THE SMELTING OF SPATHIC ORES IN STYRIA.

No. II.

The newest and most improved blast furnace plant in the Vordernberg district is that belonging to Prince Schwarzenberg, at Trofojach, which was entirely rebuilt in the year 1871. It stands about half-way between Vordernberg and Leoben, in a more open situation than any of the upper furnaces, so that all the materials charged have to be lifted through the full height of the furnace. As in the works previously noticed, the ore is calcined by the waste gas of the furnace in Fillafer's patent kilns, of which there are ten, arranged in a rectangular block, 13·5 metres long by 4·25 metres broad. Each kiln has an internal capacity for 2·2 tons of ore, and is twice filled during the twenty-four hours, giving 3 tons of roasted from 4·5 tons of raw ore charged. The working of the kilns is regulated by the addition of more or less small ore; but when large ore alone is used the production is increased by one-half. The furnace is remarkable for the careful provision against loss of heat by radiation, the stack proper being surrounded by an outer casing at a considerable distance from it. The intermediate annular space is closed both above and below, and encloses a large volume of air, which, being stagnant, remains at a nearly uniform temperature of about 60 deg. Cent., the utmost variation between summer and winter being only 5 deg. The outer casing forms an imposing-looking tower of masonry, the lower part being square, 11 metres in the side and 5·6 metres high, with a slight taper upwards, each of the four sides being pierced by a large round-headed tuyere arch. The upper part is octagonal, also tapering, in a height of 11 metres, from 10 metres in diameter below to 8½ metres at the level of the charging platform. The octagonal wall is continued for a short distance above the platform, and the space between it and the tunnel head is roofed-in, forming a shelter for the men working at the furnace top against the inclement weather prevalent in winter time.

The furnace stack, which is scarcely more than one-third of the diameter of its outer casing tower, is made up of two walls. The outer one, of common bricks hooped with iron rings, is carried upon six cast iron columns, of the same height as the main tuyere arches, and carries the tunnel-head chimney above the charging platform. The inner stack stands entirely free within the outer one. It is built of fire-brick. The interior is nearly cylindrical, being formed of two acute conical portions joined by a cylindrical portion at the boshes. The leading dimensions are—Height, total, 15·900 metres; height of lower cone, 4·109 metres; height of cylindrical boshes, 2·184 metres; height of upper conical stack, 5·373 metres; diameter of hearth, 1·580 metres; diameter of boshes, 2·580 metres; diameter of throat, 1·100 metres; cubic volume of stack, 58 cubic metres.

Experience has shown that there is no considerable wear in the stack of these furnaces, except in the lower part near the hearth, which requires renewal after five or six years of continual working. Iron supporting columns are therefore used, as in the outer casing; but they are not so tall, leaving only a height of 2 metres of hearth proper, that can be rebuilt when necessary. The tuyere plane is 530 mm. above the hearth bottom. There are six bronze tuyeres, the two lower ones blowing into the centre, while the axes of the two middle ones are laid 80 mm., and those of the two front ones 150 mm., off the centre line. The blast nozzles vary, according to circumstances, from 46 mm. to 70 mm. in aperture. The gas trap is formed by a sheet iron cylinder, 1·10 metres diameter and 2·2 metres deep, suspended in the throat, which is correspondingly enlarged to form a ring flue. The opening of the gas flue, which is 948 mm. diameter, is 1·3 metres below the furnace top, and is fitted with a balanced valve for shutting off the gas when it becomes necessary to clean the flue, at which time the gas is allowed to pass into the air by an opposite passage connected with a chimney. At a depth equal to half the height of the furnace the gas main passes into a cylinder of 1·58 metres diameter, terminating below by a funnel and pipe closed by a water joint, where the dust carried over is deposited, and the purified gas is delivered by a lateral tube to the conduit leading to the kilns and stoves. The latter are a modified form of Gjers' well-known pattern, and contain twelve pipes of elliptical section, 461 mm. by 106 mm., giving a total length of travel for the blast of 55 metres. The heat attainable is 555 deg. Cent.; but it is not found desirable to go above 340 deg., owing to the ready fusibility of the ore, which is liable to cause obstruction at the tuyeres if the blast is too highly heated. The blowing engine, driven by an overshot wheel of about 80-horse power, has two horizontal cylinders, of 1·264 m. diameter and 1·180 m. stroke, the suction valves, which work against counter springs, being placed in the cylinder cones, giving a minimum clearance space. The usual working pressure is 150 mm. of mercury. The working details are very similar to those previously given for furnace No. 14, the materials smelted being calcined spathic ore of about 46 per cent. produce, fluxed when necessary with silicious clay, and puddling and heating furnace cinder. When the latter are used beyond a fluxing quantity, caustic lime is added, which is burnt in the ordinary gas roasting kilns used for the ore, and charged hot. The fuel used is exclusively charcoal, about three-quarters of it being from soft—coniferous—wood, and one-quarter from hard wood, principally beech. The former is derived from the forests of Upper Styria, while the latter is drawn from a much wider area, including Southern Styria, Carinthia, Hungary, and Croatia. On a large average the soft coal weighs 140 kg. and the hard 230 kg. per cubic metre. The fuel is charged by two wagons at a time, of 0·75 cubic metre capacity, or 1·5 metres per charge, and the burden of ore and fluxes mixed, in two wagons, together of 750 kg. The ore wagons have conical drop bottoms, which distribute the contents towards the circumference of the furnace, while the charcoal is, if necessary, levelled by hand. The number of charges passed through the furnace is, under ordinary circumstances, ninety in twenty-four hours; but with hard driving the number may be increased to 125—the former corresponding to a production of 30 tons and the latter of 40 tons per day. Under the most favourable circumstances the fuel consumption is about 65 per cent., or 13 cwt. per ton of metal produced. The furnace is tapped at intervals of two hours, the metal forming a plate about 2 m. square and 57 mm. thick, weighing up to 50 cwt. A piece of solid metal is placed upright in the bed before tapping, forming a handle to which the crab chain is attached for drawing the plate out when solidified. When cold it is broken up by hand, or under a falling weight, into pieces about a foot square, for the refining and puddling furnaces, when the make is, as is usually the case, white refining iron. Occasionally, however, a close, dark gray metal, suited for specially strong machinery and chilled castings, is made.

The continually increasing difficulty of procuring charcoal in sufficient quantity to meet the demands of the larger modern furnaces has, for many years past, given rise to experiments on the partial or entire substitution of mineral fuel. For this purpose coke has been brought often from great distances, and it has been sought to use the local lignites in admixture with charcoal. The furnace at Trofojach was worked for a short time in the spring of 1875 with a mixture of equal parts of Leoben lignite and charcoal, but the result does not seem to have been sufficiently favourable to allow of the method being permanently adopted. Similar trials have been made at different times at Prävali and Zeltweg, but the success does not appear to have been more than an experimental one. At Prävali, where mixed coke and lignite were used, the quantities of equivalent calorific values of the different parts were determined to be 100 kilog. of coke from Ostrau, in Moravia; 125 kilog. of coke from Fünfkirchen, Hungary; 125 kilog. of lignite from Liescha; the latter material being much inferior in quality to the lignite of Leoben.

The largest experiment in the way of substituting mineral for vegetable fuel, has been made at Klein, Schwechat, near Vienna, where two large blast furnaces for smelting the spathic ore of Eisenerz with coke were erected in 1873 by the Innerberg Haupt Gewerkschaft, and which have now passed, with the other property of that company, into the possession of Alpine Montan Gesellschaft. These, both in regard to position and construction, present a striking contrast to the furnaces in the Alpine Valleys, being situated on the edge of the dreary alluvial plain extending eastwards into Hungary, and constructed onthe Buttgenbach system, where it is sought to preserve the upper part of the furnace by exposing it as much as possible to the air, and the region of the hearth, by the introduction of hollow iron boxes and blind tuyeres which are kept cool by a continual circulation of water. The furnaces are of 285 cubic metres capacity, 19 metres total height, 2·5 metres in diameter at the hearth, 5·70 metres in the boshes, and 3·85 metres at the throat, are blown by four tuyeres, and work with closed hearths and Lürmann slag twyers.

As originally constructed there were eight rings of water boxes, of the same shape as the bricks, built into the region between the hearth and the boshes, but in the last rebuilding of one of the furnaces a smaller number of square bronze water tuyeres have been substituted. They are built into the wall, and are blocked in front by about 6in. of brickwork, which can be easily replaced when burnt through. The water circulates from above downwards in a spiral course and even with the reduced number there is a considerable complication of pipes about the hearth of the furnace. The calcined ores with a proportion of raw smalls are brought by railway from Eisenerz, a distance of about 120 miles; the coal and coke used come from Ostrau in Moravia, about the same distance, and the limestone flux from the Leitha mountains, about twenty miles away. For some time past only one furnace was blowing, but recently the second has been relighted; one is kept on white forge, and the other on grey Bessemer pig, the make of the former being from 40 to 50 tons daily with a consumption of 70 per cent. of coke and 40 of coal per ton of metal made, while with grey iron the make is somewhat less and the fuel consumption is increased to 80 of coke and 50 of coal. The coke contains from 8 to 10 per cent. of ash, and about 1 per cent of sulphur. The composition of the metal is as follows:—

	White.	Grey Bessemer.
Carbon combined	2·830	0·420
Carbon graphitic	—	3·520
Silicon	0·520	1·789
Phosphorus	0·184	0·136
Sulphur	0·085	0·023
Manganese	2·670	4·446

The iron produced is mostly sold to works in Bohemia, Moravia, and other provinces, which are without a sufficient supply of pure ores for steel making. A certain quantity is also used in the steel works at Gratz. Up to the present time, however, the works, whose value consists entirely in their central position between the ore and coke supplies, have not been very successful. They are very fortunately placed, as regards the disposal of the slags, as being in an agricultural country without any stone at hand, the slags are removed for road metal almost as fast as they are produced, and there is no accumulation of any consequence about the works, although they have been more or less active for eight years.

The Neuberg works, situated about twenty-two miles north of Eisenerz, immediately below the main chain of the Norian Alps, are supplied with spathic ores from a series of smaller deposits which extend at intervals eastward as far as Schwatz in Tyrol, where they pass into the famous antimonial and mercurial copper ores which made the fortunes of the Fugger family of Augsburg in the sixteenth century. As might be expected, from this association, the ores are somewhat pyritic; those from Gollrad, Altenberg, Solln, and Bohnkogel, which are smelted at the associated furnaces of Neuberg and Maria Zell, showing by analysis from about 0·5 to 2·4 per cent. of sulphuric acid, which, however, is nearly all eliminated by careful roasting in special kilns with a large admission of air, and in the worst cases allowing the roasted ore to weather for some time before smelting in order that the sulphates found may be washed out by the rain. The high reputation enjoyed by the guns, pipes, and other castings made at the Maria Zell works is probably due to some extent to the presence of sulphur in the ore. According to the analyses furnished to the members of the Iron and Steel Institute, the amount of sulphuric acid in the calcined local ores smelted at Neuberg ranges from 0·003 to 0·377 per cent., while in that imported from Eisenerz it is 0·11 per cent.

The Neuberg works formed the subject of a series of special articles in this journal in the year 1873, in which the main features as still existing were described. Since that time, however, a peculiar process of steel manufacture has been introduced, which was shown in action to the Iron and Steel Institute. This is a combination of so-called refining in an open hearth furnace with the Bessemer process. The charge of crude metal taken melted from the blast furnace is blown in the converter for about twenty minutes, when, before it is completely decarburised, it is transferred to another ladle and poured into a fully heated Siemens-Martin furnace, where it is allowed to boil for three or four hours, two or three additions of malleable iron and steel scrap to the extent of about 4 to 5 per cent. being made at intervals, and finally about 5 or 6 per cent. of spiegel and a little ferro-manganese if necessary. This process is specially adopted for the production of the harder classes of steel when a quality equal to that made in crucibles is required. It is a somewhat delicate operation, as the success depends chiefly on keeping the metal on the boil during the entire refining period.

The average consumption of materials for the different classes of steel is as follows:—

100 parts by weight of Bessemer pig require of—		
Calcined ore	215	
Limestone	14	
Charcoal	90	
100 of Bessemer ingots require—		
Pig iron	108·7	113·2
Iron and steel scrap	3·7	
Ferro-manganese and spiegel	0·8	
100 of open hearth iron and steel ingots require—		
Pig iron (white and mottled)	30·7	104·5
Iron and steel scrap	71·0	
Mill scale	1·5	
Ferro-manganese and spiegel	2·8	
Lignite and coal	75·0	
100 of refined Bessemer steel require—		
Fluid Bessemer metal	95·0	105·0
Rolling mill waste	4·3	
Ferro-manganese and spiegel	5·7	
Lignite and coal	43·0	

The ingots produced in the steel works are almost entirely worked up in the rolling mills and forges attached to the works, in which puddled iron is also produced in furnaces heated with wood and converted into a specially high quality of boiler plates. The more important machines in the forges and mills are two large steam hammers of 17 and 6 tons, four smaller ones, a heavy plate mill, driven by a steam engine of 600-horse power, with independent steam gear for the adjustment of the rolls—described in our 35th volume—a plate mill driven by a turbine of 100-horse power, three smaller mills, also driven by water from 50 to 100-horse power each, two large steam shearing machines, and a hydraulic press of 400 tons power. The furnaces comprise two Bessemer converters of 4½ tons, two 5-tons Siemens-Martin furnaces, with auxiliary heating furnaces; three double puddling furnaces, three gas welding furnaces, ten steel ingot heating furnaces and fourteen boilers, twelve of which are heated by the waste flame of the puddling and heating furnaces. The annual productive capacity is about 14,700 tons of finished iron and steel, of which about 7000 tons consist of heavy plates both of iron and steel. Among the principal examples of finished work shown to the visitors were—a large plate, 6·145 m. × 2·250 m. × 15 mm. in soft iron, one of 7·200 m. × 1·200 m. × 30 mm. in steel, the latter intended for the frame plate of one of the locomotives now building in Vienna for the Paris, Lyons, and Mediterranean Railway Company; steel shells for torpedoes forged from ingots cast hollow, annealing pots for wire mills, and grinding discs for the Dingey mills used in the Pribram lead mines. The composition of the standard qualities of steel made at Neuberg is represented by the following analysis:—

	Bessemer.			Martin.		
	Hard.	Medium.	Soft.	Hard.	Medium.	Soft.
Carbon	0·638	0·368	0·126	0·687	0·303	0·167
Silicon	0·444	0·172	0·135	0·046	0·010	0·023
Sulphur	0·009	0·015	0·014	0·008	0·006	0·013
Phosphorus	0·042	0·044	0·060	0·036	0·045	0·062
Manganese	0·640	0·417	0·158	0·404	0·290	0·044
Copper	0·100	0·037	0·112	0·119	0·075	0·076

The mechanical properties of the different products are:—

	Elongation per cent.	Ultimate tensile strength. Kilogs. per sq. mm.	Contraction of area of fracture.	Factor for quality.
Hard Siemens steel / Refined Bessemer steel / Sword blade steel ...	15·8	95	22	117
Refined steel shell	20	75	28·7	103·7
Medium hard Bessemer steel axle	21	67·5	29·4	96·9
Medium hard Bessemer steel tire	32	52·2	51·4	103·6
Soft Bessemer steel plate ...	25·5	55·3	48·7	104·0
Soft Bessemer iron wagon tire	23·6	48·9	59·0	107·9
Soft Martin iron plate	32·2	41·2	66·1	107·3
Heavy welded iron plate ...	23	37·9	32·1	70·0
Heavy welded iron plate ...	27·9	36·0	31·3	67·3

The quantities in the last column are the sum of those in the two preceding ones, as required by the German Railway Union, whose standard of quality is from 85 to 95 for railway materials.

The largest forge in the Alpine district is that at Donawitz, near Leoben, which is well placed, being at the mouth of the Vordernberg Valley and near to the Seegraben mines producing the black lignites of Leoben. This was originally started in 1836-37 by Franz Mayr with a single puddling furnace, producing blooms which were finished at the rail mill at Prävali, and has by subsequent additions and the adoption of steam grown into a very important establishment, containing eighteen puddling furnaces, two open-hearth furnaces, and six rolling mills from 80 to 300-horse power each, with fourteen heating and annealing furnaces, producing plates, wire, and merchant iron of all kinds to the extent of about 15,000 tons yearly. The chief points of interest are to be found in the puddling furnaces, which are fired with lignite upon step grates, and are provided with an auxiliary bed for heating the metal, and stack boilers for utilising the waste flame. The weight of the charge is from 275 to 350 kilog., according to the quality of the metal, and from ten to thirteen heats are puddled, giving the very large production of 2560 to 4500 kilog., with a consumption of fuel of 3300 kilog. These results are in great part due to the high quality of the metal, which is practically free from silicon, and to some extent to the careful heating of the metal before charging. The roofs of the furnace are built of magnesite bricks, a speciality of the works where they have been made for a great number of years past, and are found to stand well in places where they are exposed to flame only, and not to the scorifying action of oxide of iron. They are made from the native carbonate of magnesia, which is calcined, ground, and rendered plastic for moulding by the addition of a little clay as a binding material. The manufacture of cement steel for springs is also carried on at these works, but it is of diminishing importance, owing to the substitution of Martin and Bessemer steel. In the year 1881, 233 tons of spiral springs were turned out. There is also a department for boiler work, in which about 325 tons of boilers and special forgings were produced in 1881. The plates are produced from hammered blooms made in the old open charcoal hearth in the forges at Töllerl and Waasen in the neighbouring valleys. Other forges are attached to the works at S. Peter and Göss, which are employed in the production of scythes and other agricultural implements, and there is also a small sheet mill at Gemeingrube, which is historically interesting as having existed as a rolling, driven directly by a water-wheel, as far back as 1817.

Amongst the numerous other establishments of the Alpine Montan Gesellschaft we may mention the Crucible Cast Steel Works at Kapfenberg on the Mur, which did no however, lie within the route of the visitors. Th se are noted for producing the highest quality of crucib.e steel, particularly the harder kinds, among which the so-called manganese steel, containing about 1·5 per cent. of carbon and 1 per cent. of manganese, is specially noticeable. This is now being used for the rotating toothed cutters of Brandt's hydraulic boring machine in the Pritram mines and the western end of the Arlberg tunnel, the temper being given by immersing the points of the teeth in water when at a low red heat. Crucible cast steel is also made at Eibiswald, near Marburg, the melting furnaces being on Siemens' principle, and heated with gas from lignite.

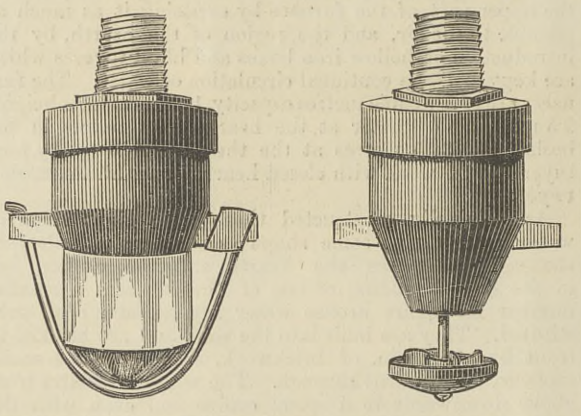
The last, and in many respects one of the most interesting establishments visited in Styria, was the steel rail mill of the Southern Railway Company at Gratz. This is principally intended for the re-manufacture of the iron rails worn out on the company's lines—which have a total length of about 1700 miles—into steel by the Siemens-Martin process. The works, which were designed by the manager, Herr Prochaska, include two smaller and two larger furnaces, the former taking 5½ and the latter 10 to 12½ ton charges, which are modified in several important particulars from those in use elsewhere. The regenerators, instead of being immediately below, are in front of the furnaces, and the gas is introduced at the full temperature of its production without being previously cooled by passing through a rising pipe and horizontal main, which does away with the difficulties produced by the deposition of tar and other condensible products. The gas and air admission passages in the furnaces are laid with their axes converging towards the centre of the hearth, both in the horizontal and vertical planes, so that the point of maximum intensity of the flame is in the middle of the bath, which not only gives a better utilisation of the heat, but protects the roof, which will stand from 300 to 600 heats without renewal, the furnaces being kept at work for six or eight months continuously. The charge for rail steel consists of about 80 per cent. of old malleable rails, which are dissolved in a bath composed of one-third grey coke pig from Schwechat and two-thirds white charcoal metal from Vordernberg, with a final addition of about 3 to 4 per cent. of spiegel and ferro-manganese. The steel contains:—Silicon, 0·3 to 0·4 per cent.; carbon, 0·4 to 0·6 per cent.; manganese, 0·45 to 0·65 per cent.

The smaller furnaces make 16 to 18 meltings per week, or about 4000 tons yearly. The consumption of melting coal is about 60 per cent. of the weight of the ingots in the large furnaces. The latter have a large annular casting pit about 40ft. in diameter with a central ladle crane. The ladle is so deep that the stream of metal would issue with too great a velocity if allowed to flow into the moulds direct, and the current is therefore moderated by interposing a shallow trough with two spouts, which is slung below the top hole of ladle and allows two moulds to be filled simultaneously, with a corresponding reduction in the velocity of the stream. When the demand for rail ingots is insufficient to use up the whole of the steel in the ladle, a proportion of ferro-silicon previously melted in a crucible is added, and the remainder is cast into crossheads and other parts of locomotives, crossings, &c., the addition of the silicon producing perfectly sound castings. The rail ingots of two rail lengths are reheated in a Bicheroux furnace, heated with Köflach lignite, having a bed about 25ft. long with eight working doors, and an inclination towards the fire-bridge of 10 deg. After passing the cogging mill they are sawn in two, and carried by a chain creeper to the mill and heating furnace, where they are rolled into rails in single length. This mill being merely for the company's own requirements, it was not worked at the speed common in works making rails for sale; but great care is taken to obtain the correct section, for which purpose a special finishing mill with only a single groove is used. The rail rolls are entirely of steel cast on the spot, and specimens of these were shown in the lathe that had been in service for four years in the mill. The various stages of the operation are controlled by analysis, and for this purpose special rapid methods are adopted in the laboratory. Thus the phosphorus determinations are made by gauging the volume of the phospho-molybdate precipitate in narrow-bore divided tubes, and the same solution that has served for the carbon determination by Eggertz's method is used for the estimation of manganese by boiling it with peroxide of lead, which converts the manganese into permanganate, giving, after rapid filtration through asbestos with the help of an exhausting pump, a rose-coloured solution, in which the metal is estimated by a standard solution of ferrous sulphate, as in the ordinary method of iron assaying. In this way a sufficiently accurate determination is made in about half an hour, instead of the much longer time required when the result is to be obtained by weighing.

In concluding this brief and imperfect notice of a very large subject, which may, however, indicate to the reader the rapid manner in which a series of objects of the highest interest were presented to the visitors in the short space of three days, we must express our thanks to the various officials and managers of the different works, who, both by personal explanation and more particularly by the admirable statements prepared for the use of visitors, and from which most of the details given in the preceding pages have been derived, did so much to render the visit pleasant and profitable.

AUTOMATIC FIRE EXTINGUISHERS.

Herewith is illustrated an automatic water jet for fire extinction as made by Messrs. J. and W. Kane, of Philadelphia. Messrs. Kane claim for their invention that the valve has no sharp, tight-fitting slides or grooves to slide upon before opening, nor are there any fine teeth or perforations liable to become filled up, so that the danger of sticking on account of any rust or



roughness on the surface is entirely removed. The valve has a full ½in. opening, and a little dish, or cone-shaped wheel, which causes the water to cover a large circumference. The cap shown on the valve, as closed, is simply placed there as extra precaution against dust. It drops off instantly from its own weight, as soon as the spring releases the water. The spring is made of steel, and cannot be removed until the solder holding it is melted, when the dust-cup drops, and instantly the valve is at work.

THE STRUCTURE OF IRON AND STEEL.

Dr. H. C. Sorby, F.R.S., delivered a very interesting lecture in the Firth College, Sheffield, on last Saturday night, upon the subject of "The Microscopical Structure of Iron and Steel." There was a very large audience, which included many of the scientific men of the district.

