fitted on a stud secured to an arm of the treadle lever. The fulcrum of the treadle works on a stud in a frame, and the end of the treadle arm near the tappet is made with a half-moon, to which is secured a band which takes the curve of the lifting and lowering motion, the other end of the band being secured to the frame of the heald. To the other end of the treadle is secured a band passing over pulleys on studs in the top rail and attached to the healds.

1375. Locks, *J. H. Black, Surrey.*—21*st March*, 1882. —(*Not proceeded with.*) 2*d.*

This relates to improvements in locks, whereby their construction is simplified, the key bolt is dispensed with, the dimensions reduced, and the necessity for a keyhole in the door abolished. The locking mechanism is contained within the knob of the lock, which is fitted with the usual spindle to operate the spring bolt.

1376. Spile Holes of Casks, &c., *W. Watts, East India-road.*—21*st March*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in fitting a tube into the spile hole and inserting the spile therein, so as to drive the one already stopping the same into the interior of the cask.

1377. Producing Ammonia from Coal, &c., *W. Young, Peebles, and G. T. Beilby, Midlothian, N.B.* —21*st March*, 1882. 1*s* 8*d.*

This consists, First, in the production of ammonia from coal, shale, ironstone, and other bituminous or carbonaceous minerals containing nitrogen, by decomposing or burning the carbon resulting from the distillation thereof or anthracite at such a temperature, and in the presence of such an excess of steam, either alone or mingled with air, or with the products of combustion of carbon and air, as will burn the carbon and will eliminate the nitrogen contained therein; Secondly, the re-distillation of the oils resulting from the distillation of shale, coal, or similar bituminous substances by the heat of the steam used to eliminate the nitrogen in the coke, as ammonia, together with the heat from the products of distillation from the retort; Thirdly, the construction and arrangements of the apparatus to carry on the processes described.

1378. Waterproof Garments, *G. and S. Mandleberg and H. L. Rothband, Manchester.*—22*nd March*, 1882. 6*d.*

This relates to ladies' india-rubber cloth waterproof capes, mantles, or cloaks, the object being to improve the ventilation, render them reversible, and also of holding them down to prevent the wind acting on the inside, and at the same time giving them the appearance of having been, to some extent, shaped to the body of the wearer.

1382. Drawing off Water, &c., *C. Fisher, Leicester.* —22*nd March*, 1882.—(*Not proceeded with.*) 2*d.*

In the cistern, in which the level is kept constant by a ball tap, a syphon pipe is placed, and its longer leg connected with the draw-off pipe. The syphon is in two parts connected by a flexible tubing, and the shorter leg is connected by a chain to one end of a weighted lever arranged so that when the syphon is not required to act it holds the shorter leg up, so that the bend of the pipe is above the water level.

1383. Healds for Looms, *J. Green, Blackburn.*— 22*nd March*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to manufacture healds without knots and to dispense with the metallic or glass "mails" usually employed in such manufacture, and it consists principally in the substitution for such metallic or glass "mails" of small endless bands or rings of vulcanised india-rubber, through which the twine (of which the body of the heald is made) is merely passed in the form of a loop.

1384. Tip Wagons, *W. March, London.* — 22*nd March*, 1882. 2*d.*

The hinder ends of the frame on which the wagon rests are of iron or steel and bent outwards and downwards, forming two spurs, to the outer ends of both of which are fastened axle arms on which the hind wheels revolve.

1385. An Improved Construction of Electric Contact Making Thermometer, *J. Formby, Formby, near Liverpool.*—22*nd March*, 1882. 6*d.*

The object of this invention is the conversion of an ordinary horizontal thermometer into an electric-contact making thermometer by means described in the specification.

1386. Separating Cream from Milk, &c., *G. M. Allender, Bayswater, and W. C. Crossby, Chelmsford.*—22*nd March*, 1882.—(*Not proceeded with.*) 2*d.*

A horizontal drum is mounted on a shaft working in end bearings, and in it are two or more inner circular plates and three or more cross pieces.

1389. Filtering Liquids, &c., *F. A. Bonnefin, London.* —22*nd March*, 1882. 6*d.*

This relates to improvements on patent No. 3019, A.D. 1877, in which the filtration was effected by capillary action through or among fibres forming elastic fabrics held between surfaces of a soft or yielding material. A vertical filter is formed by bolting a number of metal frames to a plate, each frame being covered with india-rubber, having a thick ring or flange at the inner edge of the frame. Between the rings the filtering cloth is placed, and a cover fastens the frames together and forms a cylinder, to which the liquid is introduced by a pipe. Other improvements are described.

1390. Apparatus for Driving, Regulating, and Indicating Speed of Dynamo Machines, &c., *J. B. Rogers, London.*—22*nd March*, 1882. 6*d.*

The rotation of wheels or axles of railway carriages are utilised to drive dynamos, the dynamos being regulated and kept at a uniform speed by means of two cone drums and belts, together with gear for altering the position of the straps, &c., according to the speed required. A spindle rotated from one of the drums is made to indicate the speed by suitable gearing, &c.

1394. Chest Expanding Corset, *H. M. Knight, London.*—22*nd March*, 1882.—(*Not proceeded with.*) 2*d.*

The corset has two straps at the back, which after being crossed are passed over the shoulders and then back under each arm, through hooks or staples near the middle of the back, and then brought to the front and fastened to buckles at the waist.

1395. Lamps for Bicycles, Tricycles, &c., *J. Lucas, Birmingham.*—22*nd March*, 1882.—(*Not proceeded with.*) 2*d.*

The elastic tubular clip to support the lamp on the axis of the wheel is formed with a series of symmetrically arranged holes in it, and on the outside of the clip are fixed a series of axes equal in number to the holes. These axes carry antifriction rollers, which project through holes inside the clip.

1396. Materials for the Purification and Deodorisation of Sewerage, &c., *G. J. Andrews, Harrow-road, and F. H. Parker, London.*—22*nd March*, 1882. 4*d.*

The sewerage is placed in an agitator and streams of hydrochloric acid and a solution of alkaline soda injected into it during the agitation. Chlorine gas is evolved and destroys all impure gases, at the same time oxygenating all carbonaceous particles. The matter then flows into a reservoir, at the entrance of which a solution of sulphate of iron is introduced, and which combining with the salt—chloride of sodium—already produced in the previous operation, hastens the precipitation, and renders perfect the deodorisation of all solid matter, preserving therein the ammoniacal and phosphatic salts, thus increasing the value of the deposit as a manure.

1397. Flower-pot Stand for Windows, *J. F. Grimmo, Leyton.*—22*nd March*, 1882. 4*d.*

The object is to enable the saucers usually placed under the pots to catch the surplus water to be dispensed with, and it consists in forming a stand, from which the surplus water runs to a suitable receptacle.

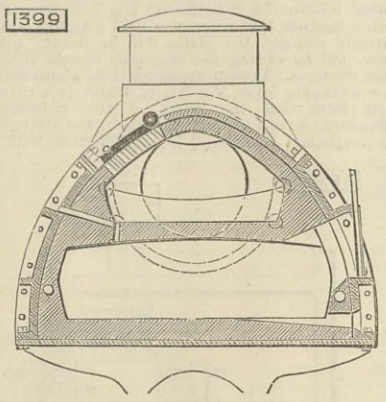
1398. Crimping Machine for Boots and Shoes, *H. H. Lake, London.*—22*nd March*, 1882.—(*A communication from G. P. E. Lenormand-Carpentier, Amiens, France.*) 6*d.*

This consists of a rotary crimping machine having arms or blades, more or less in number, cut out of a single piece of sheet metal or formed of separate pieces fixed to a hub or shaft in the centre and to the rim or periphery of the toothed wheel, and turning between two adjustable plates to crimp the front or the back of boot uppers and similar articles.

1399. Construction of Furnaces, &c., *J. Burch, Stockport, and W. Evans, Manchester.*—22*nd March*, 1882. 6*d.*

This relates to furnaces for the manufacture of pure malleable iron and steel, and consists in the employment of a furnace of the reciprocating or swinging class of special configuration internally. The First part of the invention relates to the construction and internal form of the hearth or refining chamber and to the preparatory mode of heating and melting the succeeding charge; the Second part relates to the mode of working, and the introduction during such time of fluid, comminuted, or solid substances; the Third part relates to the manner and means employed

1399



for introducing compressed air into the hearth or refining chamber whilst the metal is under process, with a view to change the nature of the product either to pure malleable iron or steel; and the Fourth part relates to the special mechanism employed for imparting to the hearth or refining chamber the requisite reciprocating or swinging motions, either regular or intermittent, as best suited to effect the required change upon the metal in process. The drawing is a section showing the hearth chamber with bridge above, the heating crucible and details.

1401. Locking Devices for Miners' Safety Lamps, *J. McKellar Main, Cumberland.*—23*rd March*, 1882. —(*Not proceeded with*) 2*d.*

This relates to a locking apparatus whereby the lamp cannot be opened without being taken to the place where suitable means are provided for so doing.

1403. Gas Burners, *J. Lewis, Stepney.*—23*rd March*, 1882. 6*d.*

This consists essentially in the arrangement and construction of platinum wire gauze burners for consuming a mixture of gas and air (the latter under pressure) for the production of light and heat, in such manner as to prevent the transmission of heat from the burner to the supply pipe by the introduction of steatite or other non-conductor of heat between the burner and the supply pipe.

1406. Corkscrews, *W. H. Holroyde, Manchester.*— 23*rd March*, 1882. 2*d.*

This relates to the employment of a cone, whereby several corks may be drawn without loss of time, each cork forcing the preceding one up the cone and eventually splitting it, when it falls from the cone.

1407. Automatic Gear for the Prevention of Overwinding, *W. T. Lewis, Aberdare, and W. H. Massey, Henley-on-Thames.* — 23*rd March*, 1882. 6*d.*

The gear is so arranged that if the cage is being wound up the pit and the engineman neglects to shut off steam or move over his reversing lever in proper time, then one or other or both of these operations are performed automatically, the lever or levers being moved over slowly or quickly to suit the particular case, and the winding engine so stopped by the time the cage arrives at the top of the pit, or at any rate slowed down, so that if the engine runs further than it ought it may then be stopped (without risk or damage) by the ordinary steam or other self-acting brakes in common use.

1408. Instrument to Facilitate the Administration of Fluids in the Stomach, *F. Kingston, St. John's, Kent.*—23*rd March*, 1882. 4*d.*

This relates to an instrument for administering liquid food or medicine to young children or invalids.

1409. Armour Plates for Ships, &c., *H. Reusch, Prussia.*—23*rd March*, 1882. 6*d.*

This consists partly in the use of ledges or side pieces, made either separate from or cast in one piece with the iron shell plate, in the latter case the said shell plate being made of the size desired for the steel casting, thereby avoiding the previous manipulation of the said ledges or side pieces to obtain a casting of the desired dimensions.