Dr. Sorby said he was first induced to investigate the subject of his lecture as bearing on the structure of meteoric iron. Little or nothing was known of the minute structure of irons and steels, but much might be learned of the nature of iron and steel by artificial fractures, though these showed more the lines and planes of weakness and the divisions between the constituent crystals, than the actual structure of the crystals and their relation to one another. It was, therefore, requisite to devise some means of ascertaining the exact structure of the metal independent of any lines of weakness revealed by fractures. The learned lecturer having described the means adopted by him to ascertain the exact structure of the metals, said as far as could be learned from the careful use of the microscope, various kinds of iron and steel contained at least well marked constituents. In the first place there was pure iron, and what was probably three well marked compounds of iron, with varying amounts of carbon or other substances met with in small quantities in different sorts of iron and steel, portions of included slag, well marked crystals of graphite, and small crystals, which might be silicon. The lecturer then proceeded to exhibit by means of the oxy-hydrogen lamp a considerable number of illustrations of the structure of various kinds of artificial iron and steel, some being photographed by Mr. Charles Hoole direct from the preparations, others from drawings by the lecturer, and others from natural prints. Commencing with various kinds of cast iron, it was shown that their structure was sometimes chiefly modified by the presence of crystalline plates of graphite, over which was deposited what was probably free and the interspaces filled by what were probably two distinct compounds of carbon and iron. In other cases the structure was mainly dependent on the crystalisation of the iron itself, the graphite being thrown off towards the close of the process. In the case of white iron, the principal constituent was probably an intensely hard, white refined iron, with much carbon associated with which were one or more of the other compounds of iron and carbon present in grey iron. The microscopal structure of this white iron was exceedingly curious and beautiful. The next illustrations were of various kinds of wrought iron. The hammered bloom was shown to consist of irregular mixtures of crystals of iron and portions of slag. When rolled out into a bar those portions of slag not squeezed out were drawn out into long threads, but the crystals of iron seen in the bar were not the original crystals of the bloom, but fresh crystals formed on the cooling of the bar, since they exhibited little or no tendency to elongation in the line of the length of the bar, as would occur if the original crystals were drawn out by the process of rolling. The fibre seen on fracturing such specimens of wrought iron was mainly due to the elongation which occurred during the fracture, and was not characteristic of the unaltered iron. In connection with this illustrations were shown of the structure of armour-plates, of welded joints, and of all those kinds of iron which are employed in the manufacture of steel by the converting process. The change of structure produced by the process was, the lecturer pointed out, very striking, the most characteristic feature being the development of a network of flat crystals of an intensely hard compound of iron and carbon, scarcely acted upon at all by diluted acid, so that the rest of the steel may be dissolved away, and this compound left in sufficient relief for exquisite prints to be taken, as from a wood cut. Numerous illustrations thus taken direct from the iron and steel were exhibited with a lantern, and few microscopical objects are more beautiful than some of the preparations of this cemented blister steel; since, when specimens are prepared, some of the constituents gave rise to the most exquisitely beautiful colours by interference of light. The difference between the structure of the outside of the converted bars where this hard compound of iron and carbon had been developed, and of the interior of the bar, was shown to be very great, this latter being mainly due to recrystallisation of the original iron. Ingots of cast steel produced by melting such blister steel had a totally different structure, which depended in the first place on large crystals, and in the second place on the minute microscopical structure of these crystals. The principal difference between the structure of such an ingot and that of hammered bars was that the whole mass was made more uniform and the grain very much finer. This was still more the case when the hammered steel was hardened, in which case the constituent crystals were so small that it was very difficult to learn much about them by microscopical study. The structure of Bessemer steel ingots was naturally different from that of the varieties of steel containing more carbon, and, though of coarser grain, closely approached the structure of some varieties of Swedish iron. This structure upon hammering was greatly altered, and became of fine grain and more uniform. In conclusion, the lecturer exhibited several illustrations of the structure of meteoric iron. This differed so much from that of most varieties of artificial iron that it was a long time before any point of similarity could be discovered. Alloys of iron and nickel of the same composition as meteoric iron were melted and slowly cooled, but nothing at all resembling the structure of meteoric iron was obtained. At length it was found that the closest approach to this structure was in the case of iron which had been kept for a long time at a high temperature but not actually melted, under which condition some varieties of iron containing little carbon crystallised in large crystals, having some of the important characteristics of meteoric iron, whilst iron containing a certain amount of carbon crystallised in a manner imperfectly resembling the very perfect crystallisation of meteoric irons. Only that in these artificial preparations there was crystallisation of various compounds of iron and carbon, whereas in the meteoric iron there were varying compounds of iron and nickel. The inference to be drawn from these facts was probably that meteoric iron had been crystallised very slowly at a temperature below fusion. A hearty vote of thanks was accoıded to the lecturer.

The tender of Messrs. Mowlem and Burt for carrying out the Hyde Park-corner improvement scheme has been accepted—total, £31,000—and they have commenced the work of removing Wellington Lodge, preparatory to its re-erection lower down Constitution-hill. The other tenders were Messrs. Hill and Higgs, £39,000, and Mr. W. Webster, £39,727.

How to Melt Babbitt Metal.—L. F. Lyne in *American Machinist*, says: "I wish to say a few words in reference to the treatment of Babbitt and other similar anti-friction metals. Workmen who are unaccustomed to mixing or treating metals while in liquid state will generally melt such metal upon a blacksmith's forge by applying heat so rapidly that the ladle will become red hot before the metal within it begins to melt. When it has melted a dross rises to the surface and is skimmed off by the workmen and thrown away. The skimming process is kept up as long as the ladle is kept on the fire. Now such a course is all wrong, because, by applying heat too suddenly, the metals which fuse at lower degrees of heat sweat out, and are burned before those which melt at higher temperatures become fluid. The dross, as it is commonly called, which rises to the surface, is in many cases the antimony or hardening property of the alloy, and should not be thrown away. The surface of the melted metal should be kept covered with fine charcoal, which will prevent oxidation. A small lump of sal-ammoniac should also be kept upon the surface of the metal. The metal should always be stirred before pouring, otherwise the heaviest metals will separate and sink to the bottom of the ladle, and a constantly varying quality of metal will be the result. By melting the metal slowly and keeping it properly fluxed as described, it will run sharp, each casting will be found uniform throughout, and the metal be of equal hardness. In observing these simple precautions, much of the dissatisfaction now experienced in using Babbit and other anti-friction metals will disappear, and the metal not be condemned because it simply obeys the laws of nature and separates when improperly treated."

The Vienna Elevated Railway.—Unless, says the *Wiener Herald*, October 15th, 1882, every sign be false, the decision, with regard to the granting the concession of the Stadtbahn stands already on our threshold, and, in spite of the procrastinating policy of our Gemeinderath, in favour of Messrs. Fogerty and Co., the concession will, as we, in common with the *Neue Frie Presse*, hear, very shortly be granted to Mr. Fogerty by the Government, over the heads of our worthy "Fathers of the City." Strongly as we support the autonomy of the Gemeinde, we are equally glad that its members will suffer defeat, and in no way grudge Mr. Fogerty his victory. When one thinks of the experiences this man must have made when he came to Vienna to carry out his plan of providing the city with a railway, such as would not have been more ably thought out, nor better suited to the interests of traffic, we cannot but admire the pluck and perseverance with which Mr. Fogerty stuck to his idea. Everything that common-place, narrow-mindedness, short-sightedness and malignity could devise, was summoned to thwart the execution of his project. Every stick, so to speak, that could be found was thrown between Mr. Fogerty's legs, and all his goodwill and all his readiness to comply with every wish of the Gemeinde, and to make the most extensive concessions, were met with systematic derision instead of a proper acknowledgment. And at last, when they were almost at their wits' ends for wherewithal to annoy Mr. Fogerty, attempts at bribery had to be invented in order to discredit him as much as possible. Instead of thanking heaven that foreign capital and constructive capacity can be induced to carry out an undertaking, for whose execution we must wait for many a year before we are in a position to call it into existence with native powers, the opponents have, in their almost incredible ignorance, employed every means they could think of to render the undertaking impossible. It must, therefore, be considered as a truly fortunate circumstance that the Government, less short-sighted than the worthy members of the Gemeinde, and more capable of recognising the advantages and scope of such a project as Mr. Fogerty's, have come to the conclusion to grant him the concession for the Stadtbahn. The Government allows itself, moreover, to be influenced by other reasons to bring this question at last to a settlement. There is reason to fear that the London gentlemen who are interested in this undertaking, if there be any further delay in its realisation, will withdraw from the business, which would be all the more to be regretted because the financing of the Stadtbahn is intended to be principally effected by English capitalists. The English not only bring us their good ideas, they bring us also their good money.

GORDON'S DYNAMO-ELECTRIC MACHINE.

THE first steam locomotives were crude machines compared with those which were constructed in the course of a few years after their first introduction. Just so, no doubt, will be the case with dynamo machines. The first dynamos were little more than models, and we are only now beginning to realise the fact that it is more economical to construct a dynamo which will absorb 100-horse power than it is to construct one to absorb a single horse-power. Then, again, new uses require new designs. The design of a pumping engine differs from that of an express locomotive; so the design of a dynamo to supply the electric current for a large number of incandescent lamps differs considerably from that designed to supply a large number of arc lamps. A few years ago the success of incandescent systems was scouted by many and doubted by others. Time has proved that their fears were groundless, and that incandescent lighting is not only an actual fact, but it is the system towards which almost all eyes and efforts are directed as the great work of the immediate future. Directly incandescent lighting became practical and no longer merely an incident of the laboratory, attention began to be directed to its introduction upon a large scale. Gas was already in possession of the field, and usually changes are not made unless the evidence of gain is very strong. There is, however, a stronger incentive to gain than mere economy, and that is fashion. The electric light seems to have become fashionable, and this in addition to its inherent merits as a light. It is said to be, when used on a large scale, as economical as gas and as much under control. This being the case it was to be expected that machines would be designed to supply the current on a large scale. Under the usual conditions arc lamps have hitherto been arranged in series, that is, one after the other upon the wire joining the two terminals of the machine. Now, as each lamp opposes the current with a certain resistance, the adding of lamps in series increases the resistance in proportion to the number of lamps. If the resistance of one lamp is represented by x; the resistance of the lamps in series is represented by nx. A certain electro-motive force is required to overcome the resistance x; but n times that electro-motive force is required to overcome the resistance nx, the current being constant, and, of course, the more constant the current the better for the lights. Putting this into the familiar symbols of Ohm's law, $C = \frac{E}{R}$, we know at once that to retain C constant when R becomes n R, we must make the numerator n E. The feature of machines required to supply the current to

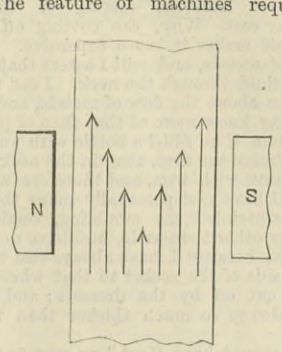


Fig. 6

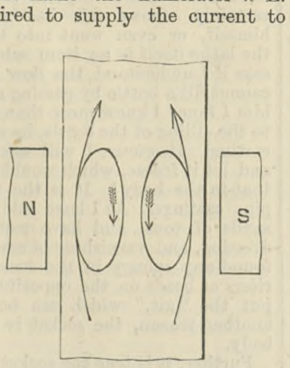


Fig. 7

a number of arc lamps in series is high electro-motive force. To a certain extent quite an opposite condition holds when a large number of incandescent lights are under consideration. These lamps are generally arranged in multiple arc, or each lamp provides a path for the current from terminal to terminal; or say two large main wires are taken from the two terminals of the machine, the lamps are strung between these two wires. In the case of the arc lamps, with one lamp we require, say, a current of 20 Ampères; the machine is not asked to supply more current though 100 lamps are in the circuit. It still sends 20 Ampères through the circuit. But taking one incandescent lamp as requiring 1 Ampère, by the arrangement adopted 100 such lamps require 100 Ampères, that is, 1 Ampère through each branch wire and lamp. Hence the machine has to provide quantity in one case and electro-motive force in the other. In the latter case, E represented in the formula $C = \frac{E}{R}$ is constant, and C is increased by diminishing R.

From these remarks it will be seen that a large amount of knowledge, talent, and ingenuity may be brought into play in designing dynamos for different purposes. Besides, however, the electrical matters to be considered in such designs, there remain the purely mechanical details such as the proportion of parts, the strains, &c., to be brought into play, and these present some curious problems when taken in connection with the electrical requirements.

The latest and most important development of the dynamo electrical machine we illustrate this week on page 316. It is the invention of Mr. J. E. H. Gordon, and has been constructed from his designs—in the preparation of which he was aided as to details by Mr. Clifford and Mr. Lucas—by the Telegraph Construction and Maintenance Company at its works at Greenwich. Before proceeding to describe the machine more minutely, it will be well to explain the principle on which it acts in general terms. The central armature is an iron disc, on which are arranged a series of wire coils, the wire being coiled in the same plane as the disc. The wires are united in a ring on the central axis, against which ring bears a gun-metal contact lever, into which is sent a current of electricity from two Burgin machines which act as exciters. The armature revolves between the two sides of a frame of cast iron, which carries a number of electro-magnets; that is to say, of cores covered with insulated wire. From these the currents developed in them are led off to the lamps. Thus it will be seen that the field magnets are attached to the armature, and move, while the equivalents of the armature coils are at rest. There is no commutator, the machine being of the alternating current type.

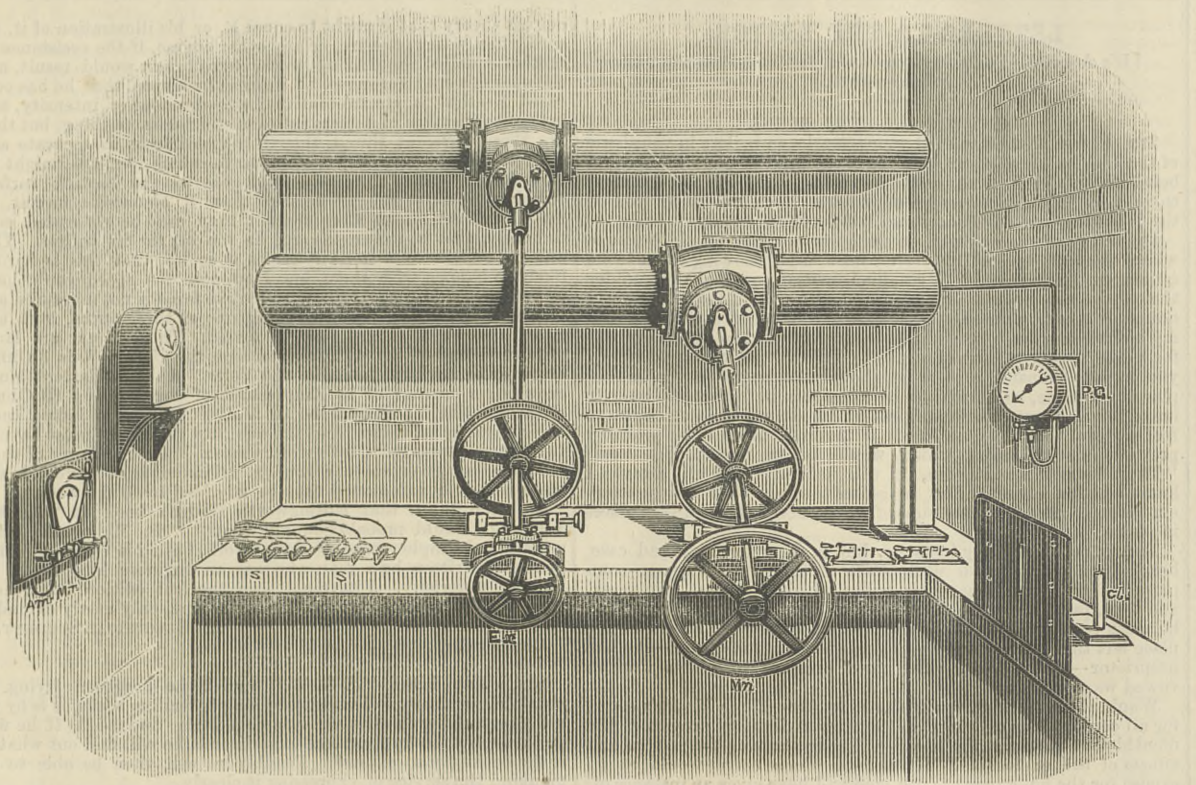


Fig. 5—THE PHOTOMETER ROOM.

On Wednesday evening a number of gentlemen interested in telegraphy, among whom we may mention Mr. W. Shuter, Mr. J. E. H. Gordon, Mr. Brandreth, J.P., Mr. Stern, Sir James Anderson, Mr. Swan, Mr. Crompton, Mr. Dever, Mr. Willoughby Smith, Captain Halpin, Mr. T. Fuller, Mr. Clifford, Mr. Lucas, Mr. Moore, Mr. Willoughby Smith, jun., Mr. William Smith, Edmund Dicker, visited by invitation the works of the Telegraph Construction and Maintenance Company, near Maze Hill, Greenwich, to see the first large Gordon machine which has been constructed. This machine can, with sufficient power, light 6000 Swan lamps, but this is not at present available, the engines used to drive it being a pair with horizontal cylinders, 20in. stroke, and 16in. diameter, making about 140 revolutions per minute. They were used for some time on board the Calabria for picking up cables. On Wednesday night about 1300 Swan lamps of over 20-candle power were in use, lighting up every department of the large works. It will give some idea of the dimensions of the system if we state that there are about 8 miles of wire leads in use.

This is not the first machine made by Mr. Gordon. Mr. Gordon's present machine is an improvement upon an earlier one. In the former machine the revolving rings each carried the same number of magnet coils as the fixed rings carried armature coils, and it was found that an injurious inductive action militated against the efficiency of the machine. If a certain number of lamps were maintained by one coil, and the circuit of the next coil was then closed, there was a reduction of light in the lamps of the first circuit by some 20 or 30 per cent. The cause of this was in the current circulating in opposite directions in the contiguous coils. In the present machine the armature coils are twice the number of the magnet coils, hence the magnets act on alternate coils. For example, at the instant when the 32 magnets are acting with their maximum effect on the alternate coils 1, 3, 5 . . . 63, the other alternate coils, 2, 4, 6 . . . 64, are practically idle, and although the coils 1, 3, 5, &c., do act upon each other, it is with far less effect in there being comparatively a long distance between them, so that the effect is inappreciable. Our illustration of the general view of the machine, as seen at Greenwich, will give a better idea of the machine than mere description. Its total weight is about 18 tons. The weight of the revolving magnet wheel is 7 tons. The space occupied by the bed-plate is 13ft. 4in. by 7ft., whilst the diameter of the magnet wheel is 8ft. 9in. With 1300 Swan lamps in two circuits, the 128 coils are arranged 4 in series and 32 in quantity. The number of revolutions is 140 per minute, which gives a velocity of a little over 60ft. per second to any point in the revolving wheel. The revolving magnet coils are magnetised, as we have said, by the current from two Bürgin machines—one would in reality suffice—conveyed in the usual way by brushes making contact with the rings L Fig. 1, on the collars C, Fig. 2. The rings are usually of phosphor bronze, and are separated from the iron collars by an insulator. The current in the magnets is 19 Ampères, with an electro-motive force of 88 volts. The current in each armature wire is 27·5 Ampères. A detail illustration of the armature coil is shown in Fig. 4. Each coil is wound with wire ·185in. diameter, its cross section is ·0269 square inch, and the total cross section of the 128 coils of wire in quantity is $·0269 \times 128 = 3·44$ square inches.

The coils may be coupled up in almost any way desired. For example, if the full 5000 lamps were placed on this machine, the 128 coils would be all coupled together for quantity. The number of revolutions would be raised to 200, with a current of 48 Ampères in the magnet's coils, giving the same electro-motive force as before, and the same current—24·25 Ampères—in the armature wire. The armature wire will take a current of 40 Ampères easily. The core of the coil, N, is of wedge shape, and made of a piece of boiler-plate bent upon itself, so that the angle forms the thin end of the wedge, and the free edges, which do not quite meet, form the thick end. A wedge-shaped head of a T-piece is inserted into one end of the folded plate and welded to it, the stem of the T being turned and screwed is passed through a hole in the fixed ring, and secured by nuts. A German silver flange is rivetted on a shoulder cut on the end of the core. This flange has cut into it slots as nearly as possible in a direction at right angles to the currents which may be induced in it. The connection of the outer ends of the cores of the coils is made by prolonging the cores outwards from the magnet coil, and securing them to a fixed iron ring-shaped plate, which form their support.

In order that power may not be wasted in inducing currents in this plate, it is set back some distance, the cores being correspondingly prolonged. The space between the wire of the coils and the iron plate may be filled up with wooden plates or blocks, which form the second flange of the coil, Fig. 1. The thickness is such that the algebraic sum of the magnetic potentials, induced by the magnetic poles at any point of the fixed iron ring, is as nearly as possible zero. The wheel consists of two central discs A, and of two cones B, whose bases fit upon the central discs, and through whose apices the main shaft passes. The discs A and cones B, Figs. 2 and 3, are made of segmental pieces of boiler plate, so cut that the grain of the plate is radial to the wheel at the centre of each segment. The segments are rivetted together with butt strips in the way usual in boiler making. The discs A are kept apart at the centre by a cast iron distance piece. At the rim they are kept apart by a wrought iron ring. The cones B are of less diameter than the discs, so as to leave a space of flat disc all round exterior to the cones. The cones and disc are separated at the centre by massive cast iron bosses, turned square to the shaft where they butt against the disc, and conical where they butt against the cones. The cast iron distance piece D is of somewhat larger diameter than the bosses, so that the discs can be rivetted to it without the heads of the rivets interfering with the bosses. The cones, discs, ring distance piece, and bosses are all firmly rivetted and bolted together, being still further strengthened by angle pieces placed between the disc and the cones. The discs are rivetted with double butt strips, the cones with single ones. The butt strips of the cones are placed inside them, and the rivet heads countersunk, so that the outsides of the cones have perfectly smooth surfaces. The flat outer portion of the wheel receives the magnet cores M, which are 32 in number. Each magnet consists of a cylindrical iron core, of two bobbins of brass or other metal other than iron, containing wire, and of two pole pieces. The core passes right through a hole in the discs A and wrought iron ring E, and is fixed so as to project equally on both sides. The brass bobbins are then slipped on one at each side of the disc, and the pole plates being fixed on hold the bobbins in their places. The pole plates are of iron, preferably wrought; their sides are not parallel, but form radii of the magnet wheel.

The shaft runs in bearings, preferably of phosphor bronze, which are carried by the side frames. There is a large gap or opening in the sole plate, through which a portion of the wheel dips into a pit below the machine. This enables the centre of gravity to be kept low, and greatly increases the stability of the machine. The end thrust is taken by two loose iron collars placed on the shaft, and pressed gently against the inside ends of the phosphor bronze journals by means of set screws projecting from the ends of the cast iron bosses. These set screws are secured by lock nuts. Fixed rings of cast iron carry the fixed coils; each carries sixty-four armature coils. These rings are supported by being bolted to the inside of the gap in the sole plate, and by four cast iron struts. They are also tied together by the screwed rods. Each fixed ring is made in three segments, one being much smaller than either of the other two. This is for the reason that if one of the magnet coils breaks down it can readily be got at by removing the small segment of one of the fixed rings, and turning the wheel until the damaged coil comes opposite to the gap so produced in the ring, the damaged coil can thus quickly be removed and replaced by another.

The exciters used to supply the current to the magnet coils are driven by a small separate steam engine. A dark room—Fig 5—is provided near the machine, in which is a photometer, and through which the steam pipes of the two engines pass. Stop valves are attached to these pipes, so that a man can control them while reading the photometer. A micrometer slow motion is attached to the valve wheels, so as to avoid any sudden changes of light. The following instruments are placed in the photometer room, in convenient positions for observation:—A strophometer, for showing the speed of the large dynamo; an Ayrton's ammeter for showing the strength of the exciting current; and a steam pressure gauge. There are two lamps in the photometer, one in each of the two circuits into which the machine is divided. They are lighted alternately by means of switches. If there is any very great difference in the number of lights on the two circuits, the one having the fewest lights will be brightest. In practice when the same class of houses are supplied from the two circuits there will never be any great difference in the number of lamps on each. An adjustment is, however, provided by the street lamps near the machine, which by a simple switch, S S, can be instantly transferred 50 or 100 at a time from the dimmer circuit to the brighter one.

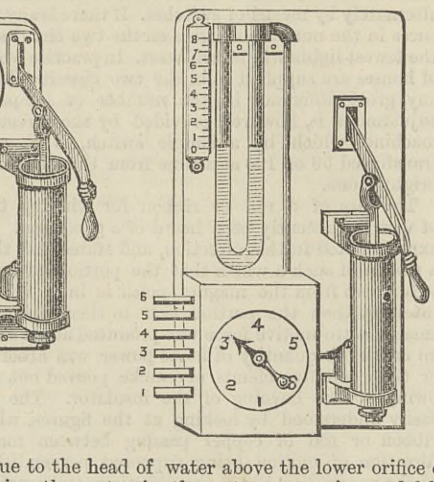
The use of a rod or ribbon for winding the coils instead of wire has recently been heard of a good deal. Mr. Gordon has experimented in this direction, and states that the effect of using a ribbon of such a width that the portion of its diameter which is furthest from the magnet poles is in a field of sensibly less intensity than the portion near to them was that only a very small electro-motive force was produced at the ends of the ribbon, an enormous quantity of horse-power was absorbed, and in two or three minutes clouds of smoke poured out of the machine, owing to the burning of the insulator. The reason of this is easily understood by looking at the figures, which represent a ribbon or rod of copper passing between magnet poles, the direction of motion being supposed perpendicular to the plane of the paper. In Fig. 6 the directions and lengths of the arrows represent respectively the directions and magnitudes of the electro-motive force produced, while Fig. 7 shows the direction of the current due to them. Thus we see that only a small portion of the current arrives at the ends of the ribbon, and that most of it is wasted in forming "eddies" in the width of the copper.