1410. Means of Ingress and Egress to Theatres, &c., in Case of Fire, *A. Scott, Oxford-street.*—23*rd March*, 1882. 4*d.*

This relates partly to the use of balconies on each floor, with staircases connecting them.

1411. Flyers Employed in Spinning, *R. E. Sykes, Cleckheaton.*—23*rd March*, 1882.—(*Not proceeded with.*) 2*d.*

A ring or flange is placed on the top of the flyer, having a hook or hole formed in a stud, through which the yarn is passed previous to being wound on the bobbin.

1413. Umbrellas, &c., *J. Willis, Bournemouth.*—23*rd March*, 1882. 6*d.*

This relates principally to the manufacture of the bottom tip ends of the ribs.

1414. Pulleys and Wheels, *G. W. Benyon, Reading.* —23*rd March*, 1882. 6*d.*

The pulley is constructed with a rim or flange turned inward from or connected to the periphery, and projecting inwards from the periphery towards the axis, the rims or flanges on the opposite sides of the pulley being either parallel or inclined inwards or outwards.

1415. Ships' Rudders, *Sir J. E. Commerell.*—23*rd March*, 1882. 6*d.*

This relates to a rudder consisting of a blade formed in sections, each of which has a socket jointed to it, the several sections of the blade being connected to the rudder post by passing their sockets over or on to the said post.

1416. Binnacles, *W. R. and C. A. Williams, Newport.* —24*th March*, 1882. 6*d.*

This consists in the combination with a binnacle of a transparent compass and of reflectors or mirrors so arranged that the image of the compass card will be reflected in the mirror in the wheel-house below the binnacles, so as to appear in front of the helmsman.

1418. Weaving Looms, *A. Rollason, Lowell, Mass., U.S.*—24*th March*, 1882. 6*d.*

This relates, First, to means for driving looms; Secondly, to means for operating the harness shafts; and Thirdly, to means for actuating the shuttle-driver. A is the driving shaft, B the driving pulley, C a pulley on shaft A driving the fast and loose pulleys D on crank shaft X. By this arrangement several looms may be placed in a row and all driven from one shaft, the pulley of which can be placed at one end so as to leave the alleys between the looms

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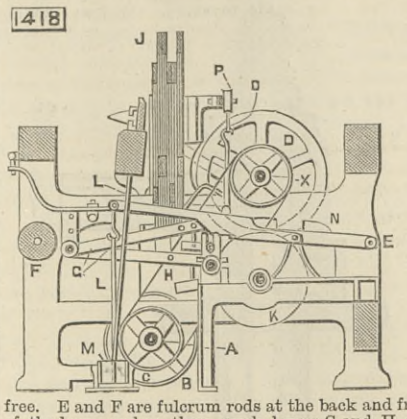
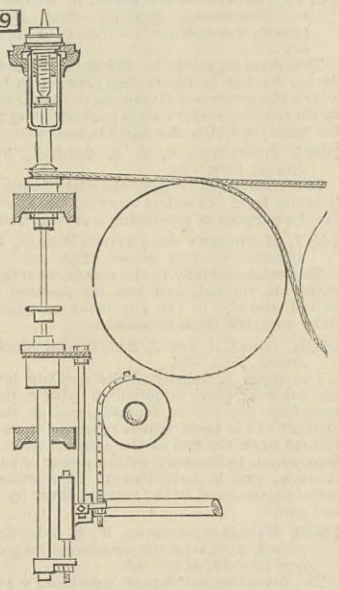


free. E and F are fulcrum rods at the back and front of the loom, and on them work levers G and H connected by rods, several holes being made in the levers so as to vary the extent of motion. J are the harness shafts, each connected to two of the levers by rods which act directly on the shafts. Cams K actuate the levers. L are two driving bands actuating the shuttle-driver, and are guided by rollers M, and driven by levers N which are actuated from the cam shaft by toothed wheels and tappets. The levers N are yoked together by a cord O passing over rollers P.

1419. Spinning, *F. Ripley and T. H. Brigg, Bradford.* —24*th March*, 1882. 6*d.*

A rotating spindle is employed, on which is a flyer and cup or its equivalent. The cup is encircled by the ordinary "ring" and traveller. The spindle receives its rotation from the legs of the flyer by means of a notched disc or cross pin; the rotation of the cup on flyer, within the ring, gives what may be termed frictional aid and ensures the traveller being carried

1419



by the induced motion past or beyond a line central with the spindle; the upper edge of the cup extends above the ring. In order to assist in the action of the apparatus and make efficiency complete, the ring and its rail are traversed. The upper portion of the spindle is detachable for the purpose of recovering and piecing up broken "ends."

1420. Manufacture of Ice for Domestic Use, *R. P. Picket, Geneva.*—24*th March*, 1882. 6*d.*

The object of this invention is the application to domestic use of the process of freezing by anhydrous sulphurous acid by means of an apparatus capable of producing in ten minutes a kilogramme of ice.

1421. Combined Nail Cutter and Cleaner, *J. P. Jones, London.*—24*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to an instrument for scraping or cutting the nails and also cleaning them.

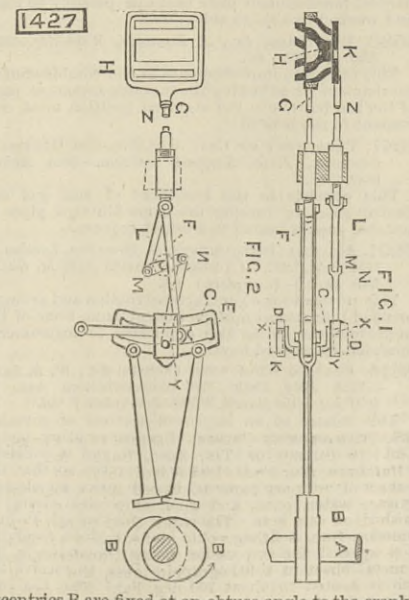
1422. Umbrellas, *J. Miniére, Paris.*—24*th March*, 1882.—(*Complete.*) 6*d.*

This consists in a new system of disengaging devices for the runners, by means of which the umbrellas or parasols are closed by one hand.

1427. Variable Expansion Gear for Link Motion Engines, *T. English, near Dartford.*—24*th March*, 1882. 6*d.*

This relates to improvements in variable expansion gear for link motion engines in which the travel of the slide valve is regulated by shifting the link block along the link. A is the crank shaft, on which the

1427



excentrics B are fixed at an obtuse angle to the crank, the excess over the right angle being the angular advance of the excentric. C is the link jointed to the excentric rods, and at its central point, or point of least movement, pivots X are provided, and have their bearings in blocks Y capable of sliding towards or away from the crank shaft in rectilinear guides D. E is the link block, the position of which in the link may be varied by levers and rods in the usual way to alter the cut off, or to start, stop, or reverse the engine; F is the rod connecting block E with the rod G of the main slide valve H working on an ordinary valve seat, and having two steam ports through it, over which works the expansion valve K. The point of cut off is determined by the amount of lap given to the edges of the port of the expansion valve. The rod Z of this valve is connected by link L with the lower arm of a rocker M, the fulcrum of which is carried in stationary bearings. The upper arm of the rocker is connected by link N with one of the blocks Y, so that the movement of the latter is, after its reversal in direction, transmitted to the expansion valve. Modifications are described.

1426. Valves, *W. Jones, Glasgow, and J. MacLeod, Birkenhead.*—24*th March*, 1882. 6*d.*

The valve is formed of a complete disc or plate of rubber, canvas, or other flexible material, which is held at its outer edges, while the central part is free to rise and fall, to open or close the valve.

1428. Steeping Tanks Employed in the Manufacture of Malt, *R. Free, Mistley.*—24*th March*, 1882. 6*d.*

The tank is constructed preferably square, and the bottom part thereof is formed with inclined sides terminating at the bottom in a discharge aperture which can be opened and closed when desired by a valve; just above this discharge valve is a draining aperture, which is covered by a perforated plate either flush with the inner surface of the tank or slightly recessed below the same, and such aperture is connected with a pipe to convey the drainage water to any desired position, and the said pipe is provided with a cock or valve to enable the passage therethrough to be opened and closed as desired.

1429. Raising and Forcing Acids, Chemicals, &c., *C. T. Wordsworth, Leeds, and J. Wolstenholme, Radcliffe.*—24*th March*, 1882. 6*d.*

This relates partly to the employment of an india-rubber bag or bladder for the purpose of raising liquids from one part to any other part of a building.

1430. Obtaining Power upon Ships or Vessels, *A. M. Clark, London.*—24*th March*, 1882.—(*A communication from K. Anunsen, Winchester, U.S.*) 6*d.*

The invention consists principally of a water-wheel and suitable power-transmitting connections, the wheel being adapted to be lowered into the water at the side or end of the vessel, and held so as to be turned by the water as the vessel moves along. The wheel is raised and lowered upon or with the main shaft, and the blades of the wheel are adapted to be adjusted to suit the wheel to the rapidity of movement of the vessel. It further consists of the shaft frame adapted to be secured to the side of the vessel, of the means for locking the wheel in position for action, and of the construction, arrangement, and combination of parts.

1431. Machinery for the Preparation of Copper Plates used in Pottery Engraving, *T. Smith, Stoke-on-Trent.*—24*th March*, 1882. 6*d.*

This relates to machinery in which the plates are held in frames of various sizes to suit the various-sized plates beneath successive stones and burnishers, both the frames and the stones or burnishers reciprocating horizontally but at different speeds, and in directions at right angles to each other.

1433. Rollers for Washing, Printing, Spinning, Carding, &c., *J. Lewthwaite, Halifax.*—24*th March*, 1882. 4*d.*

This relates to the employment of Parksine, xylonite, or other analogous paste or compound for covering the rollers.

1434. Sewers, *E. G. Banner, London.*—24*th March*, 1882. 6*d.*

The sewers are divided into sections, separated from each other by traps, and each such section is provided with, at one end, an inlet or inlets of any suitable construction for air to enter the sewer in any convenient manner, and at the other end a shaft or shafts of suitable diameter (according to the size of the sewer) provided with means, such as a cowl or cowls or other appliances, for exhausting air and gases from the sewer, so that they shall be discharged into the atmosphere at a much higher level than is now usual.

1435. Chimney Flues, *B. Finch, Westminster.*—25*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in constructing the flues of glazed pottery ware so as to prevent the deposit of soot, and further, in providing a ventilator flue extending from the basement to the chimney-top, and serving to ventilate each room through perforations in the flue level with the ceiling.

1436. Adapting Certain Parts of Ships' Furniture for Use in Saving Life, *J. N. Cressy, Glasgow.*— 25*th March*, 1882. 6*d.*

This consists in rendering ships' bed or cot frames useful for saving life by constructing them with open rectangular frames of wood rendered buoyant by the application thereto of cork, and having wire netting fixed across, but so as to leave an opening at the middle to receive the person to be supported in the water.