After their inspection of this fine machine and the lighting, which is on the largest scale yet attempted, the visitors were conducted through the Telegraph Construction and Maintenance Company's cable constructing works, where they inspected the various machines at work and the processes employed in coating cable cores, and then building upon these the various insulating and strengthening materials and wires that go to make up the modern submarine cable. Few people have any idea of the enormous strength requisite for the shore ends of an oceanic cable, or for the cables of some of the small but turbulent and irregular-bottomed seas. A visit to these works will, however, soon show that though all the cables used in the world are made by a small number of firms, these few use an enormous quantity of materials of different kinds gathered in from many directions. The central portion of the cable consists of one or several strands of copper wire, usually coated with gutta-percha by machines which, though simple, are the results of costly experience. This core is in many cases covered with a cotton tape laid on longitudinally and succeeded by a thin brass tape about 0·625in. wide, and laid on by simple machines carrying a pair of bobbins revolving round the core as it travels, and placed at an angle, which causes the edges of the tape to meet or slightly lap. The brass tape is succeeded by narrow cotton tape steeped in a preserving substance, such as boiled Stockholm tar, and sometimes other materials of a similar nature. These tapes are wound or laid on the core in the same way as the brass tape, and in some cases two are used, the one covering the other, the lay or direction of winding of the outer tape being contrary to that of the under tape. As the cable so far completed leaves this machine it passes through a mixture of Stockholm tar, &c., and is then covered with a coating of jute yarn. From the machines which perform this coating the cable runs into tanks and lies there in water, lengths of about twenty-five miles being in each tank. While in these tanks the continuity of the core of the cable and its electric resistance are tested by a complete arrangement of testing apparatus in a separate building. In passing it may be mentioned that some of the 1500 lamps supplied by the monster machine are in this testing department, and though it was questionable whether the powerful currents passing through a number of leads in this house would affect the delicate instruments employed, it has been found that they have no effect whatever, the expected induction effects being completely prevented by the alternating current, and by the eliminating effect of the proximity of the several leads.

As the jute covered, and so far completed, cable leaves these tanks it passes through a machine of large dimensions, by which it is covered with galvanised iron wire. The cable passes vertically from one floor to one above through the axis of a machine consisting chiefly of a horizontal revolving disc carrying a number of bobbins filled with the wire, and to which are given a motion similar to that of the moon, so that they always present the same face in the same direction, and thus prevent the twisting or torsion of the wire. Machines for performing this work are usually made with vertical bobbin discs, the cable passing horizontally, but there seems to be some advantages in the arrangement above described. As the wire is wound on by these machines it squeezes the water out of the jute covering, and in its progress the cable passes through a machine by which it is again payed over with boiled Stockholm tar, &c. In this condition the cable may be complete for some purposes, but for shore ends it is again coated with two wide jute tapes wound on in opposite directions, and subsequently with one or more coverings of coated iron wire, sometimes as much as 0·375in. in thickness. All the machinery for effecting these operations is in communication by belts and strap shifting gear and brakes, because a fault or break of wire, tape, coating, or any other imperfection making it necessary to stop one, makes it necessary to stop all, for the process is a continuous one from the commencement of the combination of core with tapes. Some idea of the quantity of materials used at the works may be gathered from the fact that when the company began to adopt the tape covering they could not obtain the quantity required from any tape manufacturer. There was not one that could give them more per week than they wanted per day, namely, about 6000 gross of yards. Of the jute tape about 30 tons per week are used, and over 200 tons of wire are sometimes used per week. The repairs of cables cost an immense sum, and some of these machines are always at work in making the cable, with which the Telegraph Construction and Maintenance Company are prepared without a moment's loss of time to repair and maintain those of the Eastern Cable Company in all waters and at all times by means of their fleet of steamships.

PNEUMATIC HYDROMETER.

Messrs. W. Reid and Co., of 5, New London-street, E.C., are making what is known as a pneumatic hydrometer for measuring liquids and semi-liquids at a distance. This apparatus consists of a glass U water gauge with attached pipe or pipes, and a small pump to charge the pipe with air. It is made for measuring and indicating by an attached air pressure indicator the depths of liquids in seas, rivers, mines, wells, reservoirs, vats, ships' holds, and so on. By charging the pipe leading to the liquid required to be measured with compressed air, which will have a pressure



equal to that due to the head of water above the lower orifice of the immersed pipe, the water in the water gauge rises and falls in unison with that in tank or vat, and the indications are continuous. By means of sundry outlets in a distributing tap, corresponding with an index and pointer, the contents of any number of receptacles can be registered on the same gauge. Thus, on a single indicating dial placed in the captain's cabin or engine-room, the depth of water in all the bilges, holds, tanks, and water receptacles in the ship, as well as the draught of water fore and aft, may be at once indicated; or the contents of every vat in a brewer's store may be indicated in his office, simply by momentarily depressing the handle of the charging pump. When great accuracy is not required the water gauge is not employed, but only a pressure indicator. As constructed by Messrs. Reid and Co., the apparatus is handier than in the form commonly used.

THE COST OF STEAM ON TRAMWAYS.

The Stockton and Darlington steam tramways have now been in constant work for upwards of twelve months, and Mr. Robert Sutehall, the manager, gives some very valuable details as to the running expenses attending the six Merryweather engines of the steep gradient and air-condensing pattern. The figures given below include renewals and repairs. The chief gradients are two, varying from 1 in 20 to 1 in 30, and a third, 300 yards long, also varying from 1 in 20 and upwards. The sharpest curve is of 40ft. radius.

Stockton and Darlington Steam Tramways Company, Limited.—Cost of Repairs and Running of Engines for week ending Monday, July 24th, 1882.—*Average week.*

No. of engine.	Wages.	Repairs and renewals.	Coke.		Coal.		Oil.		Waste.		Total.	Miles run.	No. of cars worked.	Cost per engine per mile
			Quantity.		Quantity.		Quantity.		Quantity.					
	£ s. d.	£ s. d.	tons. cwt.	£ s. d.	c. qr. lb.	s. d.	half pints.	£ s. d.	lb.	s. d.	£ s. d.			d.
1..	1 15 0	0 11 0	0 22	0 16 2	0 2 0	0 4	18	0 3 2	1½	0 4	3 6 0	275	4 cars }	3·22
2..	1 15 0	0 6 0	0 27	0 19 10	0 3 0	0 5	19	0 3 4	1½	0 4	3 4 11	310	1 day }	2·84
3..	1 15 0	0 15 2	0 22	0 16 2	0 3 0	0 5	18	0 3 2	1½	0 4	3 10 3	300	5 cars }	3·15
4..	1 15 0	0 5 10	0 31	1 2 9	0 3 0	0 5	23	0 3 11	1½	0 4	3 8 3	350	5 days }	2·68
5..	2 0 0	0 8 6	0 27	0 19 9	0 2 0	0 4	19	0 3 4	1½	0 4	3 12 3	345½	6 cars }	2·85
6..	1 15 0	0 15 2	0 27	0 19 9	0 3 0	0 5	19	0 3 4	1½	0 4	3 14 0	325	1 day }	3·07
Steam riser ..	1 4 0	—	—	—	—	—	—	—	—	—	2 15 0	—	—	—
Coke trimmer..	1 1 0	—	—	—	—	—	—	—	—	—	—	—	—	—
Cleaner	0 10 0	—	—	—	—	—	—	—	—	—	—	—	—	—
	13 10 0	3 1 8	7 16	5 14 5	4 0 0	2 4	116	1 0 3	—	2 0	23 10 8	1905½	—	—

Average cost per mile, 2·97d. Cost of water, ·12d. Total, 3·09d.

LETTERS TO THE EDITOR.

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

COLLAPSED BOILER FLUES.

Sir,—I was pleased to read your remarks on boilers in your issue of the 18th inst.; and as an example of the want of such information being widely diffused, not only amongst firemen, but also amongst their masters, the proprietors of boilers, I beg to inform you of the following case which occurred last week:—

I met a gentleman who has recently taken over an old business where there are several boilers at work, and, knowing them to be uninsured, I asked him if it was his intention to place them under the care of a company. He answered, "No, Sir, I should certainly not allow any of your inspectors to take a hammer and chisel into my boilers in order to knock a hole through and so stop the works for perhaps several days or weeks." I said, "Whatever company you propose to insure them with, should the inspector find a thin place in a plate, so thin that he considers it dangerous, he will knock a hole through or be neglecting his duty; and you ought to feel grateful that he does knock it through, because he probably prevents an explosion, which would be an incalculable loss." "Then," says the gentleman, "I will not insure at all, because I know enough about boilers to be well aware that nearly every explosion is caused by shortness of water, never through thin places in plates."

This is not a solitary instance, but is a particularly bad case because this gentleman is well aware of the cause why one company has refused to insure his boiler within the past two years, and why, previous to that, another company gave them up; and he must also know that the best fireman they ever had about the place left them on account of the persistence of his master—the late proprietor—working one boiler at a pressure that this fireman vowed was unsafe.

Would it not be wise, under the new Act—Hugh Mason's Act—for all corporations and local authorities to distribute copies of the monthly returns from the Board of Trade showing the causes and effects of the explosions? If this was done there would be no excuse for the ignorance of such men as I have given an instance of.

Bradford, October 23rd. A Reader.

ELECTRICAL STANDARDS OF MEASUREMENT.

Sir,—There is a certain gentleman who sometimes writes to a technical contemporary over the signature "Omega" whom it would be well to invite—if only one knew his real name—to answer your correspondent "J. B. W." The task of enlightening "J. B. W." has been undertaken, however, by a well-known electrician, J. B. Sprague by name, in the pages of the *English Mechanic*. No letter nor even a sledge hammer will avail "J. B. W.'s tutor unless he —"J. B. W."—is willing to put himself entirely in the hands of his teacher. He must not have "other ideas," at any rate when dealing with electrical units, for the subject is never settled for twelve months together, so that what we talked "shop" about yesterday is consigned to a bottomless limbo to-day. "J. B. W." writes, as Artemus Ward said, "Sarkastic." Does he not know that the writers in the said standard work he quotes are those that sit at the feet of the modern Gamaliels?—I beg pardon, at the feet of the modern mathematical giants—Sir W. Thomson, Lord Railegh, the late Clerk-Maxwell, Prof. Tait, Prof. Ayrton, Prof. Clausius, Prof. Helmholtz, and so on. Is thy servant a dog that he should despise the teachings of these mighty men? Certainly not; and I for one thoroughly believe that we shall get clearness and symmetry out of chaos, and this too ere long. Whether the writers understand the masters is another question, but that some strut in borrowed plumes is unmistakeable. I could, I think, explain the standards of electrical measurement to "J. B. W.," if he would let me begin and go on as I wished, and get rid of those preconceived ideas of his—such, for example, as "The electro-motive force can under no possible circumstances exceed the resistance." B.

London, October 23rd.

Sir,—The electrical definitions quoted by "J. B. W." in his letter in last Friday's Engineer, seem to me to be "some of those things that no fellow can understand." I understand the technical terms he quotes as follows, and five or six years' study of electricity has not shown me anything incongruous in these definitions:—(1) *Potential*, or more strictly, difference of potential: the power of doing work; the quantity and tendency of the electricity in two oppositely charged conductors to combine; analogous to the total pressure on a steam boiler, which is really the difference of pressure between all the steam and the atmosphere, not the pressure per square inch only. (2) *Electro-motive Force*: the useful effect of potential when put to work—analogous, perhaps, to mean cylinder pressure × area of piston. (3) *Conductivity*: the converse of resistance. (4) *Resistance*: electrical friction, which, like mechanical friction, causes heat; it also resembles the friction of liquids in pipes. (5) *Intensity*: high-pressure electricity; a concentrated current of great speed, capable of doing effective work through high resistances. (6) *Quantity*: low-pressure electricity, a current of less speed, giving great power through low resistances, but easily checked—intensity and quantity are only another illustration of the mechanical rule, "What is gained in speed is lost in power." (7) *Capacity*: to use "J. B. W.'s" simile, the amount of beer that the jug will hold, but except with very large surfaces or long lines, it is so small as to be almost infinitesimal; *e.g.*, if a very long cable be insulated at one end, and the battery current put on at the other, the current will flow into it for a perceptible time till it is full, and will then stop.

"J. B. W.," in discussing Ohm's law and the equation $C = \frac{E}{R}$ says, "Let E = 100 Volts, R = 10 Ohms, then $C = \frac{100}{10} = 10$, but 10 what?" 10 Ampères, C being the measure of quantity of the current, not of the intensity, and the Ampère, the unit of quantity, is that quantity which an electro-motive force of one volt will drive through a resistance of one Ohm in one second. I do not make out his theory that E ought to equal R, or his illustration of it, for surely in a water pressure, or any other engine, if the resistance to motion equalled the driving power equilibrium would result, and the engine would not move. I suppose he means that he has confused E—that is, electro-motive force—tension, or intensity, and internal resistance of battery into one and the same thing, but they are three different things, though very difficult to separate and define. Internal resistance of battery—which, perhaps, might be very loosely called inversely analogous to the heating surface of a boiler—must not be greater than R of outside circuit, or the circuit will take more current than can be generated continuously, that is, the engine will be too big for its boilers. The internal resistance of most dynamos is so low that this is hardly likely to happen with them, but I suppose the speed would have to be increased if it did. Electro-motive force is not measured and defined by R, but by R and C, being one of three terms, from any two of which the third may be found. Thus, if an arc lamp requires a current of 40 Ampères and the circuit R is 3 Ohms, electro-motive force must be 120 Volts. An incandescent lamp, requiring a current of 1½ Ampères, R of circuit being 60 Ohms, electro-motive force must be 90 Volts. Makers of lamps know their working resistance, and the quantity the circuit must have to light them properly. Makers of dynamos know the power of their machines for given speeds; R of metal circuit is easily found, and the speed of dynamo must then be adjusted to do the work.

I should think that Killingworth Hedge's book on "Electric Lighting" would probably supply what "J. B. W." wants, being a plain and simple record of actual work, both his own and other people's; written by a man who was an engineer long before he took up electricity. I have not seen the last edition, but I hear that it is in the same style as his older one, only vastly extended and improved. An Electrical Student.

October 23rd.

Sir,—May I tell "J. B. W." that if he has been trying to obtain clear ideas on electricity by simply reading books, it is by no means surprising that he has become a little "mixed." If he will go through a steady course of experiments he will find out what it is the books try to express. Possibly he will then be able to do mankind the service of expressing it clearly.

One Who Has Tried.

6, Westminster-chambers, Victoria-street, S.W.,
October 24th.

THE CASTING OF PIPES.

Sir,—In your esteemed journal of this week I see there is a reply to my letter on the above subject. Now I am sorry a practical man has not taken the matter up; but then I am sure men of experience would agree with me, and not with the gentleman who signs himself "Prior," and who has simply had the "charge" of about 80,000 tons of pipes. I am at a loss to know what he means by the "charge;" does he mean the superintendence of the moulding, casting, proving, or laying? He says all engineers specify that pipes shall be cast with their sockets down, which is not true, as I can name and show him the specifications of many eminent engineers of the present day who will have their pipes cast socket up.

"Prior" asks if I ever saw a pipe cast. Allow me to inform him that I have cast personally—not merely seen them cast—double the quantity he states he has had in "charge," and have superintended far more than this; I have made them in 9ft. and 12ft. lengths, sockets up and down, and when I say they are better sockets up I can prove it, and as to his saying it is not more expensive to cast them sockets down it certainly shows he has never had the casting of them himself, or even went into the cost. Why, the cutting off in the lathe itself is an item which makes it more expensive. He asks if I understand the flow of metals, and will I assert that he cannot fill a bottle by passing a fluid through the neck. I can tell him I fancy I know more than he about the flow of metals, and as to the filling of the bottle, he may know more of that than of pipe casting. However, I will ask him if he filled a bottle with water and let it freeze, which would freeze the first, that in the neck or that in the body? It is the same with iron, and therefore with pipe castings. As I have said, I have cast personally many thousands of tons, and have superintended the moulding, casting, dressing, and varnishing of many other thousands, and have never found any spongy in the socket, because I have always cast two risers or heads on the opposite side of the socket to that where I put the "git," which can be cut off by the dressers; and for another reason, the socket is always so much thicker than the body.

Further, it is true the socket cannot have "set" as soon as the body, it being so much thicker; therefore, when you cast the socket down it is useless to put any head on, as it will have set in the body long before the socket, but if you put two risers as I have named on the socket they can then do their work, and you will find the socket as sound as a bell, and the spigot end—in fact the whole of the length of the pipe—will be found sound, as there will be this great quantity of metal on the top to feed it.

Your correspondent must remember that he is talking to a thoroughly practical man, and one that has tried all these things before he began to talk of them. Experience.

October 23rd.

RHEOSTAT FOR ELECTRIC LAMPS.

Sir,—Referring to the cut and descriptive paragraph in your issue of October 20th of a rheostat for varying the resistance of incandescent lamp circuits, by means of which the brightness of the individual lamps of an installation can be regulated at will, which instrument is stated by the *Scientific American* to be the invention of Mr. Patrick H. Fox, of New York city, I beg to state that an essentially similar rheostat was designed by me and used at the Earnock Colliery as far back as August, 1881. The only difference between Mr. Fox's regulator and mine is a mere matter of detail. I employed a travelling contact pressed firmly against the convolutions of wire and actuated by a small crank, in place of the loose collar and set screw used by him. Alfred R. Bennett.

30, Hill-street, Garnethill, Glasgow, October 25th.

RAILWAY MATTERS.

THE directors of the Madras Railway Company have elected Mr. Harry J. Thompson, A.K.C., Stud. Inst. C.E., to fill the vacant appointment of assistant civil engineer on their Indian staff.

THE *Moniteur Belge* of the 16th inst. contained a statement that a meeting was to take place in Paris on the 24th inst. for the purpose of considering the proposed winding up of the Eames Vacuum Brake Company.

ON behalf of the Austro-Hungarian railways, the Lemberg-Zernowitz-Jassy Railway Company have introduced a new direct through tariff for the transit of goods from the Austrian frontier to or through Roumania, the goods being by this tariff franked for the Austrian, Hungarian, and Roumanian customs' requirements. This tariff will necessarily facilitate and simplify the traffic to a great extent, and will doubtless lead to a considerable increase of trade between the countries named.

MR. JAMES GOWANS, contractor, of Edinburgh, commenced the work of laying down the South Shields Corporation tramway at the pier promenade on Monday, July 24th, and finished at Tyne Docks on Saturday, October 21st, this being the exact time allowed for in his contract, viz., twelve weeks. The length of the tramways laid down, taken as a single line, is three and a-half miles. The gauge is 3ft. 6in., and the system laid down is that known as "Gowans." The works have been carried out under the direction of Mr. Matthew Hall, borough engineer.

THE Magistracy of Vienna have, after an exhaustive discussion during three meetings, at which the project of Ob. Ing. Berger, chief of the Stadtbauamt, found general approbation, unanimously decided for the arching in of the Wienfluss, a small stream, a tributary of the Danube, from which Vienna takes its name. It has long been proposed that this stream should be arched over, and the project is now brought forward in connection with a Stadtbahn, and the execution of the project is to be completed within three years. The Magistracy recommends the Gemeinderath also to accept the scheme. Herr Berger calculates that he will obtain from the sale of the ground reclaimed by the execution of the project a surplus of three million florins after defraying all expenses.

AS far as is at present known, the most serious result of the storm of Tuesday is the destruction of a railway bridge on the Great Western Railway over the Avon at Cattistock, near Dorchester, just as a train from Bristol was passing over it. One carriage fell through, but there was no one in it. The driver was severely scalded, and the fireman escaped with a few slight burns. Some of the passengers were a good deal shaken. The entire bridge, buttresses, and wing walls were swept away by the tremendous rush of water, which flooded the line for a mile, and destroyed a good deal of the permanent way. All traffic was suspended for the day, as it was also on the Bridport section of the Great Western Railway, owing to extensive landslips. Two other bridges further up the line from Cattistock were also washed away.

MAJOR-GENERAL HUTCHINSON has sent in a report on the causes of the accident which occurred shortly before 7 p.m. on the 7th August, near Ewood Bridge, on the Blackburn and Over Darwen Tramways. In this case as a heavily laden ear drawn by a steam engine, going from Blackburn to Over Darwen, was passing round a curve just after crossing Ewood Bridge the car turned over on its right side, and was dragged along a short distance before the engine stopped. The lessons to be derived from this accident, he says, are (1) the importance of observing very moderate speeds in the descent of sharp inclines; (2) the necessity of avoiding overcrowding, especially on the roofs of cars; and (3) the importance of having the governor examined at short intervals by a competent person, to see that it comes into action at the speed laid down in the rules.

A CORRESPONDENT writes to the *National Car-Builder* as follows:—"A very effective and cheap method of testing locomotive boilers, either in the repairing of them or in new work, has been invented by Mr. Robert Wiggins, general foreman of the Cleveland, Columbus, Cincinnati, and Indianapolis shops, at Delaware, O. The method consists in completely filling the boiler with cold water when it is over the pit. A connection is then made with the steam-heating pipes in the pit from any convenient opening in the boiler, the steam turned on, and the water in the boiler heated. When the water is sufficiently heated to approximate the condition of the boiler when in actual service, a small force pump is connected with the boiler, and as the latter is already full of water, a few strokes of the pump, drawing water from a bucket, runs the pressure up to any desired height."

THERE was a narrow escape outside Abernant tunnel, Vale of Neath Railway, Monday night. The last passenger train from Swansea to Merthyr, immediately on coming through the tunnel at forty miles an hour, came into collision with the hind part of a goods train, which had just preceded the passenger train and was being shunted. Fortunately, one of the men of the goods heard the approaching train, and ran back with his light, enabling the driver to reverse and slacken considerably. "But query," adds our correspondent from Wales, "should there not be a rigid inquiry. Should the 'passenger' be allowed to pass through the tunnel until the 'goods' was shunted. In shunting a wagon might give way, and there would be no chance of avoiding a disaster. Is it possible, I do not say it is true, that a signalman long accustomed to the fact that a train took so many minutes to go through the tunnel would, at the expiration of that time, let the passenger train go without having 'line clear.'"

THERE is such an enormous difference between the great tropical heat of Vera Cruz, with its ordinary temperature of 98 deg. in the shade, and the cooler atmosphere of the elevated upper plains, that it would be imprudent, if not absolutely dangerous, to expose the train officials of the Mexican Railway to the risks contingent to working direct from the one to the other. Boca del Monte, or mouth of the mountain, stands, as its name implies, at the top or commencement of the valley which leads down to the lower plains. It is situated near the foot of the snow-capped mountain, Zitlaltipetl, whose summit is 17,800ft. above sea level. Its peculiar position gives it such a highly rarefied, chilly atmosphere, as to be keenly felt even by persons arriving from the direction of Puebla and the city of Mexico, and it can therefore be readily understood how severe would be the effect on those proceeding from the tropical sea coast. For train working, or climate purposes, the Mexican line has, therefore, according to a paper read before the Institution of Civil Engineers in Ireland, by W. H. Mills, to be divided into three sections—the first, from Vera Cruz to Paso del Macho; the second, Paso del Macho to Boca del Monte; and the third, from Boca del Monte to the city of Mexico and Puebla.

THE Canadian Pacific's main line is constructed for a distance of 440 miles west of Winnipeg, of which about 300 have been built since May by Messrs. Langdon, Shepard, and Co. The whole distance was built within fifteen months. The south-western branch of the Canadian Pacific is now built two miles south of Morris, and the Selkirk branch is also under construction. Mr. Van Horne, general manager of the Canadian Pacific, states that the whole of the line north of Lake Superior will be under contract by January 1st, 1883, and that next season work on the western division will be completed to the Rockies. Mr. Senecal is said to contemplate extending the North Ghore Railway to Tadonssac, and establishing a new line of steamers from that point, thus making the winter port of the western provinces of the Dominion. An era in the progress of Ottawa has been marked by the opening of the Canada Atlantic Railway, extending from that city to Coteau Landing. The new line considerably shortens the route from Ottawa to Montreal. Arrangements have been completed by which Mr. E. B. Denny, in connection with English capitalists, undertakes the construction of the Ottawa and Gatineau Valley Railway. Rapid progress is being made on an extension of the Canada Southern Railway from Essexleutre to Detroit. The new line is to be finished by November 1st, when Canada Southern trains will run *viâ* Detroit, instead of *viâ* Amherstburg as at present.

NOTES AND MEMORANDA.

THE use of papier maché as the body of railway wheels is described in a patent specification dated 14th June, 1849, of a Mr. Henson, who had made many improvements in railway apparatus.

THE localities of the wrecks on the coasts of the United Kingdom, excluding collisions, are thus given:—East coasts of England and Scotland, 1088; south coast, 503; west coasts of England and Scotland, and coast of Ireland, 987; north coast of Scotland, 82; and other parts, 202. Total, 2862.

AT a recent meeting of the Academie des Sciéncés, a paper was read on "The Nature of Vibratory Motions which Accompany the Propagation of Flame in Combustible Gaseous Mixtures," by MM. Mallard and Le Chatelier. They have studied, with the help of photography, the period of accelerated and very irregular velocity—accompanied by sound—which follows a (first) period of slower, silent, and regular propagation, in a tube closed at one end, and having its combustible gaseous contents—bioxide of nitrogen, and sulphide of carbon—lit at the other. A vibratory movement is indicated; the amplitude increasing as the last third of the tube's length is neared—where is one of the ventral segments of vibration. The mean velocity of propagation is accelerated as the amplitude and rapidity of the vibrations increase.

THE 3575 wrecks, casualties, and collisions, reported as having occurred on and near the coasts of the United Kingdom during the year 1880-81, comprised 4297 vessels. The number is larger than in the previous year by 1159, and is in excess of the casualties reported, because in cases of collision two or more ships are, of course, involved in one casualty. Thus 713 were collisions, and 2862 were wrecks and casualties other than collisions. On subdividing these latter disasters, we find that 636 were wrecks, &c., resulting in total loss, 670 were casualties resulting in serious damage, and 1556 were minor accidents. During the year 1879-80 the wrecks and casualties other than collisions on and near our coasts numbered 1916, or 946 less than the number reported during the twelve months now under discussion.