1438. Stoppers for Bottles, *H. Barrett, London.*— —25*th March*, 1882. 6*d.*

This relates to improvements in the screw stoppers described in patents No. 4184, A.D. 1879, and No. 5154, A.D. 1881, and it consists, First, in replacing the thread on the stopper by two or more projections which engage with the thread in the neck of the bottle; and Secondly, in providing screw stoppers with a valve which will allow the bottles to be filled through the stopper, and permit the air to escape.

1440. Spreading Manure, &c., *R. G. Garvie and H. Skinner, Aberdeen.*—25*th March*, 1882. 6*d.*

The machine consists of a hopper containing the manure and mounted on wheels, one side of same being formed through a grating, through which pass rows of spikes worked by cranks on a shaft extending through the hopper, and driven by gearing from a second shaft actuated by a chain and wheels from the hub of the wheel. The spikes are fixed on bars attached to the crank shaft, and by the action of the cranks throw out the manure from the hopper, and are cleaned in passing through the grating. A second series of spikes on a rocking shaft near the top of the hopper are caused to oscillate and traverse through between the lower spikes, and prevent the manure escaping too fast.

1441. Exhausting Air from Glass or other Vessels, *E. Edwards, London.*—25*th March*, 1882. —(*A communication from P. Clere and A. Hémot, Paris.*)—(*Not proceeded with.*) 6*d.*

This relates to apparatus in which a column of mercury is employed to exhaust air from glass or other vessels, and it consists of a tube with a reservoir at its upper end, while its lower end communicates by a flexible tube with another reservoir having a valve at top. The second reservoir can be raised and lowered by means of a chain and wheels. The tube communicates with a barometer tube having a bulb at top and communicating with two other tubes, one of which constitutes a "Geissler's" tube, while the other contains caustic potash. The end of the barometer tube is connected with the vessel to be exhausted.

1443. Measuring and Indicating the Rate of Motion of Ships, &c., *J. Armstrong, New Swindon.* —25*th March*, 1882. 6*d.*

An ejector or ejectors are fitted near the keel of the vessel, and formed so that as the vessel passes through the water a partial vacuum is formed therein proportionate to the speed of the vessel, and the extent of which can be readily measured.

1442. Beater Bars for Thrashing Machines, *C. Green, Lincoln.—25th March*, 1882. 4*d*.
This consists, First, in forming the beater bars with the ribs arranged from the centre to the right and left; and Secondly, in making the edge of the bar reach down against the front of the stretcher for attachment to the drum.

1445. Separating Cellulose from Fibrous Plants, &c., *W. Springer, London.—25th March*, 1882.—(*Not proceeded with.*) 2*d*.
Marine and other fibrous plants are submitted to a process of fermentation to reduce them to a homogeneous mass, which is placed in a vessel and acted upon up a vertical agitator, which completes the process of disintegration. The material is then washed and the water removed by pressure, after which it is treated in a warm bath with alkaline oxides, and soap. It is allowed to stand and then bleached by chlorine or alkaline chloride.

1446. Mules and Twiners, *J. Wain, Manchester.—25th March*, 1882. 6*d*.
This consists of an arrangement of parts in the headstock of the mule or twiner, by which the backing off is effected as the carriage runs out, and it consists in the use of an auxiliary shaft for communicating motion to the roller coupling shaft and to the carriage, so that the rollers may rotate and the carriage complete its outward run after the rim shaft has been reversed.

1447. Dyeing Textile Fabrics, *J. W. Hepworth, near Leeds.—25th March*, 1882.—(*Not proceeded with.*) 2*d*.
This relates to machines to dye fabrics in continuous lengths, such as those described in patent No. 898, A.D. 1873; and consists in improvements to enable the fabrics to be dyed evenly. A vessel contains rollers placed near the bottom amongst the dye liquor, and a corresponding number of nipping rollers at top, which squeeze a portion of the dye from the piece, but so as to cool it and remove the superfluous dye; the fabric is passed from the delivery rollers through a trough in which a stream of cold water is kept running.

1448. Plaiting and Sticking Machines, *J. Dowling, London.—25th March*, 1882.—(*Not proceeded with.*) 2*d*.
This relates to improvements on patent No. 4587, A.D. 1881; and consists in using a cam in place of the excentric to actuate the knives, whereby both of them can be actuated so that one moves forward to form the plait, and remains in that position until the other knife has formed its plait. Further improvements relate to the feed motion and to apparatus for sticking two lengths of fabric together by means of a moist or adhesive thread.

1449. Apparatus for Smoking Cigars, *W. Boggett, Chelsea.—25th March*, 1882.—(*Not proceeded with.*) 2*d*.
This consists of an elastic tip to be placed on the end of the cigar, and pierced with a hole at one end, the other end being open to receive the cigar.

1450. Syphon Bottles for Aerated Beverages, *H. H. Lake, London.—25th March*, 1882.—(*A communication from E. Musitsky, Hungary.*) 6*d*.
All the parts of the mechanism with which the liquid comes in contact are made of glass or caoutchouc, and rings of soft caoutchouc are used in such a manner that a perfectly gas-tight closure is effected.

1452. Chucks, &c., *J. M. Alling, London.—25th March*, 1882.—(*A communication from A. Y. Alling, Rochester, U.S.*) 6*d*.
This relates to improvements in chucks, designed more particularly to be employed in the decoration of articles of china or pottery. It consists in providing the centreing jaws of the chuck with an elastic cushion interposed between them and the articles of china or pottery ware, for the purpose of compensating for the irregularities in the outline of the latter. It also consists in the construction and arrangement of mechanism for operating the centreing jaws.

1454. Apparatus for Raising Liquids, *G. Macaulay-Cruikshank, Glasgow.—27th March*, 1882.—(*A communication from M. E. Bourgeois du Marais and P. Doudart de la Grée, Algiers.*) 8*d*.
The invention embraces various arrangements of apparatus for communicating a to-and-fro motion to the receptacle for the liquids, and by which the liquid is raised and discharged from above at certain periods in the motion of the receptacle, the bottom of which is furnished with a clack or valve, which, after confining a certain quantity of liquid and imparting to it a certain velocity, is, when the receptacle descends, opened by the pressure of the liquid surrounding its lower end.

1456. Tanning Hides, *A. C. Henderson, London.—27th March*, 1882.—(*A communication from C. Bez and Sons, Léran, France.*) 6*d*.
This relates to the tanning of hides by aid of a continuous flow or current of tannic liquor.

1460. Producing Transparent Block Ice, *C. D. Young, London.—27th March*, 1882. 6*d*.
This consists in a method of agitating the water in the freezing chambers during the process of freezing by a paddle or paddles.

1461. Manufacture of Explosive Compounds, &c., *E Turpin, Paris.—27th March*, 1882. 4*d*.
This relates to improvements in the manufacture of explosive compounds having peroxide of nitrogen for a base, and in means and apparatus for utilising such explosive compounds.

1463. Dress and Equipment of Divers, *W. H. Skipper, London.—27th March*, 1882. 4*d*.
The inventor claims the mode of attaching the vulcanised india-rubber collar-piece of the dress to the shoulder-piece and breast-plate of a helmet, forming a portion of the equipment of a diver.

1464. Improvements in Electric Piles or Batteries, *F. de Lalande, Paris.—7th March*, 1882.—(*A communication from G Chaperon, d'Alosno Mines, Province de Huelva, Spain.*) 4*d*.
The improved battery consists of a positive pole formed of a plate of iron or other metal surrounded by oxide of copper, built up and maintained by a bag of hemp. The exciting liquid is composed of a solution of caustic soda or potash, zinc forming the negative pole.

1467. Lubricants, *F. Field, Beckenham.—27th March*, 1882.—(*Not proceeded with.*) 2*d*.
Substances known as stearate of lead or stearate of zinc which may contain oleates of the same metals, are dissolved in the heavy hydrocarbon oils, and also in neutral, animal, or vegetable oils, under the application of gentle heat.

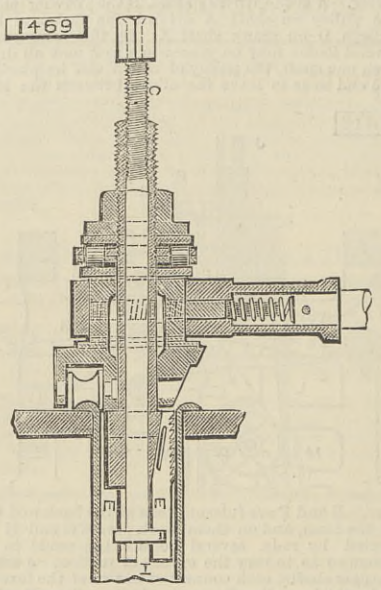
1468. Fireproof and Waterproof Plates, *C. D. Abel, London.—27th March*, 1882.—(*A communication from J. Nagel, Hungary.*) 4*d*.
This consists partly in the process of manufacturing fire and water-proof plates from a combination of amianthus or asbestos with annealed oxide of zinc.

1470. Construction of Furnaces, &c., *J. Hodgkinson, Bolton.—27th March*, 1882. 8*d*.
This relates to an arrangement of self-cleaning fire-bars, which are arranged transversely in the flue on endless chains or bands.

1471. Metallic Packing for Piston Rod Stuffing-boxes, &c., *W. V. Ley, Liverpool.—27th March*, 1882. 6*d*.
Metal, such as white metal, in a molecular condition, is used in combination with asbestos and paraffine, wax, grease, or equivalent lubricant.

1473. Moreen Fabrics, *E. H. Wade, Bradford.—27th March*, 1882. 2*d*.
The inventor claims the combination of an unsized double-twisted moreen warp, made from materials which have been dyed the same or different colours previous to being spun, with yarn that has been dyed previous to being woven, or with metallic tinsels either alone or in combination,

1469. Tube Beaders, *J. A. Frieake and T. McCormick, London.—27th March*, 1882. 6*d*.
The object of this invention is to provide in a tube beading tool of the kind described in patent No. 2374, dated 19th June, 1877, means of automatically releas-



ing the gripping pieces E, and the inventors claim the arrangement shown of the internally gripping pieces E, fitted to slide along inclined beds on the mandril in combination with the screw C, having a head H engaging in notches of the pieces E.

1476. Ornamenting China and Earthenware, &c., *H. Doulton, Lambeth, and J. Slater, Burslem, Staffordshire.—27th March*, 1882. 2*d*.
This relates to the process of ornamenting china and earthenware and other pottery by impressing textile fabric, such as lace, upon the clay, together with the application of colour, or coloured clay, and pressing the clay so embossed in clay or other moulds.

1477. Harvesting Machines, *B. Samuelson and W. G. Manwaring, Banbury.—27th March*, 1882.—(*Partly a communication from C. W. Marsh, U.S.A.*) 6*d*.
This consists partly in the application of a binding device having reciprocating packers to harvesters in which the grain is delivered to the said binding device by means of elevators, such packers being placed above the table on which the grain is bound.

1484. Tin-plates, *C. S. B. Gardner, Neath.—28th March*, 1882. 2*d*.
This consists in chilling the plate immediately after it issues from the rollers working in the molten tin, for the purpose of producing a crystallised tin-plate.