THE largest State in the civilised world is Texas, which boasts an area of 274,356 square miles; the smallest is the little State of Monaco in Europe, which has only an area of six square miles. The Austrian Empire contains 240,943 square miles; the German Empire, 212,091; France, 204,091; Spain, 177,781; Sweden, 168,042; California, 157,801; Dakota, 150,932; territory of Montana, 143,776; Norway, 122,280; New Mexico, 121,201; Great Britain and Ireland, 120,879; Italy, 114,296; Arizona, 113,916; Nevada, 112,090; Colorado, 104,500; territory of Wyoming, 97,883; Oregon, 95,274; territory of Idaho, 86,294; territory of Utah, 84,476; Minnesota, 83,531; Kansas, 80,891; Nebraska, 75,994; territory of Washington, 69,994; Indian territory, 68,991; Missouri, 65,350; Turkey in Europe, 62,028; then come a number of other American States, after which are Roumania, 45,642; Bosnia and Herzegovina, 28,125; Bulgaria, 24,360; Servia, 20,850; Netherlands, 20,527; Greece, 19,941; Switzerland, 15,235; Denmark, 14,553; Eastern Roumelia, 13,500; Belgium, 11,373; and Montenegro, 1770.

IT appears by the measurements recently taken by Government surveyors that the great lakes of North America boast the following vast relative capacities:—Lake Superior is 335 miles in length, and its greatest breadth is 160 miles; mean depth, 688ft.; elevation, 827ft.; area, 82,000 square miles. The greatest length of Lake Michigan is 300 miles; its greatest breadth, 108 miles—but it is generally very narrow as compared with Lake Superior; mean depth, 690ft.; elevation, 506ft.; area, 23,000 square miles. The greatest length of Lake Huron is 300 miles; its greatest breadth, 60 miles; mean depth, 600ft.; elevation, 274ft.; area, 20,000 square miles. The greatest length of Lake Erie is 250 miles; its greatest breadth, 80 miles; mean depth, 84ft.; elevation, 261ft.; area, 6000 square miles. The greatest length of Lake Ontario is 180 miles; its greatest breadth is 65 miles; its mean depth is 500ft.; elevation, 261ft.; area, 6000 square miles. The total of these five great lakes is 1265 miles, covering an area of upwards of 135,000 square miles, thus affording natural advantages for navigation beyond any other part of the world.

THE annual iron produce of the world is calculated from the most recent statistics to yield some 19½ millions of tons. The yield from all the more important countries has been ascertained up to the year 1881. In regard to the others, it is assumed that the yield has not fallen off since the latest figures reported. For the year 1881 the yield of Great Britain was 8,377,364 gross tons; United States, 4,144,254; Germany, 2,863,400; France, 1,866,438; Belgium, 622,288; Austria-Hungary, for 1880, 448,685; Sweden, for the same year, 399,628; Luxembourg, for 1881, 289,212; Russia, 231,341; Italy, for 1876, 76,000; Spain, 73,000; Turkey, 40,000; Japan, 10,000; and all other countries, 46,000. Under "other countries" are included Canada, Switzerland, and Mexico, each producing about 7500 tons per year, and Norway, with 4000 tons per year. The grand total is 19,487,610. Great Britain, the United States, Germany, and France, produce no less than 88·4 per cent. of the world's iron supply; the first two 64·3 per cent., and Great Britain alone 43 per cent. The chief consumer is the United States, taking 29 per cent.; Great Britain comes next with 23·4 per cent.; and these two use more than half the whole supply.

MR. A. J. HADCOCK, A. Inst. Chem., recently related the following:—A kettle filled with boiling water was hung in the hottest room of some Turkish baths with the lid on. The temperature of the surrounding air was 262 deg. Fah. After about an hour the temperature of the water was taken, and indicated, as was expected, 212 deg. The kettle was then re-hung with the lid off. The temperature of the room was now 252 deg. In twenty minutes the temperature of the water had fallen to 185 deg., in thirty minutes to 178 deg., in forty-five minutes to 170 deg., and was evidently still falling. The manager stated that it generally fell finally to about 140 deg., when a point of equilibrium seemed to be established, and the water neither got hotter nor cooler. Mr. Haddock supposes this loss of heat was due to rapid vaporisation, and conversion of the sensible heat of the water into the latent heat of steam, and as dry air is a very bad conductor of heat—one of the worst known—the heat required to convert a portion of the water into steam had to be abstracted from the remainder of the water, thus lowering its temperature. In substantiation of this explanation it is well known that if water is placed in a vessel over a large bulk of strong sulphuric acid, in the receiver of an air-pump, and the air is exhausted, the rapid evaporation of one portion of the water will actually cause the rest to freeze.

THE British Association Committee on underground temperatures in their last report adopt 64ft. per degree rise in temperature, or 0·01566 of a degree per foot depth. To obtain an approximation to the rate at which heat escapes annually from the earth, they reduce the above rate of increase ·01566 to Centigrade degrees per centimetre of depth. For this purpose we must multiply by ·0182, giving ·000285. To calculate the rate of escape of heat, this must be multiplied by the conductivity. Prof. Herschel, in conjunction with a Committee of the British Association, has made a very extensive and valuable series of direct measurements of the conductivities of a great variety of rocks, and has given additional certainty to his results by selecting as two of the subjects of his experiments the Calton Hill Trap and Craigleith sandstone, to which Sir William Thomson's determinations apply. From combining Prof. Herschel's determinations with those of Sir William Thomson, ·0058 is adopted as the mean conductivity of the outer crust of the earth, which, being multiplied by the mean rate of increase, ·000285 gives the flow of heat in a second across a square centimetre. Multiplying by the number of seconds in a year, which is approximately 31½ millions, we have $1633 \times 315 \times 10^{-4} = 41{\cdot}4$. This, then, is the British Association Committee's estimate of the average number of gramme degrees of heat that escape annually through each square centimetre of a horizontal section of the earth's substance.

MISCELLANEA.

WITH reference to the collisions on and near our coasts during the year, sixty-three of the 713 collisions were between two steamships, both under way; 148 between steam and sailing vessels, both being under way; and seventy-two between steamships under way and steam or sailing vessels at anchor.

THE first number of *The Wheelman*, a new American monthly periodical devoted to the interests and amusement of velocipedestrians, is exceedingly well got up, after the manner of Scribner's and Harper's magazines, and if succeeding numbers are as good as the first, it will no doubt acquire a rapidly extending circulation. Messrs. Iliffe and Son, Coventry, are the English publishers.

THE order for the large centrifugal pumping machinery has been entrusted by the directors of Messrs. Hills' Dry Docks Company, for their new dock at Cardiff, to Messrs. W. H. Allen and Co., of York-street works, Lambeth. This dock will contain 2,131,312 gallons of water to be emptied in three hours. It will be over 400ft. in length and will be the largest dock in that neighbourhood.

THE following resolution was passed unanimously at a very full meeting, on the 23rd inst., of the Whitechapel District Board of Works, which embraces all the eastern boundary of the City:—"That this Board learns with great disappointment that the engineer of the Metropolitan Board of Works, in preparing plans for the much needed bridge across the Thames at the Tower, has made them for a high-level bridge."

THE fifth annual report of the Board of Commissioners of State of New York Survey has just been published, and shows that the survey is progressing with very creditable speed. The report is signed by the director, Mr. James T. Gardiner, and is accompanied by a series of excellently executed triangulation maps relating to Eastern New York, Central New York, Hudson River, Troy to Albany, Albany to New Baltimore, and of New Baltimore to Hudson.

NOT long since we were promised articles for various purposes made of a hard material resembling wood, but consisting chiefly of compressed cotton. On the other hand, very recently, a cotton mill has been started near the town of Norrkoping, in the middle of Sweden, solely with the object of manufacturing cotton from wood. A contemporary says the process has long since passed the experimental stage, and it is said that the thread thus made is equally as fine in quality as the best manufactured article and considerably cheaper.

THE wreck abstract for 1880-81 shows the number of lives lost on or near our coasts was 984 during the twelve months. Of these sixty-six were lost in vessels that foundered, ninety-six through vessels in collision, 481 in ships stranded or cast ashore, and 237 in missing vessels. The remaining 104 lives were lost from various causes, such as through being washed overboard in heavy seas, explosions, &c. Of the 238 ships from which the 984 lives were lost, 208 were British, involving the loss of 852 lives, and thirty were foreign, causing the loss of 132 lives.

WASTE pipe and fixture ventilation in houses, offices, and public establishments is occupying a good deal of attention in America now, and although there seems to be a good deal of room for simplification, a very effective system applied to some buildings in New York is described in the American *Sanitary Engineer*, as carried out by Messrs. Barran and Duggan, under Mr. J. M. Slade, architect, and Professor Clark. A special ventilating shaft is built with the building, and a current is induced by heated air from a stove in the basement through a central pipe; and with this shaft the apartments are ventilated. Ventilating pipes from urinals, &c., are also kept warm, and an upward current induced, by means of an encircling pipe kept hot in a smoke flue, or by exhaust steam.

A COMPANY has been formed called the Midland, Western, and Metropolitan Canal Carrying Company, Limited, with a capital of £200,000, for the purpose of providing increased facilities for the carriage and distribution of merchandise between the ports of Bristol and London and the Western and Midland Counties, and generally for carrying on the business of carriers by river, canal, railway, and otherwise, and for the warehousing of goods. The company has acquired a lease, with the option of purchase, of the Wilts and Berks Canal, about sixty-nine miles, from a junction with the Kennet and Avon Canal at Semington, near Bath, to the river Thames at Abingdon, near Oxford, with all the land, buildings, reservoirs, wharves, and works held in connection therewith.

NEW Zealand will not have much trouble about coal supply for some time if the following from a contemporary is true:—"Among the coal mines rapidly being developed in New Zealand is one situated near the town of Westport, on the west coast of the Middle Island, which is distinguished by two remarkable, if not unique, features, viz., the thickness of its coal seams, which range from 6ft. to 53ft. 6in. in thickness, and the fact that these enormous deposits are placed, and can be easily worked at an altitude of from 800ft. to 3000ft. above sea level. Some of these seams are exposed on the faces of the cliffs and can be got at with the greatest ease by tunnelling. There is the further advantage that the coal can be loaded on board ship and the empties brought back by gravitation."

ACCORDING to *L'Electrician*, the halls of the five laboratories of the Scientific School at Aix la Chapelle are heated by air, and the temperature is regulated by electric thermometers which transmit automatic signals to the heater: too cold, when the temperature is below 17 deg.—62·6 deg. Fah.—too warm, when it exceeds 19 deg.—66·2 deg. Fah. The absence of the caretaker has been provided for by call bells, which are operated at the same time as the indicators. The great amphitheatre can be lighted either by gas or by the electric light from a Siemens machine. On removing a panel behind the professor's table, a ground glass is exposed, which facilitates the use of the electric light for projecting chemical or physical experiments. A quantity machine is employed for electrolytic precipitations. Conductors bring the currents into the laboratory of quantitative analysis and into the grand amphitheatre.

AT a meeting of the Wednesbury Local Board on the 23rd inst., a resolution was passed approving of a united drainage scheme for the parishes of Wednesbury, Darlaston, and Tipton, and a small portion of Sedgley. Mr. Pritchard, C.E., whose scheme is to be adopted, estimates the cost at £79,500. The area to be united would be the districts of Wednesbury, Tipton, Darlaston, and a portion of Sedgley; that a suitable site for the outfall works would be found at or near Rayhall Farm in the Tame Valley; that the cost of the outfall works and outfall sewer from Bescot to outfall—including about 110 acres of land—and the cost of preparing it, would be £25,000; and the total cost of sewering the districts named would be—Tipton, twenty-two miles of town sewers and apportionment of outfall sewer and works, £32,000; Wednesbury, eighteen miles, £28,009; Darlaston, ten miles, £15,000; and Sedgley, three miles, £4500, making a total cost of £79,500.

SINCE the introduction of the law in France by which all vessels employed on the *long-cours* receive a premium on the distance sailed, nearly all the shipowning companies have added largely to their fleets, and many new steamship companies have been formed. The great majority of high-class steamships built abroad during the last few years for French account have been produced on the Clyde, and several of the yards in that district have now contracts on hand for our neighbours. Although the bounty system has been the means of largely increasing French tonnage, some of the enterprising companies, whose vessels are not engaged in the *long-cours*, have added considerably to their tonnage, notably, the celebrated Fraissinet company of Marseilles. This company has recently added 16,000 tons of British-built steamers to its line, six of which vessels have been built by Messrs. A. M'Millan and Son, Dockyard, Dumbarton, which firm launched on the 11th inst., the Taurus, 1800 tons and 1500-horse power, for this company, and have still two similar vessels building for the same fleet to trade in the Mediterranean and Black Sea.

ON A NEW ARC ELECTRIC LAMP.*

By Mr. W. H. Preece.

Electric lamps on the arc principle are almost as numerous as the trees in the forest, and it is rather refreshing to come upon something that is novel. In these lamps the carbons are consumed as the current flows, and it is the variation in their consumption which occasions the flickering and irregularity of the light that is so irritating to the eye. Special mechanical contrivances, or regulators, have to be used to compensate for this destruction of the carbons, as in the Siemens and Brush type, or else refractory materials have to be combined with the carbons, as in the Jablochkoff candle and in the lamp Soleil. The steadiness of the light depends upon the regularity with which the carbons are moved towards each other as they are consumed, so as to maintain the electric resistance and constant quantity. Each lamp must have a certain elasticity of regulation of its own to prevent irregularities from the variable material of carbon used, and from variations in the current itself and in the machinery. In all electric lamps, except in the Brockie, the regulator is in the lamp itself. In the Brockie system the regulation is automatic, and is made at certain rapid intervals by the motor engine. This causes a periodical blinking that is detrimental to this lamp for internal illumination.

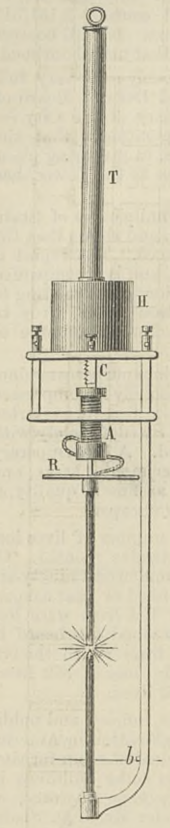


Fig. 1.—Abdank's Arc Lamp.

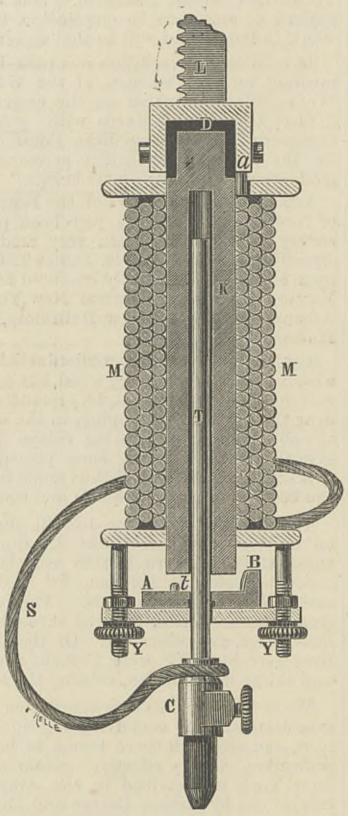


Fig. 2.—Abdank's Arc Lamp.

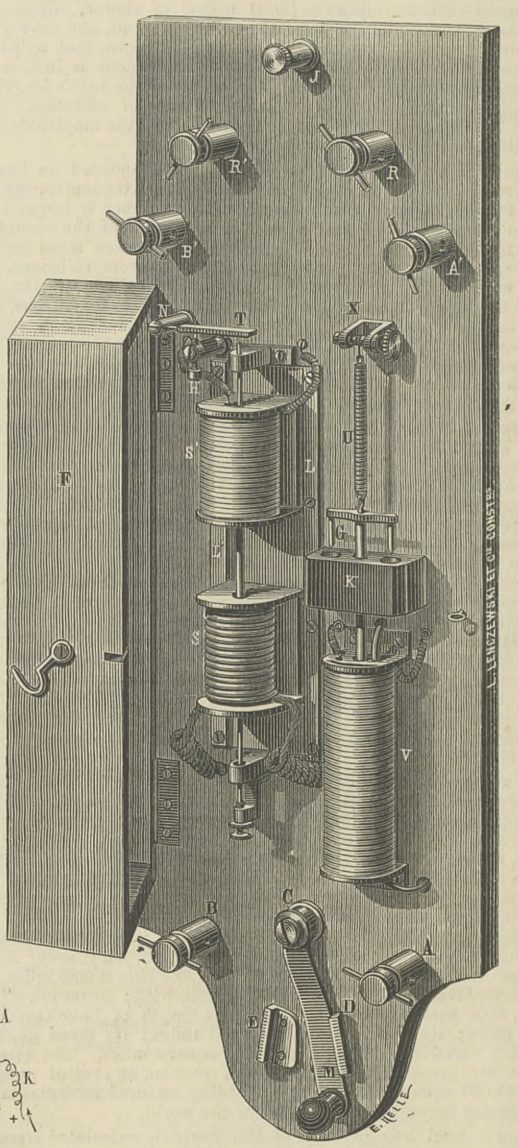


Fig. 4.—Abdank's Arc Lamp; the Balance and Cut-off.

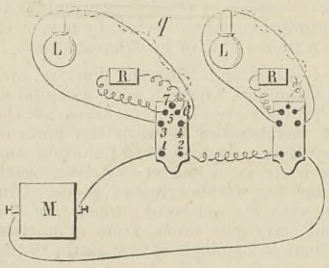


Fig. 5.—Lamps in Series.

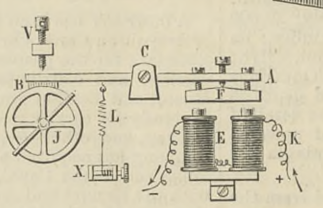


Fig. 3.—Showing Friction Break.

M. Abdank, the inventor of the system which I have the pleasure of bringing before the section, separates his regulator from his lamp. The regulator may be fixed anywhere, within easy inspection and manipulation, and away from disturbing influence in the lamp. The lamp can be fixed in any inaccessible place.

The Lamp.—The bottom or negative carbon is fixed, but the top or positive carbon is movable in a vertical line. It is screwed at the point C to a brass rod T, Fig. 2, which moves freely inside the tubular core of an electro-magnet K. This rod is clutched and lifted by the soft iron armature A B when a current passes through the coil M M. The mass of the iron in the armature is distributed so that the greater portion is at one end B, much nearer the pole than the other end. Hence this portion is attracted first, the armature assumes an inclined position maintained by a brass button *l*, which prevents any adhesion between the armature and the core of the electro-magnet. The electric connection between the carbon and the coil of the electro-magnet is maintained by the flexible wire S. The electro-magnet A, Fig. 1, is fixed to a long and heavy rack C, which falls by its own weight and by the weight of the electro-magnet and carbon fixed to it. The fall of the rack is controlled by a friction brake B, Fig. 3, which acts upon the last of a train of three wheels put in motion by the above weight. The brake B is fixed at one end of a lever B A, the other end carrying an easily adjusted soft iron armature F. This armature is attracted by the electro-magnet E E—whose resistance is 1200 ohms—whenever a current circulates through it. Its play is regulated by the screw V. The spring L applies tension to the brake.

The Regulator.—This consists of a balance and a cut-off.

The Balance—Figs. 4 and 6—is made with two solenoids S S', whose relative distance is adjustable. S conveys the main current and is wound with thick wire, having practically no resistance, and S' is traversed by a shunt current, and is wound with fine wire, having a resistance of 600 ohms. In the axes of these two coils a small and light iron tube—2 mm. diameter and 60 mm. length—freely moves in a vertical line between two guides. Its upward motion is controlled by the spring N T. This spring rests upon the screw H, with which it makes contact by platinum electrodes. This contact is broken whenever the little iron rod strikes the spring N T. The positive lead from the dynamo is attached to the terminal B. It then passes through the coil S to the terminal B', whence it proceeds to the lamp. The negative lead is attached to terminal A, passing directly to the other terminal A', and thence to the lamp. The shunt which passes through the fine coil S' commences at the point P. The other end is fixed to the screw H, whence it has two paths, the one offering no resistance through the spring T N to the upper negative terminal A', the other through the terminal J to the electro-magnet of the brake M, and thence to the negative terminal of the lamp L'.

The Cut-off.—The last part of the apparatus to be described is the "cut-off," used when there are several lamps in series. It is brought into play by switch C D, Figs. 4 and 6, which can be placed at E or D. When it is at E, the negative terminal A is in communication with the positive terminal B, through the resistance R, which equals the resistance of the lamp, which is therefore out of circuit. When it is at D the cut-off acts automatically to do the same thing. This is done by a solenoid V, which has two coils, the one of thick wire offering no resistance, and the other of 2000 ohms resistance. The fine wire connects the terminals A' and B. The solenoid has a movable soft iron core suspended by the spring U. It has a cross piece of iron, which can dip into two mercury cups, G and K, when the core is sucked into the solenoid. When this is the case, which happens when any accident occurs to the lamp, the terminal A is placed in connection with the terminal B through the thick wire of V and the resistance R, in the same way as it was done by the switch C D.

Electrical Arrangement.—The mode in which several lamps are connected up in series is shown by the Fig. 5. The + lead is connected to B, of the balance; it then passes to the lamp L, returning to the balance, and then proceeds to each other lamp, returning finally to the negative pole of the machine. When the current enters the balance it passes through the coil S, magnetising the iron core and drawing it downwards—Fig. 6. It then passes to the lamp L L', through the carbons, then returns to the balance, and proceeds back to the negative terminal of the machine. A small portion of the current is shunted off at the point P, passing through the coil S', through the contact spring T N, to the terminal A', and drawing the iron core in opposition to S. The carbons are in contact, but in passing through the lamp the current magnetises electro-magnet M, Fig. 2, which attracts the armature A B that bites and lifts up the rod T with the upper carbon a definite and fixed distance that is easily regulated by the screws Y Y. The arc then is formed, and will continue to burn steadily as long as the current remains constant. But the moment the current falls, due to the increased resistance of the arc, a greater proportion passes through the shunt S', Fig. 4, increasing its magnetic moment on the iron core, while that of S is diminishing. The result is that a moment arrives when equilibrium is destroyed, the iron rod strikes smartly and sharply upon the spring N T. Contact between T and H is broken, and the current passes through the electro-magnet of the brake in the lamp. The brake is released for an instant; the carbons approach each other. But the same rupture of contact introduces in the shunt a new resistance of considerable magnitude, viz., 1200 ohms, that of the electro-magnet of the brake. Then the strength of the shunt current diminishes considerably, and the solenoid S recovers briskly its drawing power upon the rod, and contact is restored. The carbons approach during these periods only about ·01 to ·02 milim. If this is not sufficient to restore equilibrium it is repeated continually until equilibrium is obtained. The result is that the carbon is continually falling by a motion invisible to the eye, but sufficient to provide for the consumption of the carbons. The balance acts precisely like the key of a Morse machine, and the brake precisely like the sounder-receiver so well known in telegraphy. It emits the same kind of sounds, and acts automatically like a skilled and faithful telegraphist. The contact between N T and H is never completely broken; the sparks are very feeble, and the contacts do not oxidise. The resistances inserted are so considerable that heating cannot occur, while the portion of the current abstracted for the control is so small that it may be neglected. This regulation, by very small and short successive steps, offers several advantages—(1) It is imperceptible to the eye; (2) it does not affect the main current; (3) any sudden instantaneous variation of the main current does not allow a too near approach of the carbon points.

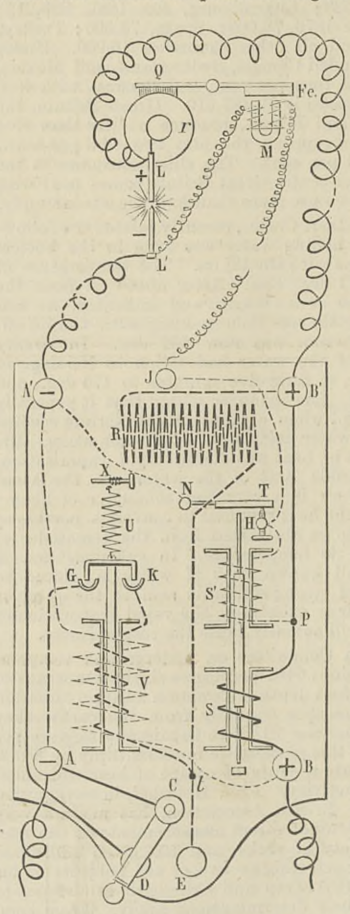


Fig. 6.—Abdank's Arc Lamp; Plan of Balance and Cut-off.

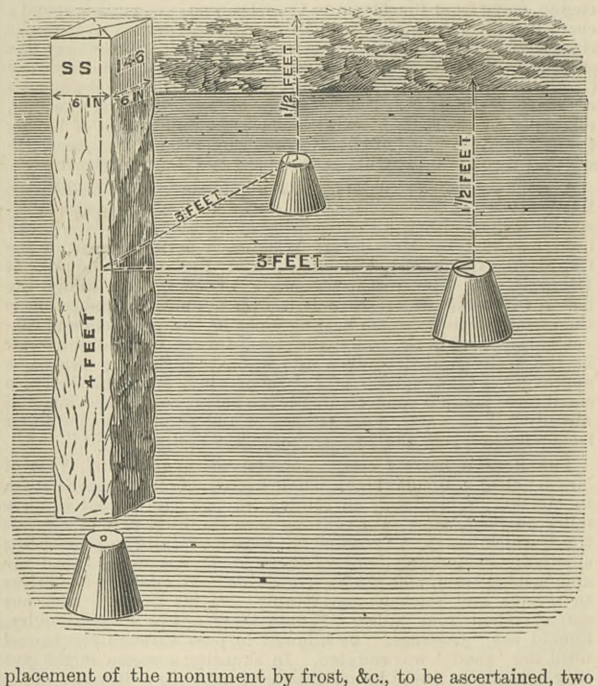
Let now an accident occur—for instance, a carbon is broken. At once the automatic cut-off acts, the current passes through the resistance R instead of passing through the lamp. The current through the fine coil is suddenly increased, the rod is drawn in, contact is made at G and K, and the current is sent through the resistance R. As soon as contact is again made by the carbons, the current in the coil S is increased, that in V diminished, and the antagonistic spring U breaks the contact at G and K. The rupture of the light is almost invisible, because the relighting is so brisk and sharp.