1487. Machinery for Cutting Metals, *W. W. Hulse, Manchester.—28th March*, 1882. 6*d*.
This relates chiefly to the means whereby the tool or cutter is rotated, and has its position adjusted or varied, and also to the apparatus on which the work to be operated upon is secured.

1488. Looms, *J. and J. Hodgkinson, Blackburn.—28th March*, 1882. 6*d*.
The upper extremity of the rocking lever carrying the catch or pawl is provided with a pair of corresponding grooves or recesses, one at the front and another at the back, which receive a cross-bar or pivot formed upon the end of the catch or pawl. The pivot is arranged to fit easily within either of the grooves or recesses, and is held therein by a suitable formed metal cap secured to the rocking lever by a screw bolt and nut.

1498. Metallic Shingles, *W. R. Lake, London.—28th March*, 1882.—(*A communication from C. Comstock, New Canada, U.S.*) 4*d*.
The invention consists in providing a projection or hook on each side of the point of the shingle by making a slit in the metal on each side just below the lower ends of the hollow ribs which extend along the inclined edges, and in springing up the metal at the obtuse corners of each shingle, so that the hooks of the overlapping shingle will pass under the adjoining edges of the two underlying shingles, and thereby hold the point in place.

1506. Apparatus for Making Ice by Means of Cold Air, *J. J. Coleman, Glasgow.—29th March*, 1882. 6*d*.
The inventor claims the combination or arrangement of parts for applying cold air in making ice; and consisting of a series of chambers protected by non-conducting walls and covers, fitted for receiving moulds or boxes in which the ice is to be formed, and provided with doors or valves in connection with passages, by means of which the cold air is made to pass successively through the chambers, with periodical changes of the succession of the chambers in regular rotation.

1512. Ladders, *T. Jones, Sedgley.—29th March*, 1882.—(*Not proceeded with.*) 2*d*.
This consists of two wooden side bars fitted with any convenient number of tubular iron or metal rungs.

1518. Projectiles, *W. Naylor, Penistone.—29th March*, 1882. 6*d*.
The object is to produce a shot having a body of maximum toughness compatible with its purpose and design, with an outside or exterior of such hardness that it shall be capable of cutting its way into the hardest faced armour plate that can possibly be made and worked to a ship's side.

1536. Bedsteads, &c., *J. Reynolds, Worcester.—30th March*, 1882. 6*d*.
This relates to improvements in the combination of mechanism for adjusting the movable frames or parts of the bed bottom to the required position most convenient to the invalid.

1541. Treatment of Coal Gas, &c., for Obtaining Benzole, *J. A. Kendall, Dalston.—30th March*, 1882. 4*d*.
This consists in the treatment of coal gas and similar gases by passing the same through pipes or suitable vessels heated to a bright redness.

3291. Musical Instruments, *G. Downing, London.—11th July*, 1882.—(*A communication from M. Gally, New York.*)—(*Complete.*) 6*d*.
This relates to the general construction and arrangement of mechanical musical instruments, some of the improvements being also applicable to instruments operated by manual keys.

3315. Coating Wire with Copper, &c., *W. R. Lake.—12th July*, 1882.—(*A communication from T. Wallace, New Haven, U.S.*)—(*Complete.*) 6*d*.
This relates to an improved method of covering wire with an electro deposit of copper or other metal, and to the apparatus to be employed, and it consists, First, in causing a coil of wire to revolve, so that the wire will enter continuously at one place an electrolytic solution forming part of an electric circuit of which the wire is an electrode, travel through it in a spiral course, and pass out at another place, receiving the deposit of metal in its course; Secondly, in the use of apparatus consisting of a tank to receive the solution, a roller to receive the coil of wire, the convolutions of which are kept separate by guiding devices, and suitable mechanism to drive such roller and thereby feed the wire progressively through the solution in a helical path.

1554. Treatment of Grain for Use in Brewing, *E. Beanes, London.—30th March*, 1882. 4*d*.
This relates to the improvements in the treatment of grain preparatory to its use for brewing or other purposes, consisting in steeping the said grain in a solution of an acid or acid compound, and thereafter subjecting it to the action of heat.

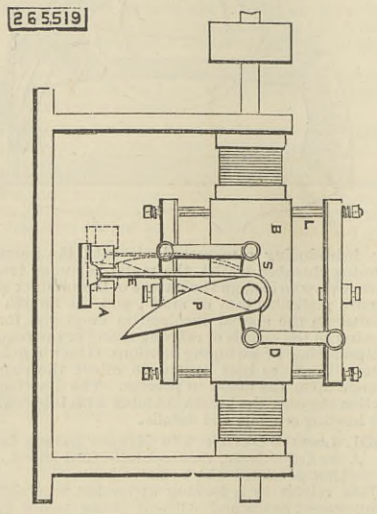
1645. Rolling Bars of Steel, Iron, &c., *A. Riche, Jeumont, France.—5th April*, 1882.—(*Complete.*) 4*d*.
The inventor claims, First, the use of rolls, one with a disc carrying a circular projection, the other roll having a corresponding groove; Secondly, the method of producing without welding articles in iron, steel, or other metal by using a pair of rolls made according to the above description.

2259. Improvements in Apparatus for the Transmission and Reproduction of Sounds by Electricity, *W. C. Barney, London.—13th May*, 1882. 6*d*.
This relates to improvements on the original instrument of Phillip Reiss, in order to make it articulate well.

SELECTED AMERICAN PATENTS.

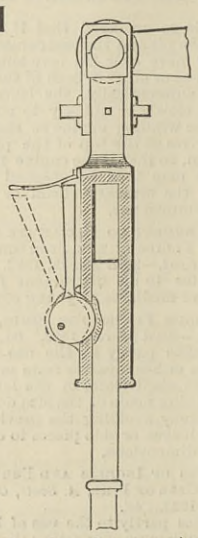
From the United States' Patent Office Official Gazette.

265,519. Regulator for Dynamo-electric Machines, *John W. Langley, Ann Arbor, Mich.—Filed March 9th*, 1882.
Brief.—Improvement on letters patent No. 247,664, dated September 27th, 1881. Magnetic plates are supported within the influence of the field magnets in such a manner that when the field magnets are too strongly charged the plates will be drawn toward them, and by closing the magnetic circuit diminish their strength. A counterpoise for these plates is hung to a swinging lever, the face of which is a curve of such form that the effect of the counterpoise will always have a certain relation to the strength of the magnets. *Claim.*—(1) In combination with the



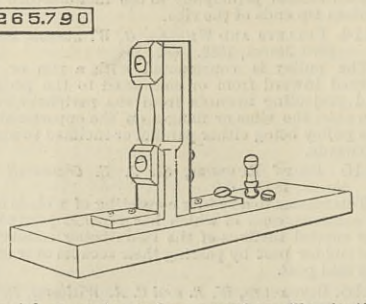
poles of a dynamo-electric machine and a magnetic metal piece so placed as to be attracted by said poles, a weight acting over and through a curved lever connected with such magnetic metal piece, and tending to force the same away from the poles, as and for the purposes set forth. (2) In combination with the poles B and magnetic metal plates L, the weight A and curved lever P, so connected with plates L that said weight offers an increasing resistance as plates L approach said poles B, as and for the purposes set forth. (3) The combination of the poles B, magnetic metal plates L, pivotted arm S, pivotted connecting rods D, curved lever P, strap E, and weight A, as and for the purposes set forth.

265,747. Stop Motion for Steam Engines, *George W. Briggs, Denver, Colo.—Filed 26th May*, 1882.
Claim.—The combination, substantially as before set forth, of a reciprocating rod provided with a depression or notch, a sleeve or socket adapted to transmit



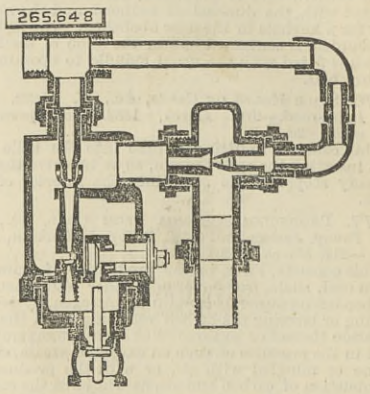
the motion of such rod, and a cam pivotted to the sleeve and adapted to enter the depression in the rod through a hole in the sleeve for the purpose of locking the rod to the sleeve at a determinate point.

265,790. Electric Lamp, *Moses G. Farmer, Newport, R.I.—Filed 7th March*, 1881.
Claim.—(1) An electric lamp, the light-producing portion of which consists of a thin and broad strip of metal having its edges shaped to a geometrical curve corresponding with the law of heat-conductivity in



such metal, so as to produce a uniform illumination throughout every portion of said strip, substantially as and for the purpose specified. (2) An electric lamp, the light-giving portion of which is composed of a flat strip of metal, broadest in the centre of its length, and gradually decreasing in breadth from the centre to each end thereof, substantially as and for the purpose specified.

265,648. Steam Injector, *Garner C. Williams, Ellenville, N.Y.—Filed 16th January*, 1880.—*Renewed 15th May*, 1882.
Claim.—(1) In a steam injector, a water-inlet port opening into and an overflow port opening out of one and the same chamber, constructed and combined to operate substantially as and for the purposes specified. (2) In a steam injector, a steam nozzle and a water-inlet port opening into one and the same chamber, and an overflow port opening out of said chamber, constructed and combined to operate substantially as and for the purposes specified. (3) The combination, in a steam injector, of the water-inlet port, the overflow port, and the steam nozzle, all in one and the same chamber, and arranged relatively to one another as described, whereby water entering the chamber will submerge the injector nozzle before it can pass out



through the overflow, substantially as set forth. (4) In a steam injector, the combination of a steam nozzle and a water-inlet port opening into one and the same chamber, an overflow port opening out of said chamber, and a partition between said ports, so that water entering the chamber from the inlet port must flow over the steam nozzle and partition before it can pass out of the overflow port, substantially as and for the purposes set forth. (5) In a steam injector, the combination of a steam nozzle and a water-inlet port opening into one and the same chamber, an overflow port opening out of said chamber, a combining tube, and a shield interposed between the steam nozzle and the combining tube, substantially as and for the purposes set forth. (6) In a steam injector, the combination, with the overflow port, of an overflow valve opening outward under the pressure of the steam in the injector when the water is not flowing to the boiler and closed by the pressure of the water when it is flowing into the boiler, substantially as and for the purposes described.

CONTENTS.

THE river Missouri may be navigated as far as the Great Falls, a distance of 3127 miles from the point where it joins the Mississippi.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Oct. 28th, 1882:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 8257; mercantile marine, Indian section, and other collections, 2409. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 4 p.m., Museum, 1457; mercantile marine, Indian section, and other collections, 309. Total, 12,432. Average in corresponding week in former years, 14,309. Total from the opening of the Museum, 21,435,307.