I have seen this lamp in action, and its constancy and steadiness leave nothing to be desired.

* Paper read at the Southampton meeting of the British Association.

NEW YORK STATE SURVEY.

The accompanying engraving shows the method adopted in the New York State Survey of marking trigonometrical State Survey stations, as described in the fifth annual report by the director, Mr. J. T. Gardiner. The underground centre-mark is a glazed earthenware pot, similar to a flower-pot. It bears the letters N. Y. S. S. upon its base, and the small hole in the centre of the base marks the precise centre of the station. The surface mark is a granite monument 4ft. long and 6in. square, weighing about 180 lb. This monument is sunk vertically 3½ft. The bottom of the stone is separated from the pot below by about 3in. of earth. The part of the monument remaining above the surface of the ground presents the form of a cube whose side is 6in.; this portion only of the monument is dressed smooth. The letters N. Y. and S. S. are cut upon two of the vertical faces of the stone, and the number of the station—146 in the sketch—is placed upon one of the remaining faces. Diagonal lines are cut upon the upper surface of the stone, their intersection being in the vertical of the centre mark below. It is to the level top of the stone that the height of the station is referred. The granite of which these monuments are formed is of a variety not to be found in the State, and its peculiar appearance readily enables the station to be identified. As an additional security, and to enable any displacement of the monument by frost, &c., to be ascertained, two reference pots are placed at a distance of 3ft. from the station centre and 1½ft. below the surface of the ground. These pots are like the one below the monument, but bear strongly-marked arrows upon their bases. The arrows point toward the station centre. The angle between the pots is approximately 90 deg., and when convenient they are placed in the directions of two of the cardinal points. In all cases the magnetic bearing of each pot is taken, so that if but one pot should be found the station centre could be recovered with accuracy. It is best, however, to resort to measurement from both pots.



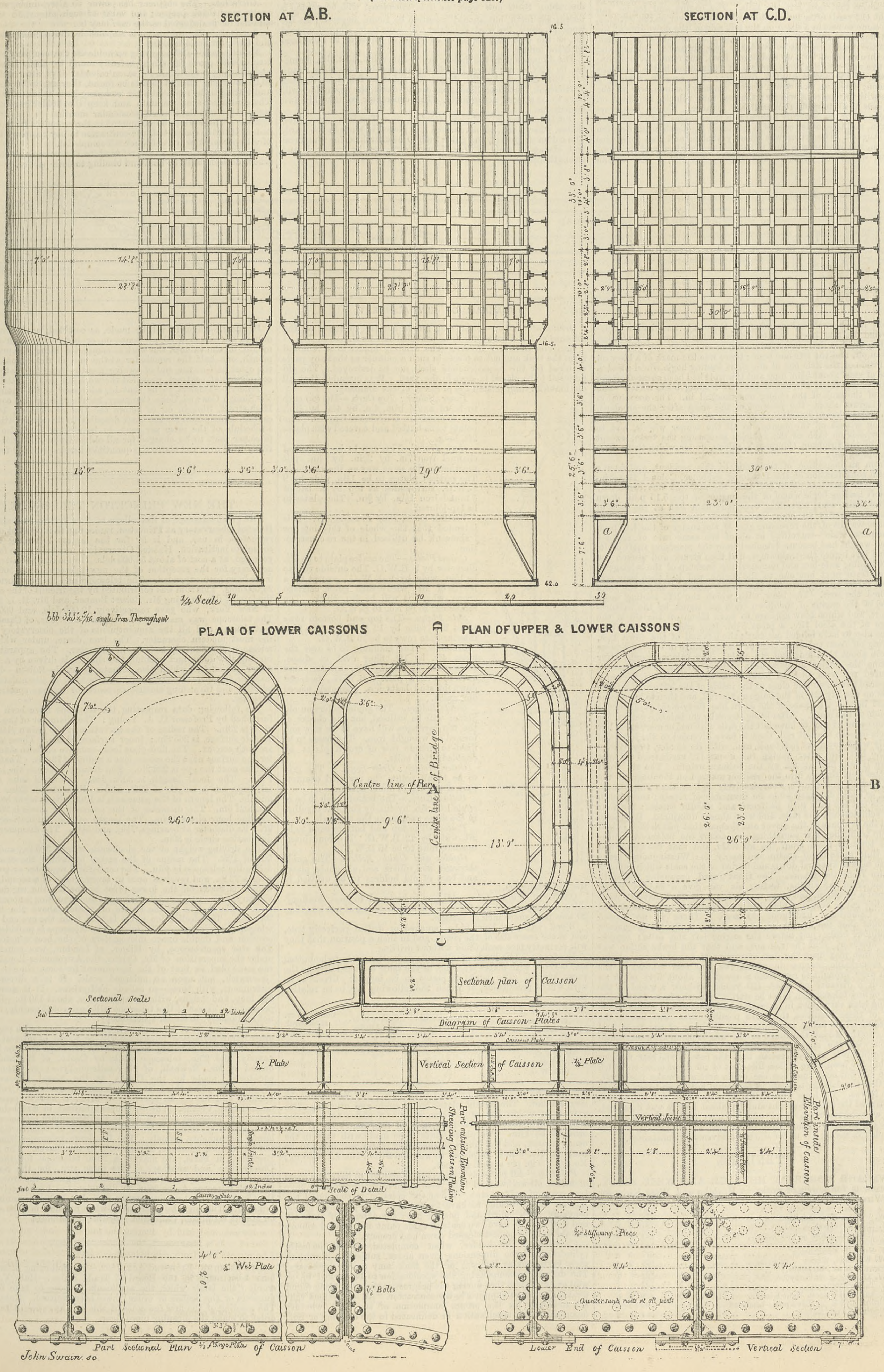
The usual method of marking, here described, must at times be modified. When rock is struck near the surface the centre pot is replaced by a copper bolt; sometimes both reference pots are also replaced by copper bolts. It may be convenient to alter the distance of the reference pots in order to find soil enough to permit of their being sunk. Very rarely the centre bolt is placed at the surface of the rock and the monument is placed at one side, where a sufficient depth of soil may be found. In this case the monument merely serves as a witness mark to enable the centre bolt to be recovered. In all cases careful notes are made of the distances and directions, and a sketch is also made showing the position of the station in relation to the surrounding country. In most cases measurements and directions are taken to permanent objects in the vicinity, such as farm corners, houses, large boulders, &c. When the station is occupied for the purpose of measuring the angles of the triangulation, it is customary for the observer to record the angles between any permanent objects like house corners, gables of barns, church spires, &c., which may be visible within a mile or two of the station. By the aid of these angles, without recourse to measured distances, the station could be recovered very nearly should the monument be maliciously removed, and by digging the underground marks could be found. As a final resort, the angles of the triangulation could be remeasured from neighbouring trigonometrical stations, and the station centre thus recovered even if all the marks should have been entirely removed.

A rumour coming from Rome states that the firm of Rubattino at Genoa is disposed to sell the Tunis-Goletta Railroad to the French Government for 11,000,000f.

THE NEW BRIDGE OVER THE THAMES AT PUTNEY.

SIR JOSEPH BAZALGETTE, AND MR. E. BAZALGETTE, MM. INST. C.E., ENGINEERS.

(*For description see page* 315.)



THE ELY ACCIDENT.

General Hutchinson has reported to the Board of Trade on the accident which occurred on the Great Eastern Railway on the 28th July at Stretham Fen. It will be remembered that in this case, as the 5.15 p.m. down express train from Liverpool-street to Norwich was running at a speed of between forty-five and fifty miles an hour across Stretham Fen between Cambridge and Ely, the engine, tender, and seven front vehicles, out of the eleven composing the train, left the rails. The engine and tender ran about 112 yards after leaving the rails, turned over on the left side, and came to rest in a ditch on the left side of the down line at the foot of a low bank on which the railway is carried. The vehicle next the tender, a third-class brake van, separated from it, and was thrown across both up and down lines, but remained upright; the five next vehicles were thrown on their sides in the positions shown in the accompanying diagram; the seventh vehicle, a London, Brighton, and South Coast Company's saloon, was off the rails with two pairs of wheels; the rear four vehicles remained on the rails as if stopped in an ordinary manner. Eleven passengers were more or less severely injured; in three cases both legs were broken, and in another case of a fractured leg death ensued on the 7th August. The driver was severely shaken and had some ribs broken, the fireman was hurt in the hip and shaken, and the front guard was much shaken. The engine, No. 609, a new engine which had commenced running in February, and had a four-wheeled leading bogie, single driving wheels, and six-wheeled tender, was but little damaged; 15in. of the right life guard was broken off, and the left one bent; there was the mark of a blow on the inside of the axle-box of the right leading bogie wheel; and a piece of steel about 5½in. long and 1in. wide had been sheared off the inside of the lip of the tire of the left leading bogie wheel. The back of the tank of the tender was knocked in. The accompanying diagram shows the position of the train after the accident. The Westinghouse automatic brake was fitted to the driving and trailing wheels of the engine, to all the tender wheels, and to four wheels on each of the vehicles composing the train, except those of the Brighton Company's saloon, under which there were brake pipes only.

From an inspection of the scene of this accident, and from a careful consideration of the foregoing evidence, Colonel Hutchinson sees no reason to doubt but that the accident was caused by the left leading bogie wheel of the engine of the 5.15 p.m. down express train, when travelling over Stretham Fen at the rate of about fifty miles an hour, having been heavily struck by the balance-weight of the reversing gear of the engine of the 4.40 p.m. up express train—travelling at about the same rate of speed—which weight had become detached from the reversing shaft of its engine just before the trains met, had then struck and broken the right leading axle-box and damaged the footstep of the carriage in the up train next but one to the engine, and had then been projected across to the down line just as the engine of the down train reached the spot. The blow with which the left leading bogie wheel of the engine of the down train was struck by the balance-weight, and which blow appears to have taken off the tip of the flange of the steel tire, a piece 5½in. long and 1in. mean width seems also to have bulged outwards the left rail of the down line, shaving off from the inner edge of the top flange of the rail a piece of iron about 11in. long and ⅜in. wide. The balance-weight after striking the engine appears next to have made a dished mark—coloured red with the red paint from the balance-weight—on a sleeper of the down line close to the inside of the left rail, fourteen yards on the Ely side of the bulge on the rail, and then to have come to rest in the 4ft. space of the down line forty-eight yards on the Ely side of this mark. After being struck by the balance-weight, the engine seems at once to have left the rails with one or more of its left wheels outside the left rail, then to have diverged to the left, and finally went down the low bank, and, with its tender, turned over on the left side, after having run about 112 yards from the spot where it was first struck by the balance-weight. The six front vehicles were thrown into the position marked on the diagram, the first, second, and fourth, comparatively lighter than the others, being so badly damaged as to be incapable of repair; the seventh vehicle left the rails with its front and middle wheels; the four rear vehicles kept the rails, and were almost uninjured. It appears from the evidence of the driver and fireman that just as they passed the up train they saw something—no doubt the balance-weight—come towards them from the up train, and that the driver had just time to shut off steam and apply the Westinghouse brake before he was knocked down and buried in the coals which came in on him from the tender. The front guard, occupying the sixth vehicle from the engine, feeling his van give a sudden lurch, grasped a partition, and as he was doing so noticed that the brake pressure gauge needle, which had indicated 65 lb. when he started from Cambridge, had gone to zero. There is no reason to doubt that the driver did, as he states, apply the automatic continuous brake just before the engine left the rails; supposing, however, that he did not, and that the brake action was called into play upon the first severance of one of the couplings, the remarkable manner in which the four rear vehicles of the train were brought to rest from a speed of about fifty miles an hour in a distance of about 120 yards, without a wheel off the rails or any telescoping, must be attributed to the fact of the brake having been very quick in its action and automatic; owing to the first of these qualities the least possible time was lost in the retarding effect being transmitted to the rear of the train, and owing to the second the brake action was kept up after communication with the engine was severed. Without a brake of this description it is almost certain that the fate of the rear vehicles would have been more or less like that of the front ones, on which there had not been time for the brake action to make itself felt, and that the damage to these latter would have been even greater than it was. We have already in our impression for August 4th illustrated the balance-weight and explained how it was detached, and we need not repeat here what we have said. The case is interesting as showing how important a part a good automatic brake can play in saving life under the most adverse circumstances.

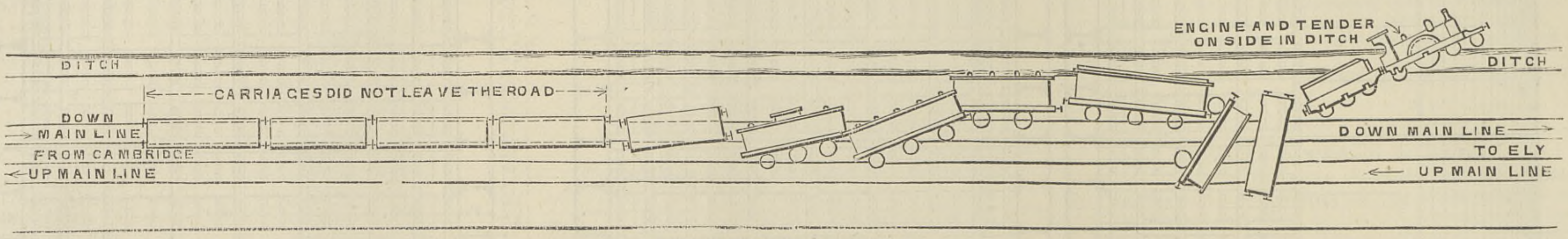


DIAGRAM OF ELY ACCIDENT.

TENDERS.

SEWERAGE WORKS AT HOYLAKE AND WEST KIRBY.

Tenders for sewerage works at Hoylake and West Kirby for the Wirral Rural Sanitary Authority.

	£	s.	d.
W. Wilson, New Brighton	895	12	6
J. Hall, Liverpool	891	7	0
T. Hamond, Rhyl	851	9	2
E. Taylor, Hoylake	746	6	6
J. Nuttall, Manchester	677	5	2
W. Winnard, Wigan	663	9	0
Fawkes Bros., Birkdale	635	18	9
W. Thomas, New Ferry	603	3	1
J. Taylor, Widnes	580	0	0
T. and J. Harrison, West Kirby	475	0	0
Holme and King, Liverpool—accepted	466	10	0
Engineer's estimate	524	18	2

CONTRACTS OPEN.

GASHOLDER AT SLOUGH.

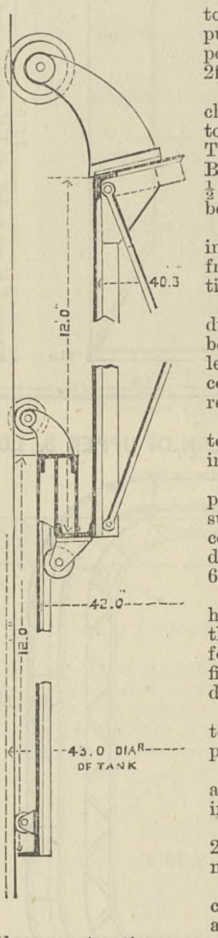
The Slough Gas and Coke Company want tenders for work to be done in the reconstruction of No. 2 gasholder on the following specification:—It is intended to reconstruct the holder in its telescopic form, utilising as much of the existing material as may be found desirable. Such new work as it is considered will be wanted is herein set forth, but should variation be found necessary as the work proceeds, the work involved will have to be allowed or paid for, as the case may be, on a schedule of prices to be submitted with the tender.

The dimensions of the holder are:—Inner lift, 40ft. 3in. diameter by 12ft. deep; outer lift, 42ft. diameter by 12ft. deep; tank lift, 43ft. diameter by 12ft. deep. Should it be found, on clearing out the tank, that these dimensions are not exact, the new holder will have to be altered accordingly. The contractor to take his own dimensions.

Outside Framing: Columns, Girders, &c.—The balance-weights, chains, wheels, &c., to be removed and placed in store in the yard. The columns, girders, and guide rails to be examined for soundness and strength, and, if found necessary, to be repaired and strengthened.

Ornamental Caps.—Caps and finials similar to those on the columns of No. 1 gasholder to be provided and fixed.

Removing Existing Holder.—The existing holder to be removed from the tank and cut to pieces in such a manner as that any parts required for the reconstruction shall not be destroyed. The old material to be placed in store in the yard. It is intended that all old material shall remain the property of the company.



Inner Holder: Top Curb.—The top curb to be of angle iron, 4in. by 4in. by ½in., put together in convenient lengths. The points to be butted and covered with plates 2ft. long.

Curb Irons.—The cup to be formed of channel iron 7in. by 2⅝in. by ⅜in. put together in the same way as the top curb. The vertical plates to be 14in. wide by 9 B.W.G. surrounded at top by a bar of ½ round iron 1¼in. by ⅜in. The plates to be lap-jointed.

Vertical Stays, Roof Framing, &c.—It is intended that the whole of this interior framework be utilised in the re-construction.

Crown Plates.—The centre plate to be 3ft. diameter by 9 B.W.G. The outside row to be 15in. wide by 9 B.W.G., except for a length of 2ft. where each guide carriage comes, where it will be ¼in. thick. The remainder to be No. 16 B.W.G.

Side Plates.—The top and bottom rows to be 2ft. wide by 12 B.W.G. The four intermediate rows to be 16 B.W.G.

Manhole.—The manhole to be over the pipes 4ft. by 1ft. 6in., oval in shape, surrounded by a ring 3in. by ⅜in., and covered with a plate 9 B.W.G., fastened down by stud bolts ⅝in. diameter, placed 6in. apart.

Guide Rollers.—The guide rollers on old holder will be utilised, but the cheeks of the top carriages will have to be new and formed of wrought iron. The bases to be fixed to outside row of crown plates by double-nutted bolts.

Outer Holder: Grip Irons.—The grip to be in all points the reversed counterpart of the cup of inner holder.

Bottom Curb.—The bottom curb to be of angle iron 4in. by 4in. by ⅜in., put together in the same manner as the top curb.

Plates.—The top and bottom rows to be 2ft. wide by 12 B.W.G. The four intermediate rows to be 16 B.W.G.

Guides and Guide Rollers.—The guide carriages and rollers and all guide plates and bars of old holders to be utilised in the reconstruction.

Quality of Work: Iron.—All iron to be equal to best Staffordshire, and capable of tensile strain before breaking of not less than 20 tons per square inch of section.

Work.—All rivet holes to be punched or drilled perfectly true, and of the exact size of the rivets, and in such a position that they will correctly face each other without drifting.

Rivets, &c.—The joints of all angle and other irons to be butted and covered with plates 2ft. long, of the same sectional area as the parts jointed. The joints of plates to be lapped. Rivets to be used where practicable, of which the following are to be relative sizes:—

Thickness of either iron joined.	Diameter of rivets.	Centre to cr. gas joints.	Centre to cr. structural joints.
⅜in. or over	⅝	2	4
¼in.	½	2	4
9 B.W.G.	⅜	2	4
12 B.W.G.	$\frac{5}{16}$	1	0
16 B.W.G.	$\frac{5}{16}$	1	0

All rivets to be snap-headed, and those over $\frac{5}{16}$in. diameter to be rivetted hot. The laps of plates on to angle and other irons to extend to within ½in. of extreme edge. Of plates on to plates 9 B.W.G., and over to be 1½in., and of thin plates on to each other to be 1¼in. The plate joints to be made with tape in the usual manner, and the joints of the heavy plates and irons to be caulked, No. 9 B.W.B. plates to weigh 6·24 lb., No. 12, 4·38 lb.; No. 16, 2·5 lb. per superficial foot.

Painting.—All plates as soon as manufactured to have two coats of boiled oil well worked into them. All other ironwork to have two coats of oxide paint. When the erection is completed the interior of the holder to have two coats of tar—provided by the company—well boiled and put on hot; the exterior of both old and new work to have two coats of oxide paint of approved colour; the old work to be first cleaned down and prepared.

Conditions.—The holder, when completed, to be perfectly cylindrical, of the dimensions given above, subject, however, to such variations as the size of the tank may render necessary. The drawing accompanying the specification to be worked to, as well as any others that during the progress of the work being found necessary may be supplied to the contractor. All operations that are necessary for the proper completion of the work, whether described in this specification or delineated in the drawing or not, shall be carried out by the contractor so that the work shall be completed to its true intent and meaning.

Material.—All material required to be supplied by the contractor and to be the best of their several kinds. Tools, scaffolding, &c., engine, lifting gear, &c., to be provided, brought to, and removed from the works by the contractor at his own expense.

Engineer.—The work to be carried out to the satisfaction of the company's engineer.

Alterations.—The engineer has power to alter, during erection, as he may think proper; the value of such alteration shall be allowed for or deducted as the case may be.

Accidents.—The contractor is responsible, during carrying out of the work, for accidents, &c.

Maintenance.—Before giving up holder to the company the contractor shall prove the same perfectly sound by filling it with air and allowing it to remain for seven calendar days, after which it is to be emptied. Should defects be found, they are to be put right, and testing to be repeated after company have taken over holder. The contractor shall maintain and keep the holder in repair, gas-tight and workable, for twelve calendar months.

Time.—The work to be completed in three months from date of order; if not so completed, the contractor to pay company the sum of £10 per week or part of week till completed.

Disputes.—Disputes to be referred to the company's engineer, whose decision shall be final and binding to both parties.

Payment.—Payment will be made, as certified by the engineer only to the extent of 80 per cent., on or before the 10th of each month, on the value of the work so completed during the preceding month, one half the remainder at the end of three months, and the other half at the end of twelve months from the date of the completion of contract, provided the work has proved satisfactory.

Tenders.—Tenders to be sent in, addressed to the chairman of the Slough Gas and Coke Company, at the office of the company, High-street, Slough, on or before the 31st of October, 1882, to contain a lump sum for the work described in this specification, and a schedule of the price per cent. to be allowed, and also of the price per cent. to be charged for all old and new material respectively used over and above the quantities herein provided for.

THE NEW PRINCETON TELESCOPE.

The great telescope of the college of New Jersey, as it stands in Halsted Observatory at Princeton, ranks fourth in the list of great refractors in use, and is by far the largest belonging to any collegiate institution. Halsted Observatory was built some fourteen year ago, at a cost of about 56,000 dols. In making the alterations necessary for the reception of the new telescope some 5000 dols. more have been expended. The telescope and its accessories cost 26,000 dols. This sum was contributed by the friends of the college; the largest donors being Mr. Robert Bonner, and Mr. R. L. Stuart, of New York, who gave respectively 10,000 dols. and 6000 dols. The telescope was made by Alvan Clark and Sons, of Cambridgeport, Mass.; and all the appointments of the observatory are of the most modern character. The iron dome, under which the telescope is mounted, is 39ft. in diameter. The apparatus for turning the dome and opening the shutter is driven by a 4-horse power gas engine, which also actuates a small—Edison—dynamo machine for operating the electric lamps used in illuminating the building and furnishing electric currents for various spectroscopic purposes.

The following data respecting the telescope have been kindly furnished by Professor C. A. Young: The diameter of the object-glass is 23in. The radius of the curvature of the crown glass lens, outside surface, is 265·8in.; inner surface, 81·9in. These surfaces are both convex. The flint glass lens—concave on both sides—has for the surface next the crown lens a radius of 73·4in. That of the surface next the eye is 222·2in. The distance between the lenses is 7·5in. The focal length is 30ft. 1in. The steel tube of the telescope has a length of 28ft. and a diameter of 33in. in the middle. The length of the polar axis is 10ft.; diameter at bearings, 8in. and 6in. The diameter of the coarse hour circle is 30in.; of the fine hour circle, 28in. The length of the declination axis is 9ft.; its diameter at bearings, 7½in. and 5½in. The diameter of the declination circle is 30in.

The driving weight of the clockwork weighs 320 lb., and has a fall of 12ft. The radius of the sector by which the clockwork drives the telescope is 40in. The centrifugal regulator or governor weighs 22 lb., and revolves once in seven-tenths of a second. The weight is taken off the lower pivot by floating the regulator in mercury. The weight of the telescope and mounting is about seven tons. The height of the centre of motion above the floor is 20ft. 9in. The declination circle is read from the eye end of the telescope by microscopes 9ft. long. The telescope is provided with position and double-image micrometers of the best construction. The star spectroscope, by Hilger, of London, was constructed under the supervision of Mr. Cristie, the Astronomer-Royal, upon the same plan as that of the instrument for some time in use at Greenwich, but upon an enlarged scale. It is a direct-vision instrument, with three—so called—half-prisms. It is more than 6ft. long, and weighs, with its appendages, about 150 lb. For the present it is expected this telescope will be devoted mainly, though not exclusively, to stellar spectroscopy.

For the purpose of comparison the following facts with regard to other large refracting telescopes will be found of interest. But two instruments excelling the Princeton telescope are now in use, namely, the 25in. telescope made by Cooke, of England, and owned by Mr. Newhall, of Newcastle-on-Tyne; and the 26in. equatorial, made by the Clarks, at the Naval Observatory, Washington. The third larger instrument, made by Grubb, of Dublin, and having an aperture of 27in., is now in process of mounting at Vienna. The instrument nearest in size below the Princeton telescope, now in use, is the Strassburg refractor, with an aperture of 19in. There are in process of construction five larger instruments, namely: The Poulkowa telescope, 30in., and the McCormick telescope, 26½in.; both by the Clarks. The Henry Brothers, in Paris, are making a 29in. telescope for the Nice Observatory, and another, of the same size, for the National Observatory at Paris. One of the discs of glass—the crown—for the Lick telescope, to be 36in. in diameter, has been received by the Clarks, who are waiting for the flint disc before beginning the grinding. This gigantic instrument, when finished, is to be erected on Mount Hamilton, California.—*Scientific American*

The Electric Lighting Act, 1882.—The following alterations have been made in the Board of Trade Rules:—Rule V.—The words "the lands which the applicants propose to take for the purposes of the licence or order" have been omitted. Rule IX.—The wording of the first few lines of this rule have been altered in order to make the meaning more clear.

THE NEW BRIDGE AT PUTNEY.

(*Continued from Page* 291.)

New Sewers.—A new brick sewer 4ft. high by 2ft. 8in. wide and 9in. in thickness, built in Portland cement and surrounded with Portland cement concrete, as shown, is to be constructed under the main Fulham approach road, from Bishop's-walk to High-street, to be connected by a bell-mouth junction with the existing sewer in that street.

Draw Dock.—A new draw dock shall be formed at the west end and on the river side of the Windsor-street approach. The road shall start at its lower end from the foreshore at the point I on general plan, and shall be carried along the foreshore parallel to the tow-path for a length of about 130ft., with a rising gradient of 1 in 13, and shall be returned thence at right angles towards Windsor-street, and double back to the foot of the Windsor-street approach at *i* on plan. The raised roadway from the lower end *y* to *k* and *m* shall be supported at its sides by slopes of two horizontal to one vertical, formed of river ballast and faced with boulders laid on a bed of Portland cement concrete 9in. thick, bedded before the concrete is set. From *k* to Windsor-street the raised roadway shall be supported by a retaining wall of brickwork upon Portland cement concrete foundation, and surmounted with a parapet of brickwork in lias lime mortar, capped with Portland stone cap. The roadway is to be formed of broken Guernsey granite 7in. in depth, and laid upon a hard core of brick rubbish or other approved material 12in. in thickness, as described elsewhere for carriage-ways.

Removal of Original Aqueduct: Description.—The general plan shows that the site intended for the new bridge is partially occupied by an aqueduct, which comprises nine spans, gradually diminishing from 90ft. at the centre to 60ft. at the extremities. The whole of these spans consist chiefly of two longitudinal wrought iron-plate girders with transverse bearers upon their lower flanges, which support two 24in. and two 12in. water mains. The superstructure of this aqueduct is supported at each of its extremities upon a brick abutment chamber, and across the river upon eight piers, each formed of six cast iron screw piles braced together and sunk about 14ft. below the surface of the river bed. The soffit levels of the superstructure or the clear headways under the longitudinal girders above T.H.W. diminish from about 22ft. at the centre span to 16ft. at the extremities. The maximum longitudinal and transverse dimensions of the timber fenders around the bases of the piers are about 22ft. and 9ft. respectively.

Removal.—At a date to be determined by the engineer the whole of the materials comprised in this aqueduct shall become the property of the contractor, who shall remove every portion of this aqueduct, and all wood or iron piling found in the bed of the river extending over or adjoining the whole area occupied by the new bridge.

Temporary use of.—The contractor shall be permitted to make such temporary use of the existing aqueduct as may, in the judgment of the engineer, be considered advisable for facilitating the construction of the new bridge.

Removal of old Putney Bridge and of the temporary aqueduct.—The contractor shall entirely remove old Putney Bridge, and the toll-houses situated at its northern and southern extremities; also the adjoining temporary aqueduct and its pipes.

Disposal.—The whole of the materials comprised in or connected with the aforenamed structures shall, from the commencement of their demolition, become the property of the contractor.

Time of Removal.—The removal of old Putney Bridge and the adjoining temporary aqueduct shall not be commenced until after the entire completion of the new granite bridge and its approach roads; nor until after the diversion of all the water from the temporary aqueduct through the permanent mains to be provided under the footways of the new bridge.

Piles.—Every portion of the wood and iron piling, and all pile stumps adjoining or connected with the aforesaid structures, shall be entirely removed from the river bed.

Iron Caissons: Description of Caisson.—Instead of the more ordinary timber cofferdams, wrought iron caissons shall be provided for the construction of each of the four bridge piers. These caissons—of which three shall be employed in the construction of every pier—shall correspond with the dimensions and details furnished upon contract drawings—see pages 292 and 293. Each complete caisson shall be built up with two—upper and lower—detachable caissons of different construction; but each portion shall be provided with halves of a horizontal water-tight joint, by means of which they may be bolted together, and afterwards detached.

Lower Caisson.—The lower caisson shall be principally utilised in facilitating the excavation of the soil from the river bed to the extent required for the construction of each pier, and the upper caisson shall be bolted to it for the exclusion of the tide during the construction of the pier. The lower caisson shall be constructed with a cutting edge at bottom, and shall consist of two skins of rolled wrought iron plates rivetted together. The external iron skin shall be $\frac{1}{4}$in. thick, separated from the internal skin $\frac{3}{16}$in. thick, nearly throughout the height of the caisson, by a uniform space 3ft. 6in. in width. The space shall be gradually filled during the descent of the caisson with Portland cement concrete, composed of one measure of cement to four measures of Thames ballast. Each skin shall be built up with plates, lap-jointed with $\frac{3}{4}$in. rivets at 2in. pitch, the horizontal joint of the lower plate overlapping the upper plate. The skins shall be connected and stiffened around the caisson at vertical intervals generally of 3ft. 6in., as shown by horizontal frames consisting of 3in. by 3in. by $\frac{5}{16}$in. longitudinal and diagonal angle irons. The lower extremity of internal skin of the lower caisson shall be connected with the outer skin of the caisson by cranking it to form a wedge-shaped cutting edge, as shown in detail on drawing No. 8, and this part of the caisson shall be stiffened by vertical gusset plates $\frac{1}{4}$in. thick, placed 4ft. apart and connected with the inner and outer skins by 3in. by 3in. by $\frac{3}{8}$in. angle irons. The cutting edges of the lower caissons shall be formed with angle irons 5in. by $2\frac{1}{2}$in. by $\frac{1}{2}$in., secured horizontally against and completely around the internal projecting edge of the external plating. The cutting edge shall be further stiffened in its external face by a $\frac{1}{2}$in. plate 12in. wide, rivetted to it around the caisson with flush-headed countersunk rivets. This caisson from its cutting edge to its upper extremity shall measure about 26ft. in height.

Upper Caisson.—The upper caisson shall be about 33ft. in height, and consist of one skin $\frac{1}{4}$in. thick, stiffened at varying intervals by internal horizontal girders rivetted entirely around each caisson. The inner flanges of the girders shall be formed of two angle irons, 3in. by 3in. by $\frac{3}{8}$in., and a $\frac{3}{8}$in. plate of varying widths as shown, and the outer flange of two angles of the same dimensions, and the skin of the caisson. These girders are connected together and stiffened by $\frac{1}{4}$in. vertical plates, connected to the webs of the girders by angle irons 3in. by 3in. by $\frac{3}{8}$in., and to the skin by angle irons 3in. by $2\frac{1}{2}$in. by $\frac{3}{8}$in. The plates are stiffened at their inner edge by two vertical L-irons, 3in. by $2\frac{1}{2}$in. by $\frac{3}{8}$in.

Erection and Lowering.—The caissons used in the construction of every pier shall be erected upon and lowered upon the river bed from a timber platform supported upon piling driven around the space to be occupied by the piers. Each caisson shall be separately lowered upon the river bed—previously prepared by dredging—by means of four lowering screws attached at the corners of each caisson. The soil shall be excavated from the interior by improved Milroy or by Brace and Batho dredgers. During its descent the weight of each caisson shall be gradually increased as may be found necessary by solidly filling the internal 3ft. 6in. space between the skins with concrete.

Underpinning.—After the penetration of each caisson to its final foundation level its cutting edges shall at once be gradually underpinned by excavating the soil—by manual labour—3ft. below and 2ft. beyond the external cutting edges. All freshly exposed foundation surfaces of clay shall be immediately covered with 12in. concrete, so as to exclude the air and prevent crumbling of the clay.

The entire lengths of the caisson cutting edges shall be underpinned gradually by projecting outwards upon the beds of concrete 12in. thick, previously prepared, Bramley Fall stones 2ft. thick, and measuring 4ft. by 4ft., as shown upon the contract drawings. The concrete shall then be gradually filled in layers 12in. thick into the interiors of the lower caissons until it is brought flush with their upper extremities, and from this point the brick footing shall be built up in the manner shown upon the contract drawings.

Bond for Piers.—Each pier having been separately constructed by means of three caissons, shall be afterwards bonded together in the width of the pier below low-water level with continuous bond stones of Bramley Fall 3ft. by 3ft. by 6ft. in length, or by cast iron ribbed plates, as may be determined by the engineer. Above these bond stones the masonry and brickwork of the superstructure shall also be bonded—after the removal of the upper caissons—by toothings provided for the purpose, in such manner as may be required by the engineer.

Ironwork.—The whole of the ironwork shall be of good quality and shall be subjected to such tests, at the contractor's expense, as the engineer may direct, and the joints and rivets shall be made perfectly watertight.

Foundations: Excavations, &c.—The ground for the foundations is to be excavated to the depths shown in the drawings, or to such greater or less depths as the engineer shall direct; but the value of any additional work is to be added to and of any reduction of work deducted from the contract amount as elsewhere provided. The sides of all excavations are in all cases to be properly secured, so as to prevent the ground caving in, and they are to be kept free of water during the construction of any portions of the permanent works.

Foundation of Piers.—The foundations for the piers shall consist of masses of concrete and Bramley Fall stones as shown upon the drawings. The concrete in the foundations of the piers shall consist of Portland cement and clean Thames ballast incorporated in the proportions of six to one respectively. No concrete shall be put into any portion of the work through water, but all trenches and excavations shall be first pumped dry.

Foundations of Approaches.—The concrete in the foundations of the approach arches and retaining walls shall, except where otherwise described, consist of Portland cement and ballast incorporated in the proportions of eight to one.

Wood Dams.—Timber Dams for Abutments.—The foundations for the northern and southern bridge abutments shall be executed under the shelter of whole tide dams, each consisting of double lines of whole pile timbers spaced 4ft. apart in the clear, and the intervening spaces filled with clay puddle, or, if in the judgment of the engineer found sufficient, of a single line of closely driven piles each 12in. by 12in., which shall be properly caulked on the outer face and rendered perfectly water-tight. The dams shall have return ends for the perfect exclusion of the tidal waters from the abutment trenches, to be sunk behind the dams. Each dam shall be provided in its height with three internal and three external lines of whole timber walings, bolted securely together with sufficient nuts and washers, and sufficiently strutted to resist the pressure of the tide, and protected from impacts from craft by efficient floating booms. The joints of the dams below the bed level of the river shall be rendered water-tight by excavating a trench about 3ft. deep, or more if necessary, previous to driving and filling the same with clay, into which the piles may be driven.

Abutments.—The abutments are to be constructed of granite ashlar facing, backed with the best quality of picked stock brickwork set in Portland cement mortar, two of sand to one of cement, and with Portland cement concret, in the manner shown upon the contract drawings No. 6 and 7. The masonry is to be composed of horizontal courses of headers and stretchers alternately, below Trinity high water, the headers to be not less than 3ft. in depth from the face, and 2ft. in width on the face, and the stretchers not more than 4ft. 6in. in length on the face, nor less than 1ft. 9in. in depth from the face, and above that level the headers to be not less than 2ft. 3in. and the stretchers not less than 1ft. 6in. in depth from the face. The vertical height of the courses to be as shown in the drawings. The stones in the alternate courses are to break bond with a lap of not less than 12in. All the concrete used in the abutments shall be composed of six of Thames ballast to one of Portland cement. The whole of the exposed face of granite throughout the whole of the bridge and river walls is to be smooth and fine axed on the face, the quality of the work being equal to that of the granite of the Victoria Embankment. The horizontal bed joints are to be fine dressed and splayed 2in. each way; but the vertical joints are to be plain and perfectly straight and fine picked for at least 15in. inward, the remainder of the granite to preserve its full dimensions, and to be fair picked and straight between. The whole of the masonry is to be set flush in beds of mortar, composed of one of Portland cement to one of sand, and properly grouted. The joints not to exceed $\frac{3}{16}$in. in thickness. The whole of the ashlar masonry is to be composed of the best close-grained granite, to be approved by the engineer. The several stones are to be worked of the form and dimensions shown on the contract drawings, the faces, beds, and joints being true, and out of windings. Grout nicks to be cut in all vertical joints of the ashlar work, according to the directions of the engineer, and slate dowels or joggles 2in. square and 4in. in length, to be used where and when considered necessary by the engineer. All moulded courses are to be fine chisel dressed, to the true form shown in the drawings, and equal to the work on the Victoria Embankment. A flight of steps shall be formed on the east side of the Surrey abutment leading down to the river. The steps shall consist of solid York stone steps, and 6in. landings, fair tooled on all exposed surfaces, and set in Portland cement mortar on brick walls, also in Portland cement mortar; and shall have, on the outer side, a wrought iron fence leaded into steps and landings, strengthened by a sufficient number of wrought iron stays.

Piers.—The piers are to be constructed of ashlar masonry, backed with brickwork in all respects similar to that already specified for the abutments, and to be of the form and dimensions shown in the drawings. The abutments and piers are to be carried up together, so that the whole five arches may be carried over simultaneously. Drains of stoneware pipes of 6in. and 9in. diameter are to be formed in each pier and abutment in the positions shown in the drawings, the joints being made with Portland cement, care being taken that no cement shall be left projecting in the interior of the pipes. Circular holes 6in. in diameter, are to be cut through the ashlar granite facing, at the level shown, to form the outlets to these drains, which, on the roadway level, are to be covered with cast iron gully gratings.

Weighting Piers.—Immediately following their construction, each of the bridge piers shall be weighted with pigs, iron—railway rails, or other approved materials to be imposed thereon. The period during which the test loads shall remain, the weight of the test loads, and the method of loading each pier shall in all cases be determined or approved by the engineer. Any subsidence of the piers during construction, or in consequence of the superimposed test loads, shall be accurately observed and immediately recorded.

Centres.—The centres of each arch are to consist of nine ribs of wrought iron, of the forms and dimensions shown upon the drawings, one of which is given at page 292.

Timbering to Main or Centre Span.—Span of centre arch is 144ft., and the centreing is to be fixed in the position as shown on the drawing, so as to leave a clear opening or waterway in the centre of span of not less than 55ft., giving a clear headway of 12ft. in the centre and 11ft. at the sides of this opening, measured from Trinity high-water level.

Piles, &c.—The main piles or supports next the centre are to be driven to a depth of not less than 20ft. into the bed of the river, or to such depth as the engineer shall deem necessary, it being understood that each pile is to take a load of not more than 15 tons. All piles are of Memel or Dantzic fir, not less than 14in. on any side, and the timber is to be carefully selected, straight, and free from shakes or loose knots, wany edges, or other defects, and must be submitted to the engineer's approval before being fixed under the pile engine. The eight piles forming together one main support are to be driven together—that is to say, no single pile is to be driven its complete depth without its neighbour being driven to nearly the same distance at the same time. Care must be taken that the piles are guided close together when they are being driven, and are to be kept perpendicular and in a true line in the positions, as shown on the drawing, of 5ft. 8in. from centre to centre. When the eight piles are driven to their proper depth they are to be securely cramped together with twenty wrought iron timber dogs to each support, and are then to have their collars removed and the heads sawn off level, so as to give a perfectly true and even bearing to the cross-head piece, which is to be set true and carefully on each four piles, so as to distribute the weight uniformly on each single pile. All piles are to be shod with wrought iron shoes, not less than 15 lb. each, and strong iron hoops also to the heads, the iron 4in. broad by 1in. thick.

Sills and Wedges.—On the top of these cross-heads—of which there are two to each support—is to be set the lower and upper sill, both of elm, and to be of carefully selected timber, as between these sills are to be placed the wedges; and the "bearing surfaces" between the wedges and that come on the cross-heads must be adzed to a true and regular line, so as to allow of the same thickness of wedges throughout, and the parts that are directly under the cast iron bed-plate to be of one uniform level. When the lower sill is fixed in position, and securely fastened with dogs driven in the sides and to each cross-head, the wedges are to be placed longitudinally with it, and care taken to have them fixed across the centre line of the girders. These wedges are to be of oak, selected timber fully seasoned, and are to be carefully sawn to the given form, and a template is to be submitted for the engineer's approval before they are fixed. When the wedges are fixed the top sill is to be placed in position on the top of them, but care must be taken that the distance between the sills before the girders are fixed is not less than 1ft., so as to have as little raising of the girders by the wedges as possible, and to have as much lowering space for the girders as can be obtained when the centres are "struck." Between the main support and the single pile that carries the end of the girder an intermediate set of piles or supports to be driven under the same conditions as those heretofore described, and in the same line, and to be dogged securely together. The single pile next to the masonry is to be placed upright in position, and in the pocket left in the masonry, and the foot of the pile sawn off square, so as to allow of its having its full bearing on the concrete. When all the piles are fixed in their proper position, the 12in. by 12in. "stringers" are to be fixed, care being taken that the faces or parts of timber that are in contact are to come close together to allow of their being bolted together with 1in. wrought iron bolts, with 4in. square washers $\frac{3}{8}$in. thick, and in no case any small packing or make-up pieces are to be used. In every alternate bay, or 11ft. 4in. apart, is to be fixed crossed single bracing 12in. by 6in. as shown, bolted securely to the top, and half-way down the piles, and fixed between the 12 by 12 stringers. The entire faces of the 50ft. opening are to be covered with 12 by 6 baling pieces, fixed 12in. apart, and to be securely spiked to the main piles, and all corners or unevenness is to be adzed off, so as to afford a smooth passage to any craft going through the opening. When all the piles are driven, and all bracing and walings are fixed complete, the girders A may be fixed or built in their places, namely, 5ft. 8in. apart from centre to centre, care being taken that the cast iron bed-plates come over the centre of the supports.

Wrought-iron Work.—All the wrought iron work shall be executed in a thoroughly workmanlike manner, and to the figured dimensions, as given. The plates forming the webs and flanges of the girders are to be carefully sheared to size, and planed at joints so as to butt closely. All angle irons of the girders shall be jointed as shown. The top and bottom flanges of the girders are to be neatly and truly curved as drawn, especially the top flanges on which are placed the laggings. Great care is to be taken that all the rivets shall accurately fit the rivet holes, and all rivetting shall be well and neatly executed. All usual and proper means shall be taken for connecting and securing together all the different parts of the ironwork, such as girders, bracing, stiffening plates, &c., whether shown on the drawings or otherwise. All bolts and nuts, straps, plates, and other similar ironwork, shall be neatly put out of hand, the threads of all screws being well cut of ample length. It is meant to be understood that the ironwork used for these centreings is to be of as good and finished a quality as if it were being fixed for permanent work. The cast iron bed-plates on the top of the two main supports, under each girder, are to be made of good sound metal, free from defects, and bolted to the bottom flange of the girder by four 1in. bolts in each case. After all the girders have been fixed and braced together complete, a piece of timber 9in. by 3in. is to be fixed on the top flange of each girder, with holes cut out for the rivet heads, and shaped out to ride over the cover plates, &c. This packing is to be bolted down at intervals, and a true line adzed or formed on the top side, so as to carry the 12in. by 4in. laggings evenly under the entire surface of the arch.

Laggings.—The laggings are to be of straight, sound, selected timber, and are intended to be cut out of a 12 by 12 die square sawn baulk by two saw cuts. They must be one uniform section throughout, and are to be spiked by 7in. spikes, 6in. apart, to the packing previously bolted on the top flanges of the girders. The laggings are to project 3ft. on each side of the face line of the arch, so as to form a regular footway outside the arch after the face stones are set. At each end of the girders is to be fixed a piece of packing about 9in. thick, to steady the girder in its place, and between this packing and the masonry is to be placed a washer or cushion, consisting of eight folds of $\frac{1}{4}$in. felt or of 2in. india-rubber. Before any of the arch stones are fixed it must be ascertained that the top of the laggings is of one true surface and out of winding.

Centreing for Intermediate and Shore Arches.—The centre openings or waterways are to be left 30ft. clear between the walings on the face of the main supports in each case, and all piles, stringers, sills, wedges, cross bearings, walings, packing pieces, and general timber work, are to be selected and fixed complete under the same conditions as heretofore specified for the timbering of the centre arch, with the exception that the main two sets of supports next the transverse centre line in each arch is to consist of four piles only in each support; these are to be driven 5ft. 8in. apart, as in the centre arch, and the same conditions enforced to secure accuracy. The wrought iron work in all the girders, bracing bolts, rivets, straps, dogs, &c., are to be made and fixed under the same conditions as heretofore described for the centre arch.

Dolphins.—No. 20 dolphins are to be built, two at each side of the entrance to each opening in each span, as shown. These dolphins are to consist of five main piles, 14in. by 14in. to each, driven into the ground at the angles as shown, and in every way the timber and construction of them is to be under the same conditions as those for the centreing, care being taken that the sheet waling comes in a line with that of the waterway left through each arch, so as to leave no obstruction to any passing craft. The apex dolphin of the floating booms is to be made of No. 3 piles, 14in. by 14in., driven in their position as shown, with bracing complete, and of which there are eight in number, four on either side, and in a line with the centre of the piers. Between the apex dolphin and that next the opening on each side of each arch is to be placed four fenders, as shown, consisting of two vertical piles with distance pieces between to form a guide for the floating booms.

(*To be continued.*)

In twenty years—between 1861 and 1881—the number of British and foreign ships that came to grief on our coasts, and from which life was lost, was 3347, resulting in the loss of 15,695 lives.

GORDON'S DYNAMO ELECTRIC MACHINE.

MESSRS. THE TELEGRAPH CONSTRUCTION AND MAINTENANCE COMPANY, GREENWICH, ENGINEERS.

(*For description see page 309.*)

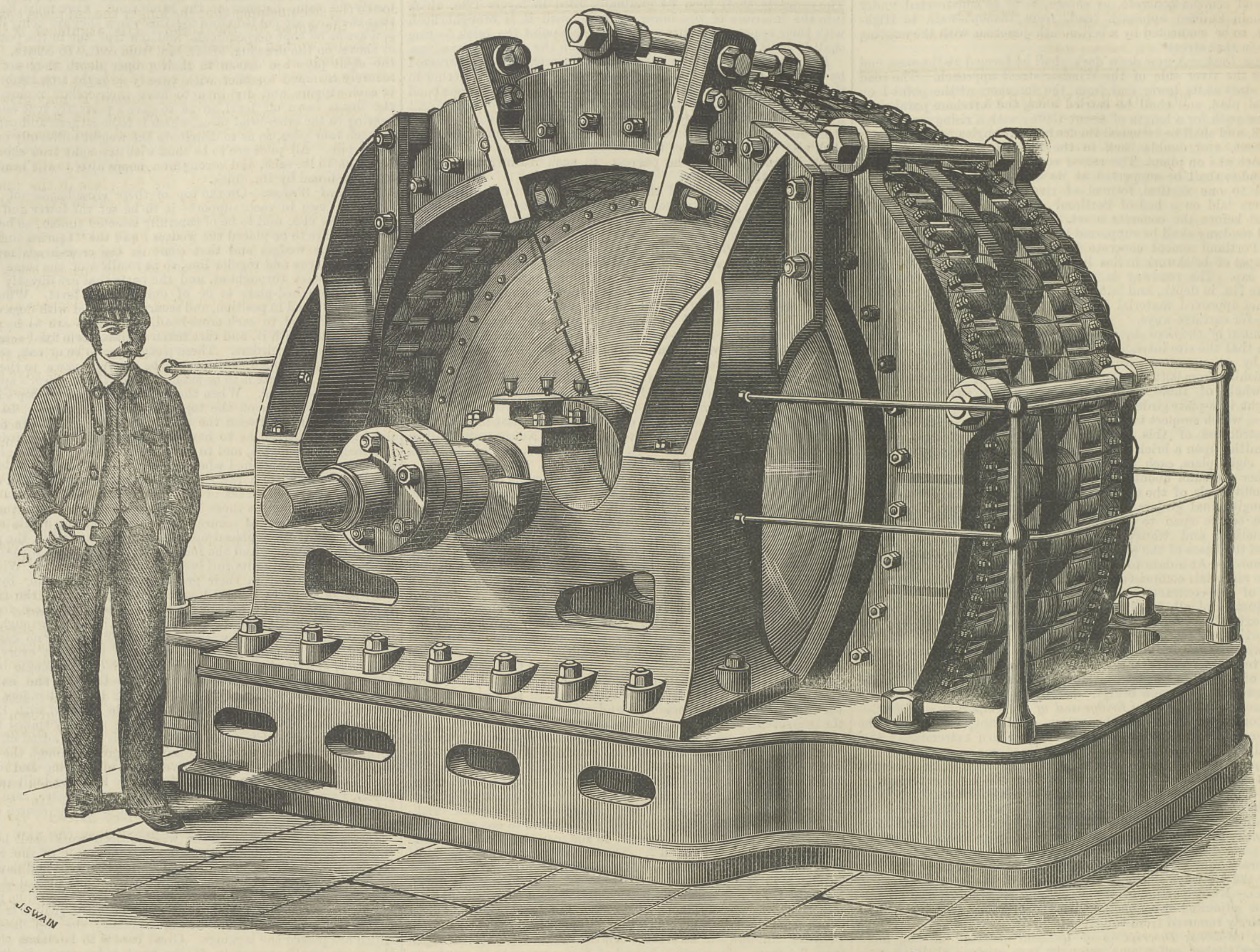
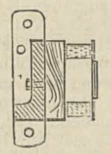
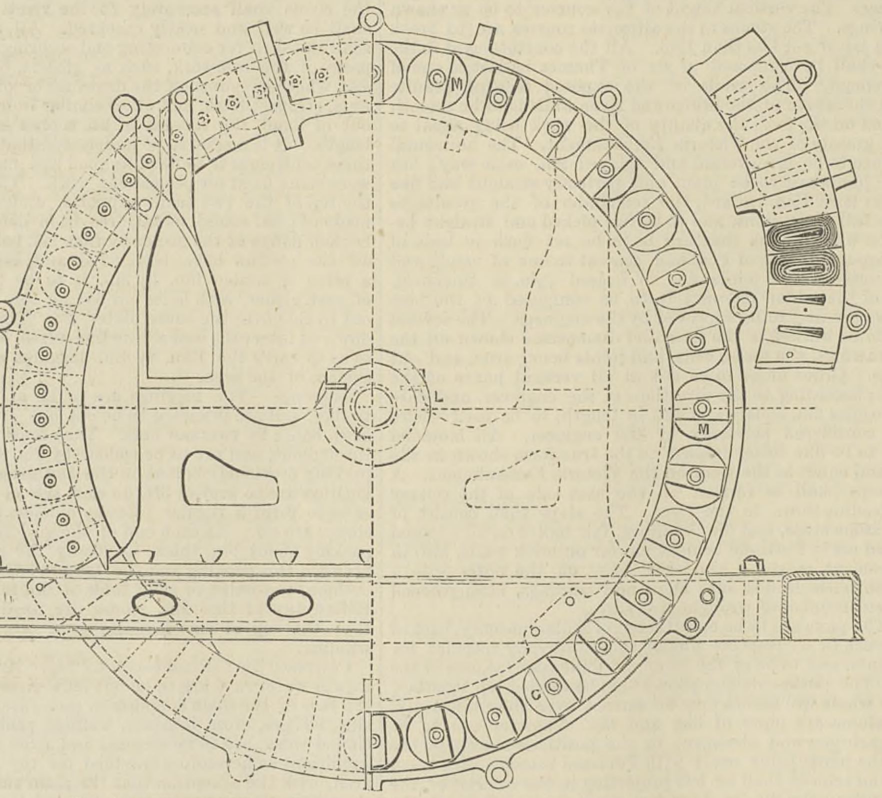


Fig 1





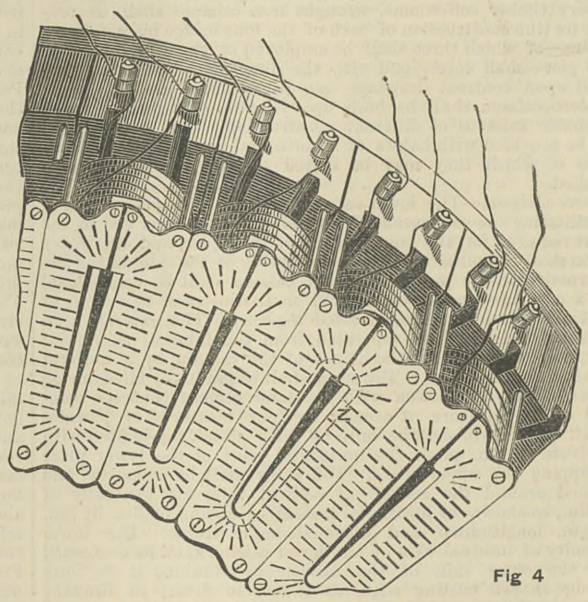


Fig 4

Fig 2

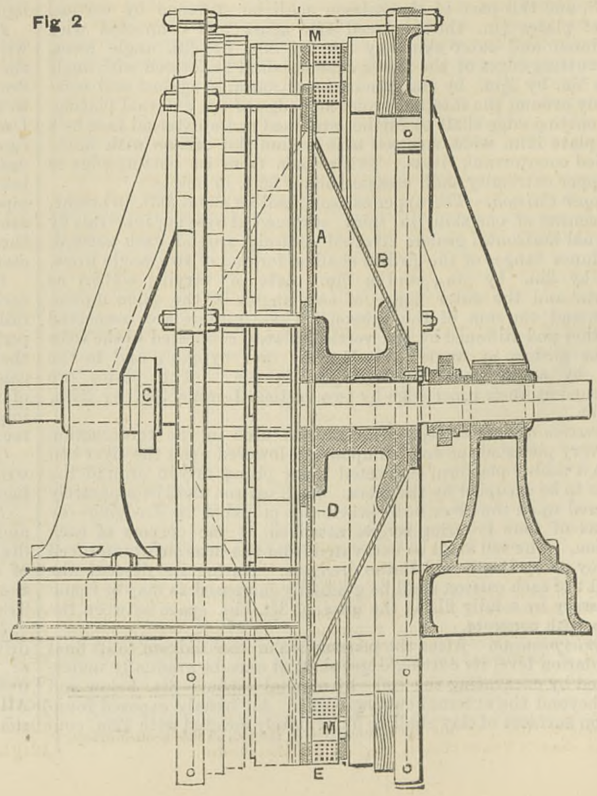
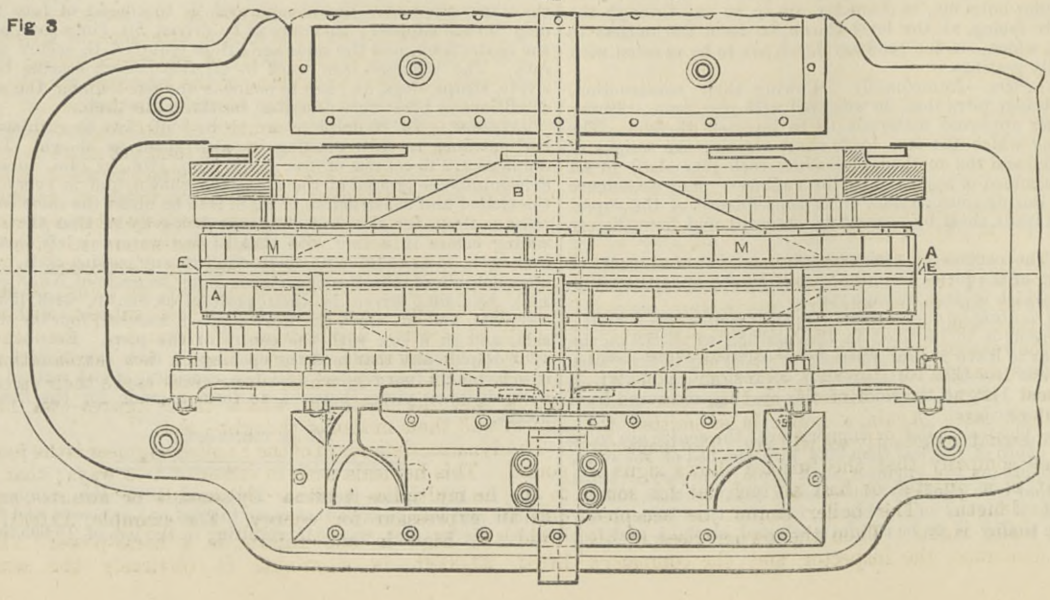


Fig 3



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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.*

W. A. W.—*That face of the propeller which is furthest from the bow of the ship is the working face.*

G. B. C. (Bury).—*Water can be lifted about 20ft. by a pump at the top of the well, or a little more if the pump be a good one. Steam tram-cars are much more than seven years in use.*

John.—*You will find the information you require in Mr. Hartnell's paper "On Governors," read before the Institution of Mechanical Engineers at Leeds, and published in our impression for Sept. 1st, 1882.*

F. H.—*Dry clay brickmaking machines are made by Messrs. Bradley and Taylor, Wakefield; Messrs. Middleton and Co., Loman-street, Southwark; Messrs. Pollock and Pollock, Leeds; Messrs. J. Whitehead and Co., Preston; and, we believe, the Patent Brick Machine Company, Middlesbrough.*

J. H. S.—"*Casting and Founding,*" *by N. E. Spretson. London: E. and F. N. Spon; published price about 11s. Overman's "Founders' and Moulders' Guide." Sampson Low and Co.; about 4s. "Iron Founding," by C. Wylie. Sunderland: T. Reed and Co. London: Simpkin, Marshall, and Co.*

Amateur.—*The steam does not "grow in power." The circumstance that the power developed in the cylinders of the Claremont augments in the way stated is in a sense an accident, and is due to the diameters of the cylinders not being accurately proportioned to the pressure of the steam in them. If less or more steam was admitted to the high-pressure cylinder at each stroke the distribution of power would be immediately altered. Engineers try to get the same power out of all the cylinders of compound engines, but it is impossible to secure this end save for one fixed pressure and rate of expansion, any departure from which causes, as we have said, an unequal exertion of power in the cylinders.*

CRUCIBLE STEEL CASTINGS.

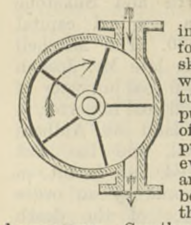
(*To the Editor of The Engineer.*)

Sir,—Can any of your readers inform me how to make crucible steel castings? Will scrap steel, old files, &c., do for the purpose; if so, what proportions of each to use, and what flux? Any information on the moulding, melting, and pouring steel castings would, I think, interest many subscribers besides R.

Exeter.

THE EFFICIENCY OF TURBINES.

To the Editor of The Engineer.)



Sir,—Can any of your correspondents kindly inform me where I can obtain data of the performances of simple radial vane turbines, such as sketch? I wish to know what percentage of work or duty is given for water expended. Such turbines are sold as small motors for domestic purposes, and if efficient and not wasteful of water, ought to prove very useful. Before purchasing, however, I would like to have some evidence besides the maker's statement that they are good. I want particularly to know what is the best head to work them with, and at what speed they should run, and what size will give, say, half a horse-power. Can they be used for blowing an organ? L. H.

Freshford, October 18th.

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MEETINGS NEXT WEEK.

Institution of Mechanical Engineers.—The next meeting of this Institution will be held at the Memorial Hall, Albert-square, Manchester, on Friday, Nov. 3rd. The chair will be taken at 3 p.m. by the president, Mr. Percy G. B. Westmacott. The following papers will be read and discussed at the meeting:—"On the Fromentin Automatic Boiler Feeder," by Mr. John Hayes, of London. "On the Automatic Screw Brake," by Mr. W. Parker Smith, of London. "On a Centrifugal Separator for Liquids of Different Specific Gravities," by Mr. W. Bergh, of London.

Chemical Society.—Thursday, Nov. 2nd, at 8 p.m.: Papers to be read:—(1) "On some Halogen Compounds of Acetylene," by Dr. R. T. Plimpton. (2) "On Dihydroxybenzoic Acids and Iodosalicylic Acids," by Dr. A. K. Miller. (3) Crystalline Molecular Compounds of Naphthalene and Benzene with Antimony Chloride," by Messrs. Watson Smith and G. W. Davis. (4) "Additional Evidence that Quinoline belongs to the Aromatic Series of Organic Substances," by Messrs. Watson Smith and G. W. Davis. (5) "On Orcin and some of the other Dioxytoluols," by Mr. R. H. C. Nevile and Dr. A. Winther.

DEATH.

On the 20th inst., at his residence, Park House, Ashton-on-Mersey, Cheshire, Joseph Sykes Hulse, Engineer, of Manchester.

THE ENGINEER.

OCTOBER 27, 1882.

THE RESPONSIBILITIES OF STEAM USERS.

A Cornish boiler, about 20ft. in length, exploded on Monday week, at the works of the Stephenson Tube Company, Liverpool-street, Birmingham, and caused the death of three men. At the adjourned inquest, held on Tuesday, upon the bodies of these men, the jury found a verdict of manslaughter against Mr. Mosedale, chief engineer; and severely censured Mr. Everitt for not having the boiler removed when reported unsafe in July. As the engineer will have to stand his trial, it would be wrong to express any opinion concerning his guilt or innocence; but it is not wrong to say that, however guilty he may have been, there are dozens of individuals using steam boilers who are quite as much to blame, and who nevertheless escape scot free. We have often pointed out that the steam user who refuses to take proper precautions to prevent boiler explosions is a very guilty man, and we see no reason why we should modify that statement. While it may, perhaps, be conceded that a boiler explosion does now and then take place concerning which there is some little mystery, it is certain that nine hundred and ninety-nine explosions out of a thousand are the results of strictly preventible causes. In a word, they would not have taken place if the boilers which gave way had been properly examined; properly treated; and properly repaired. This truth has been dinned into the ears of the steam users of Great Britain. No one worth hearing has ever attempted to say that the statement is not true; and we are happy to add that a great number of steam users act on the proposition, and by enforcing adequate inspection, even at a good deal of inconvenience, they ensure safety for themselves, their workpeople, and their neighbours. But there are, we regret to say, exceptions, and to the exceptions must be attributed the great bulk of the annual roll of deaths, maimings, and bruisings which the various insurance and assurance companies publish from time to time. The conscientious steam user does no mischief; the unconscientious steam user kills his fellow-men and destroys property and escapes scot free. It is worth considering whether this system may not be got rid of.

Before any good can be done it will be necessary to go to the root of the whole matter, and to dig up the reasons which operate to make men use unsafe boilers. If more powerful reasons can be brought to bear in favour of the use of safe boilers only, then some good will be done; but we must fully understand the relative importance and power of the causes which induce the use of bad boilers before any measures sufficiently strong to defeat them can be adopted. The best safeguard is, no doubt, competent inspection by experienced men, and this can only be had by the great majority of steam users by insuring their boilers. To the practice of insuring there are, however, three great objections. In the first place, inspectors come round and put the manufacturers to considerable inconvenience by insisting on examining the boilers under their charge; secondly, the inspectors insist on repairs being made, which cost money and interfere with work; and lastly, insuring a boiler puts a very heavy responsibility on the shoulders of the steam user. Let us explain this last proposition first. So long as a boiler is not inspected and reported upon by a competent man the owner need not know much about it. The bottom of a Lancashire boiler may, for example, be eaten away until it is as thin as a sixpence, but when the inevitable explosion occurs, the owner may plead, and with truth, that he did not know the boiler was so thin; and no jury will convict, nor will the public at large even hold that he is to blame. But on the contrary, if an inspector hand him a written report on the condition of his boiler, from which he learns that it is dangerous to use it, and if, after he has received that report, he takes no adequate steps to repair or renew the boiler, and an explosion occurs and causes death, a coroner's jury will be very likely to return an awkward verdict; and thinking men will say that the boiler owner has been guilty of criminal neglect very nearly approaching murder in its guilt. This is a responsibility which many men desire, no doubt, to avoid; going on the principle that it is not always wise to know too much. Concerning the other two reasons why men are reluctant to insure, we need say but little here. Boiler insurance companies as a rule give as little trouble as they can. There are, of course, exceptions, but the companies and their engineers are not in such cases in fault; the trouble is caused by injudicious subordinates. There is, however, another reason which we have not yet dealt with, which no doubt operates powerfully to keep men from insuring. This is the fact that boilers even in a deplorable condition may sometimes be worked for years without accident. It is not an uncommon thing to find a boiler carrying 45 lb. or 50 lb. worn so thin, that nothing keeps a large section of the bottom from being blown out save the midfeather brick wall on which the defective plate rests. When a steam user is told that a plate is much corroded, that statement carries no conviction of imminent peril to his mind. He knows that the boiler has probably been much corroded for some time—but what then? It did not explode in 1881, why should it explode in 1882? The plates when the boiler was first made were a great deal stronger than was needed to carry the stated pressure; and one of the reasons why such thick plates were used was to provide a margin for this very corrosion. Thus will the steam user argue with himself, and he can make out an excellent case. Again, a boiler is submitted for insurance, somewhat reluctantly we will say. The inspector reports to his company that the furnace shows signs of weakness. It is a quarter or half an inch flat for some portion of its length. The boiler cannot be accepted until this is made right. Then the owner rises in his might and denounces the inspector and the company's engineer and the whole system of insurance, and stoutly maintains that to his certain knowledge the flue has had a flat place in it for the last five years. He entirely overlooks the circumstance that the longer the flat place has been there the worse for the boiler. His argument is that if the boiler worked without exploding for five years, it will not explode at all because of the flat place in the flue at all events. The inspector's contention is that the flat place is a weak place, and that at any moment it may give way. Of course the inspector is right and the steam user is wrong; yet if an explosion occurred, and someone were killed, it would be very difficult to get a coroner's jury to take any view but that of the owner. He will maintain that because the boiler with the flat place in the flue did not explode for five years, he had a right to expect that it would not explode at all, and that in consequence he is not responsible for the deaths which have taken place. But it should be obvious that as the whole boiler was undergoing a gradual process of deterioration, the chances were that the small margin of safety once possessed by the flat place in the flue must have been going away by degrees, and had probably vanished altogether, or nearly so, in the course of five years. A modification of this style of reasoning is not without its influence. It is very difficult to induce steam users to believe that a boiler can be burst save either as a result of shortness of water or some occult cause; and they will point with triumph to boilers patched with old pieces of carpet and scraps of plate iron held in place by a few ancient nuts and bolts, such as may be seen in the mining districts, and they will tell one that if corrosion could cause a boiler to burst, explosions would be ten times as numerous as they are. Furthermore, it is well known that a multitude of flues collapse every year without causing an explosion or loss of life; and thence—returning to the flue with the flat place—it will be argued concerning it that to repair it is quite unnecessary, for if the worst comes to the worst there will only be a collapse, not an explosion.

Such reasoning as this would, perhaps, be convincing if it were not now and then refuted by the thunder of an explosion, the roar of falling buildings, and the shrieks of the wounded. The axiom may be laid down that no boiler any part of which is out of shape or corroded ever so little, is as safe as it ought to be. It is not that the evil as it exists this week is very serious, perhaps; but who can say to what magnitude it will have grown in a month? We suppose that there are very few steam users indeed who would not look on a longitudinal crack in a bottom plate of a boiler, no matter how short that crack was, without grave misgivings. But a craek running in from the edge of a plate, and only, say, 1in. long, is apparently a very insignificant defect indeed; yet it is known that such crack will act just as does the nick made by a draper with a pair of scissors in the side of the piece of cotton cloth which he wishes to tear across. The crack may extend at a moment's notice; even so with corrosion. This having small beginnings may proceed with astounding rapidity after remaining almost dormant for months. The same statement is true of flat places in furnace crowns and flues. All this ought to be known to steam users, and we believe indeed that the boiler owners who do not know it in the year 1882 might be counted on the fingers. If they know it, then they cannot escape from responsibility. So certain is this, and so fully has it been proved that with proper inspection and repairs boiler explosions can be wholly, or nearly so, averted, that it is quite safe to assume in all cases that the owner of an exploded boiler or his manager is in fault; that, in a word, either the one or the other is directly responsible for the occurrence, and in all law proceedings the onus of proving his innocence should be thown on the boiler owner, not the onus of proving his guilt on someone else—such, for example, as the relatives of slain men, who seek compensation. We have said before that explosions will take place even in the best-managed works, but under such circumstances the owners and their subordinates will have no difficulty whatever in showing that they were free from blame. The number of such explosions is, however, so very small that they are of little or no importance.

The one thing now universally needed is the punishment of those who by their parsimony or carelessness permit boiler explosions to take place. The Government have gone so far as to insist on a Board of Trade inquiry invariably being held when a boiler explodes within the United Kingdom. This may do some good, but until adequate punishment is inflicted on guilty parties there will be no real improvement effected. A sentence of two years' imprisonment with hard labour would do more to prevent boiler explosions in the present day than any other device which it is possible to adopt.

THE DYNE.

The letter signed "J. B. W.," which we published last week, on electrical measurements, is, we have reason to know, in no sense or way the unique utterance of a desire for information. The great body of engineers, young and old, understand next to nothing of the language spoken by electricians; and even among electricians themselves we find diversity of opinion, obscurity of diction, and lack of lucidity of style, all of which things tend yet more to confuse the minds of men who, already trained to think in one way, now find themselves compelled to think in another. At a suitable time we shall explain precisely what electrical measurements mean. We shall endeavour to give in detail a key to the language used by electricians. But before coming to details something may, we think, be said with advantage concerning the whole subject without regard to special applications of formulæ. In other words, it is advisable, to give here a few explanations concerning the way in which electricians make their calculations and the basis on which their figures—we had almost said their modes of thought—rest.

The dynamical standard of the English engineer is the foot-pound. This he deals with in either of two ways; that is to say, he multiplies it either by seconds or minutes, and gets an expression for energy. For example, 33,000 lb. lifted 1ft. high in one minute is a horse-power; 1 lb. lifted 33,000ft. in a minute is obviously the same thing, so is 550 lb. lifted 1ft. high in one second, for $\frac{33{,}000}{60} = 550$. Again, if we want to know how much work is accumulated in a falling body, we use the formula $\frac{W v^2}{2g}$, where W is the weight of the body, v its velocity in feet per second, and g the accelerating force of gravity. It will be seen almost at a glance that this formula is only an expression for the height from which a body must fall to acquire the stated velocity; because the velocity of a falling body multiplied by itself and divided by 64, gives the height from which the body has descended, and this multiplied by W, the weight of the body, gives the foot-pounds stored up in it—that is to say, the resistance which the body could push before it for a distance of one foot. Thus, let the weight be 1000 lb. and the velocity 100ft. per second, we have $v^2 = 10{,}000$, and $10{,}000 \times 1000 = 10{,}000{,}000$, and $\frac{10{,}000{,}000}{64} = 156{,}250$ foot-pounds. But this is precisely the same thing as multiplying the height 156·25ft., from which the body must have fallen to acquire the velocity of 100ft. per second, by 1000 its weight in pounds. The heat unit of the engineer is the pound-degree, that is to say, the quantity of heat necessary to raise 1 lb. of water 1 deg. Fah. Mr. Joule, by a masterly investigation, proved that this heat was equivalent to 772 foot-pounds. In other words, as much mechanical energy is expended in heating 1 lb. of water 1 deg. as would suffice to lift that pound of water to more than twice the height of the cross on the top of St. Paul's. The foot-pound, the thermal unit, and Joule's equivalent, have become engraved in the mode of thought of the English engineer. They have been found admirably convenient; and this especially so because they give figures of considerable dimensions when they are used for most practical purposes.

Now, the electricians in preparing their standards have rejected the foot-pound; rejected the British thermal unit, and rejected g. In other words, they have for the time being, at all events, adopted an entirely new nomenclature, and entirely new standards wherewith to measure the amount, degree, and quantity of the form of energy with which they deal. In part the adoption of a novel system was due to the fact that most of the theories and propositions on which the calculations were based were worked out by a small knot of Frenchmen and Germans. Sir W. Thomson is mainly responsible for the adoption of the system into this country. However, it is not to be supposed that the innovation has been heartily accepted all round. On the contrary, it cannot be said that it has been finally accepted at all. It may be regarded as used provisionally, and a committee of the British Association are to a large extent answerable for forcing on unwilling men a system which they did not want, and which entails in practice considerable inconvenience. The standard adopted, instead of the foot-pound, is the centimetre-gramme-second—that is to say, the force which, operating on a body weighing 1 gramme, or about 15·42 grains, for one second, would impart to it a velocity of 1 centimetre, or ·394in., in one second. It will be seen at a glance we are here dealing with absurdly small quantities. Engineers are not in the habit of estimating pressures in fractions of ounces—for example, in grains—and the velocity is out of all proportion slow as compared with the British foot-second. Advancing a step, it was very easy to calculate the force which, acting for one second, was required to impart a velocity of ·394 of an inch to 15·42 grains of matter. This force is one 980th of a gramme, it is called a Dyne. One grain is equal to 63·57 Dynes, and the Dyne may be and is used instead of g. Before explaining what we mean by this, it may be worth while to say a few words concerning the reasons why such minute standards of measurement were adopted.

When electricians were first called to formulate their thoughts concerning the dynamics of electricity, they had only telegraph work in hand. The dynamo-electric machine was little more than a curious toy; the arc lamp was the subject of a rare laboratory experiment, and the incandescent lamp had, of course, no existence. Mr. Holmes, it is true, was labouring to illuminate lighthouses, but the electricians did not then concern themselves with him or his doings. The forces engaged in telegraph work are excessively minute; a message has been sent through the first Atlantic cable with a battery consisting of a single cell, composed of a lady's thimble with a little strip of platinum foil in it, and a few drops of acidulated water. The foot-pound, therefore, was held properly enough to be too large a unit, and the centimetre-gramme-second was adopted, and Englishmen who see nothing but good in the metrical system were delighted with it. This, then, is apparently the reason why the Dyne was adopted; but from the first moment that the electric light began to illumine the horizon of the scientific world, it became apparent that the Dyne and all its congeners were ridiculously small for the great forces to be dealt with and developed by the dynamo. Electricians get over the difficulty by multiplying their units by millions and thousands of millions—a clumsy enough device.

We may now return to the Dyne, and explain especially for the benefit of our younger readers what is the analogy between it and g. We know that the force which must be exerted for one second on any body to give it a velocity of 32ft. in a second is equal to its own weight, and this is true no matter in what direction we desire the body to move. Thus, for example, if we want to make a cannon shot weighing 100 lb. move at 32ft. per second, and if the driving force can be applied for only one second, then it must equal the weight of the shot. In other words, a force of 100 lb. applied to a body weighing 100 lb. for a space of one second will impart to that body a velocity of 32ft. per second. It must be clearly understood that we are dealing here with what is known as "mass," that is, the quantity of matter in a body, which quantity is expressed by its weight. But when the body, as a cannon shot, is moved horizontally, it is clear that the weight of the body can neither accelerate it nor retard it. It is under such circumstances that a push equal to the weight of the body is needed to give it a velocity of 32ft. per second. Many of our readers will no doubt say that we are dealing at undue length with what every one understands, but we have reason to know that every one does not understand it, and this is specially true of men at opposite ends of the profession; that is to say, of the student who is just entering on it, and the old school practical man, who never was taught what we are trying to teach here. At the risk of being wearisome to a few, we hope to be useful to a good many. To resume, it may be worth while to explain here that the force required to impart a given velocity to a given mass of matter in a given time is easily found by the following simple formula:—$F = \frac{W v^2}{32{\cdot}2t}$. Here W is the weight, v the velocity in feet per second, t the time in seconds during which the force is acting, and F the force. We have written elsewhere thoughout this article 32 only, but the velocity acquired by a body under the influence of a driving force equal to its own weight acting for one second is more accurately 32·2ft. It will now be seen by those who have followed us so far that the Dyne is neither more nor less than a substitute for the action of gravity denoted by g. Instead of using the convenient factor, the weight of the body moved, we use the 980th part of that; in other words, we substitute for 32·2 the fraction $\frac{32{\cdot}2}{980} = 0{\cdot}0338$, which does not commend itself very forcibly to the engineer at all events. Possibly some of our readers may fancy that we have attached too much importance to the Dyne; yet this is not the case. In almost all dynamical calculations we have to use the convenient factor g, and in the same way the Dyne continually turns up in electric calculations. Volts, Ohms, and Ampères all bear an intimate relation to the Dyne, and until the true meaning of the word—which has been coined from dynamics—has been mastered, it is useless to attempt to advance far in the study of practical electricity. For ourselves we confess that we regard the Dyne and the centimetre-gramme-second with much disfavour. They originated to a considerable extent in the pedantry of a small knot of scientific and *quasi* scientific men, who either had never heard of the foot-pound, or deliberately rejected it. It is easy to see that notwithstanding the smallness of the quantities used in telegraphy, it would have been very easy to use decimal fractions of the pound, leaving g unaltered, as it is now, at the very outset. It is, we think, impossible to find a single good feature about the scheme, because it does not even secure the decimal system, for as we have explained, the Dyne, instead of being the 0·001 part of gravity, is the 980th. It is not impossible that a change may yet be made, for, as we have pointed out, there is nothing like a universal consensus of opinion in favour of the centimetre-gramme-second, and the whole subject is to be re-opened at Paris ere long. Indeed, the discussions which have already been held on the subject have been sufficiently stirring in some cases to lead to the hope that the subject will be fully re-considered by the scientific world at large. Meanwhile, however, the student of electricity, be he old or young, must try to content himself with the centimetre-gramme-second and the Dyne.

FLUCTUATIONS IN COAL SHIPMENTS.

The fluctuations that take place in the extent of the shipments of coals from the chief shipping ports of the north-east are rather remarkable when unexplained. In the first place they are changed from month to month by the state of the weather, and the increase or the contrary in the number of the vessels that bear them. But there is a further cause that has been little noticed, and that is the increase or the decrease of the tonnage of coal shipped for the use of vessels engaged in the foreign trade. In our official statistics we have the total of the tonnage shipped for this latter purpose, but none of the details of the ports it has been shipped at. It is to be hoped that this defect will be supplied early, and then there will be the materials for a full comparison of the coal shipments of the chief ports. But apart from any change that such a return would give us, it is noticeable that the Welsh ports are increasing their shipments much more than those of the north-east. This may be due to the obstacles that are thrown in the way of the shipment of British coal to some of the countries of the Continent. Cardiff now takes the lead in regard to the exports of coal, but the large addition that the home shipments give to the foreign trade from Newcastle allows that port to retain its position in the front rank of coal shipping places. Similarly there is a rivalry between Newport and Sunderland; and between West Hartlepool and one of the smaller ports of Wales. It is not difficult to trace the causes of the coal shipment being chiefly carried on from a few such ports, but the fact that there is a growing shipment of coals it is believed, at some of the ports comparatively distant from the coal-fields, is rather significant, unless that shipment is for the use of vessels in the foreign trade that call there to take in bunker coals. It is rather difficult to ascertain what is the present movement in the coal trade in regard to shipments; but it would seem to be probable that the tonnage shipped on the Tyne and at Sunderland, as well as at West Hartlepool, will increase, whilst that of the smaller ports will decrease with the growth of larger vessels; and a similar remark will apply to ports in other districts. At the same time the cheapness or the contrary of the coals will have its effect, and the result that will attend the attempt of Hull to obtain a larger share of the coal trade will be waited for with anxiety. If the attempt succeeds, a considerable part of the tonnage of coal may in the future be shipped there for London—possibly to the injury of Sunderland—but there may be, on the contrary, a growth in demand that will give employment to all the facilities of production. We have yet to notice the result, but in some way the coal trade seems on the eve of change so far as shipments are concerned.

ROD MAGIC.

The controversy which rages from time to time in the daily papers respecting the merits of the divining rod has again come to the fore, and many letters have recently appeared respecting it. A gentleman at Cheltenham writes in its favour; other practical men are equally strong against it. One of them writes:—"The suggestion that all mineral veins having been found by experiments to be conductors of electricity is scarcely a sufficient defence of the successful use of the divining rod in discovering water springs, unless it is contended that all water-bearing formations are mineral formations. As I have lately superintended the sinking of a deep well at Hambleton Hall, Oakham, where the divining rod was used at the suggestion of those living in the neighbourhood, the experience gained will probably be of interest to all who might be tempted to depend upon this mode of finding water. The knowledge I had previously gained of the geological formation of the district showed that the water-bearing formation of the rock bed was overlaid by the upper lias clay about 200ft. in thickness, and as there could be no doubt whatever that a good supply of water would be found anywhere on this hill by sinking a well through the lias, I had no hesitation in sanctioning the sinking of a well on the line of the spring indicated by the use of the divining rod; but, instead of finding water at a depth of about 100ft., as suggested by the water-spring discoverer, the result of the boring conclusively proved the correctness of the theory suggested by a knowledge of the geological formation; the water was only found by boring through the lias into the rock bed to a depth of 229ft. below the surface." The only two points that give interest to the controversy are the shape of the rod, and the manner in which electricity is mixed up in the question. At earlier times we were told that the twig was double and one arm of it was held in each hand, as a plough is held in fact; now, however, it seems that a straight rod suffices, one end being held in either hand. Again, the statement in the letter just quoted that all mineral veins have been found by experiment to be conductors of electricity, will not gain general acceptance. It happens to be quite otherwise. While, for example, pyrolusite, manganite, and Braunite conduct electricity, Hausmannite does not allow the current to pass; and of the ores containing iron, specular iron ore, brown iron ore, chrome iron ore, spathic iron ore, and Lievrite oppose its passage entirely. Zinc-blende, moreover, does not conduct electricity. But the whole subject is outside the domain of science proper. Jacques Azmar, the rhabdomancer *par excellence*, when brought up from Véran to Paris, was successfully and utterly exposed. Those who take an interest in the past history of the rod cannot do better than consult the *Dictionnaire des Merveilles de la Nature*; and perhaps the best authority on the subject is a small volume published at Amsterdam in 1693, called "A Treatise on the Divining Rod, and its Usefulness for the Discovery of Springs of Water, Minerals, Hidden Treasures, Robbers, and Fugitive Murderers. Together with the Principles which Explain the Phenomena, the most Obscure in Nature. By M. L. L. de Vallemont, Priest and Doctor in Theology." Four years ago a certain Mdme. C——— tried the action of the rod in Paris, and it pointed unmistakeably to the presence of gold in a building known as the Bank of France, in the coffers of which by law a considerable "metallic reserve" must always be kept.

THE VALUE OF COLLIERY PROPERTY IN SOUTH YORKSHIRE.

On Wednesday afternoon last a very large and influential company composed of colliery owners, mineral proprietors and others, interested in the coal trade assembled at the King's Head Hotel, Barnsley, where the Mitchell Main Colliery was offered for sale. The value of colliery property in South Yorkshire has of late years been thoroughly tested, three of the largest collieries in the district having been brought under the hammer and withdrawn. These included the South Kirby Colliery, Thorp's Gauber Hall, and the Dodworth and Silkstone Collieries floated a few years ago with a nominal capital of £300,000, and knocked down for £2000. The Mitchell Main Colliery, sunk but a few years ago by the late Mr. Joseph Mitchell, of Swaithe, Mr. Josse, the well-known coal importer of Grimsby, and Mr. Worms, a well-known French coal importer, is a fine property. It is sunk on freehold land at Aldham Junction, between Barnsley and Wombwell, and has cost £121,425 15s. The Barnsley seam is worked, and is 8ft. in thickness. The colliery was offered for sale by an order of the Court of Chancery, in consequence of the death of one of the partners necessitating a dissolution of partnership and a realisation of the partnership assets. At first 358 acres of coal were acquired, and of that 104 acres have been won up to the close of June last, making the yield still to get about 2,400,000 tons, which can be raised from the present shafts. The short gettings up to the end of June last amounted to £5422, and the purchaser would have the advantage of being able to overtake this. The winding shaft is fitted with a pair of horizontal engines, 34in. cylinders and 5ft. stroke, whilst at the upcast shaft there is a large Guibal fan, capable of passing 130,000 cubic feet of air per minute through the workings. There are fifty-two newly erected coke ovens, on the beehive pattern, whilst the surface plant is laid out with most modern appliances. The colliery, which it is stated is being worked to a profit, is now turning out 4000 tons of coal per week. The bidding opened at £10,000, and progressed until the sum reached £21,500, at which sum it was withdrawn, no reserve being named. The last bidder was Mr. Thomas Wilkinson, corn factor, of Barnsley, who, it is stated, was acting on behalf of Mr. Josse, of Grimsby.

THE DISPUTE IN THE COAL TRADE.

One point of the dispute is not sufficiently kept in view by the employers. The men, per Mr. Pickard—who seems to take the place of the late Mr. Macdonald, M.P.—do not deny that the price of coal is low—too low to grant any great advance—but they say to the coalowners, "All you have got to do is to pay us 15 per cent. more wages, and then you must increase your rates for coal." Their object is to compel the public to pay more, and thus put the employers in a position to give more for coal getting. It is needless talking to them about the low price of fuel. They admit all that, and say emphatically, "We mean to alter that, and this is our way of altering it. Once give us 15 per cent. more, and you cannot help yourselves, coal must go up." Undoubtedly this argument would hold good for the home markets of Yorkshire and Derbyshire and adjoining counties; but what of the greatest market of all—the metropolis—by which South Yorkshire coalowners and coal-getters mainly live, and when the Yorkshire coal now is so handicapped by railway rates that fuel from the Tyne can be placed on the market at 4s. per ton less? A point which came out very clearly at the coalowners' meeting was that the South Yorkshire miners, with their present wages, are earning more money than those in other districts. One gentleman present, who is interested in collieries in Nottinghamshire, stated that since the advance of wages his men were leaving for Yorkshire. Of course they would not do so unless they earned more money there.

LITERATURE.

The Law Relating to Electric Lighting. By George Spencer Bower, B.A., of the Inner Temple, Barrister-at-Law, and Walter Webb, Solicitor, of the Supreme Court. London: Sampson, Low, Marston, Searle, and Rivington. 1882.

The object of the authors of this book has evidently been to furnish a guide as well for legal practitioners as for the very numerous class which comprises projectors and investors in the shares of electric companies. Strictly speaking, it is a legal work, dealing mainly with the technicalities of the recently-passed Electric Lighting Act; but it possesses a scope really far wider than that, and may be termed a *vade mecum* for all who are financially or otherwise interested in the many projects for the supply of electricity now before the public, and seeking its suffrage. The authors acknowledge that to a considerable extent their labours can only be deemed tentative; but so, correspondingly, is the Act with the elucidations of which they profess to deal. The whole scheme of the supply of electricity for lighting or motive power is still in its infancy; a vigorous infancy no doubt, but quite as yet in the mists of inexperience. It was questionable, indeed, in the minds of many if this new science was so far advanced as to call for the legal recognition it received by the passing of the controlling Act; but the speculative rush which its large application has created rendered it necessary that a somewhat wild enthusiasm should be placed under proper control. The Act above referred to was therefore passed after the most careful inquiry, and consideration of the best opinions that could be obtained from experts and others, and in spite of many difficulties arising from conflict of interests, the Act is, perhaps, well fitted on the whole to form a basis for present action. It possesses, apart from a few clauses, but little that is new to legislation. Portions of former Acts relating to gas and water supply, of the Lands Clauses Acts, and other general enactments protective of public interests, have been embodied in it, and these having long borne the test of experience, have needed but slight comment from the authors.

The impression raised by the perusal of this book is a foreshadowing of many complications likely to arise, and, to a great extent, from possible varied interpolations of those clauses which deal solely with the speciality of the Act. To these Messrs. Bower and Webb have not failed to direct attention, with explanations which they consider will probably be accepted. Were it only, therefore, as affording a guide among the shoals and quicksands of legal phraseology as applied in this instance, the book under review will prove to be most useful. Scientific technicalities have been avoided almost entirely, the few employed being only such as are in the most current use, and therefore not at all calculated to embarrass the unscientific reader. After a short preface, explanatory of the objects of the work undertaken, a considerable section is devoted, under the heading of "Introduction," to a sketch of the circumstances which led to the framing of the Act; as also of the evidence upon which many of its leading provisions have been based. This evidence we find quoted at considerable length—a course which greatly aids the reader in estimating the value and justness of the several restraints imposed or concessions made, although of course incapable of use in putting a construction upon the statute.

Following the "Introduction" comes the Electric Lighting Act itself, each section being printed in bold type, and having subjoined the elucidatory notes of the joint commentators. These notes of comment are valuable, for they show how many important questions may arise from provisions which seem to the non-professional reader perfectly final in their clearness.

Following the Act itself is an appendix containing the rules made by the Board of Trade with respect to applications for licences and provisional orders. As regards these, Messrs. Bower and Webb point out with clearness how the proceedings of intending undertakers—*i.e.*, companies or municipal authorities—will be hampered by the insistence on the statement of maximum price for the proposed supply. Considering the uncertainty of the extent to which electricity will supersede gas, it is speculative to estimate the amount of the demand, and consequently unsafe to fix a price for it, as so much must depend upon the relative consumption within authorised areas. Nor has the, at present, unsolved problem of the popular meterage of electricity escaped attention; in fact, it is insisted upon as one which, at present, involves the whole scheme of general electric lighting in a *prima facie* disadvantageous position as compared with gas. Throughout the whole work, indeed, every opportunity is afforded to readers to form a fair judgment as to the hindrances to success which should be taken into account by intending investors in electric companies' shares.

The closing pages are devoted to the form of provisional order or licence to be sought from the Board of Trade, a very copious and well-arranged index succeeding. A very extensive reading may be assured for this book, the pioneer only of further information on the same subject which the authors promise, as experience with electric lighting developes new questions and difficulties. That such will arise is tolerably certain, from information as to those already existing with which Messrs. Bower and Webb's work has furnished us. No one contemplating the purchase of electric shares should fail to be aware of these, and we cannot do better than to recommend to them the perusal of the subject of this review. The book has the rudiments of a standard work on the subject of which it treats.

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Hand Railing and Staircasing. By F. O. Creswell. London: Cassell, Petter, and Galpin. 1882.

Minutes of Proceedings of the Institution of Civil Engineers. Edited by James Forrest, Assoc. I.C.E., Secretary. London: The Institution. 1882. Vol. lxx.

Journal of the Iron and Steel Institute. No. 1 of 1882. London: E. and F. N. Spon. 1882.

Transactions of the Society of Engineers for 1881. London: E. and F. N. Spon. 1882.

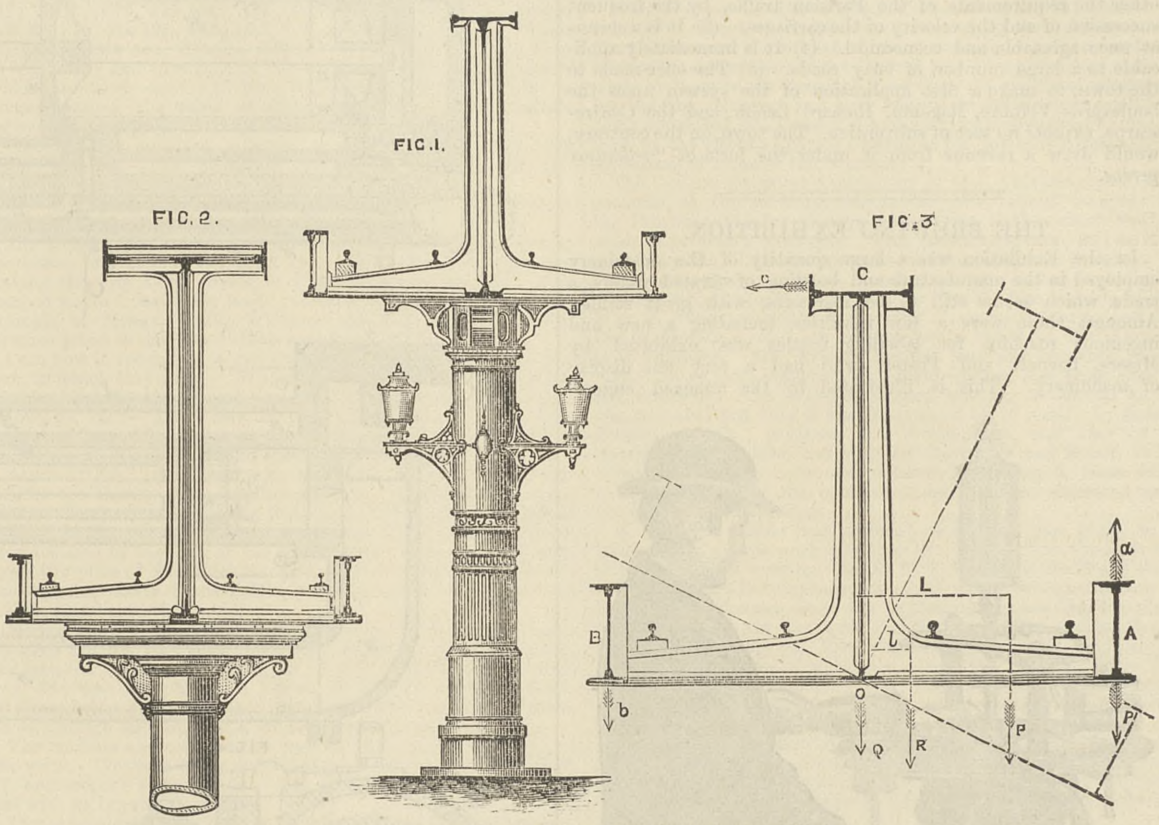
Proceedings of the United States Naval Institution. No. 1. Vol. iii. 1882.

Die Berechnung des Schiffsinderstandes. Von Prof. W. Riehn. London: David Nutt. 1882.

Proceedings of the Association of Municipal and Sanitary Engineers and Surveyors. Vol. viii., 1881-82. Edited by Thos. Cole. London: E. and F. N. Spon. 1882.

AERIAL ELECTRICAL TRAMWAYS.

The following abstract of a paper read before the Société des Ingenieurs Civils, Paris, is of interest, though mainly descriptive of a project of M. J. Chretien, who, in conjunction with M. Felix, came before the public a few years ago with an application of electricity to the purposes of agriculture. He says:—It is quite unnecessary to attempt to demonstrate the necessity of establishing new means of circulation and transport in Paris. This point is quite conceded, and it is only necessary to discuss the various schemes proposed to afford such means, and the choice that should be made among them. All these solutions may be grouped into two classes, viz., underground railways and aërial tramways, the latter term being taken to denominate elevated railways constructed along public ways. I feel an invincible repugnance towards any scheme of subterranean railways, and that repugnance is certainly shared by the large majority of the Parisian public. The objections to any such scheme on the score of hygiene, of the safety of the travelling public, and of the difficulties and expense of construction, are surely sufficient to obtain its condemnation. When additional accommodation became necessary in New York, engineers were sent from there to inspect the Metropolitan Railway in London. On their return, however, they decided on aërial tramways. Why should we imitate that of which London furnishes the only example, rather than follow New York, Philadelphia, Rotterdam, Berlin, &c? M. Shaller has told us here that Mr. Fowler, the constructor of the London Metropolitan Railway, frankly declared that if he had the work to do again he would use the aërial system. I am therefore most unreservedly a partisan of aërial tramways, and the object of this communication is to prove that they offer an easy and advantageous solution, looked at from all points of view.



PROPOSED ELECTRIC AERIAL TRAMWAY FOR PARIS.

Conditions to be fulfilled.—The true solution consists in establishing a network of routes along which carriages shall traverse the town, with the advantage over omnibuses of transporting more rapidly a much greater number of passengers, and of not obstructing the roads, already over-crowded with traffic. To avoid waiting, there should be a large number of carriages succeeding each other very closely, and running as quickly and cheaply as possible. To effect this I would construct an elaborate network of railways, formed of a number of distinct lines crossing each other as often as possible in different planes, and having common stations at the crossing points. Upon this system of lines single carriages with accommodation for fifty people should succeed each other at intervals of one minute. If necessary two carriages could be coupled together, accommodating 100 passengers.

Capacity of Transport.—The above conditions would realise what we may call the maximum capacity of transport of a railway where the stations are very frequent and the stream of passengers large and continual. With longer trains there would be crowding at the stations to be feared, the departures would be less frequent, the stoppages longer, and the final result less satisfactory. With the system of two carriages coupled as above, 200 passengers a minute might be circulated along each line at say twelve miles per hour. Taking account of the changing of passengers *en route*, indeed, one might count in extreme periods upon double this number per minute, moving at say twenty-four miles per hour. This, however, is more than it is expedient to hope for. The hypothesis that two passengers would on each journey be accommodated for each seat provided is not extravagant if we consider the number carried by existing tram and bus lines. Without doubt, at some places and times, the above power of transport would be insufficient, but a work of this magnitude cannot be made to provide for quite an exceptional state of things. To give an idea of what is expressed by the statement of 100 persons circulated each way per minute, it may be stated that in the large streets with pavements four metres wide—Rue Lafayette for example—each pavement will scarcely allow passage to 50 persons per minute each way. It may be pointed out, too, that this power of transport compares favourably with that of existing railways, even those where the traffic is great, as upon the lines to Versailles, St. Germain, Vincennes, &c.

Lightness of Construction.—One important consideration in favour of this scheme is the lightness of the moving masses compared to those of a railway, and consequently the lightness and elegance that may be exhibited by the structure erected to carry them.

Mode of Construction.—That which I have adopted consists in placing a metallic viaduct with double lines upon a single row of columns. Figs. 1 and 2 give sections of this viaduct. The columns are to be placed 15 metres apart, in any space where vehicular traffic is interdicted, such as we find in the exterior boulevards, &c., and at 40 to 50 metres apart in other places. The normal elevation of the rails will be 5 to 6 metres, but it may be reduced to 4 or increased to 8 if desired. The resistance of the viaduct to rupture and flexion may be easily examined approximately. The greatest twisting strain will be when two carriages pass the middle of the span upon one side only. It will tend to distort the section into the dotted position of Fig. 3. The greatest direct bending strain would be when two pairs of carriages occupy the middle of a span, one pair upon each line. Let P be the weight of the two carriages, acting as in the Fig. 3; this will give rise to transverse strains at the girders A B and C, which we will indicate by the small letters *a b c*. Let *p* be a force, which, acting at A, would produce the same result. Now we may consider the axis O as sufficiently rigid, and taking moments about that axis, we get the equation—

$$p + \mathrm{A\,O} = a + \mathrm{A\,O} + b \times \mathrm{B\,O} + c \times \mathrm{CO}$$

In the short spans we may have—

$$\mathrm{A\,O} = \mathrm{B\,O} = \mathrm{C\,O}$$

and therefore, since the reactions are proportional to these—

$$a = b = c = \frac{p}{3}$$

In the long spans, as it is not convenient to make the girders A and B very large, since they would then come above the platforms. I propose in that case to make the system sufficiently rigid, so that nearly all the strain shall be taken by C, for which purpose C O may be made large (see Fig. 3). Therefore, neglecting *a* and *b*, we shall have—

$$c \times \mathrm{C\,O} = p \times \mathrm{A\,O}$$

$$c = \frac{p \times \mathrm{A\,O}}{\mathrm{CO}}$$

As to the columns supporting the lines, they have to bear a compressive strain, which reaches its maximum when two pairs of vehicles meet immediately above them. When a single pair arrive there the resultant strain will not be, as before, along the axis, but will act in some other direction as at R, the position of which may be readily found. If P, as before, be the weight of the pair of vehicles, Q the weight due to the girders—

Then the force $\mathrm{R} = \mathrm{P} + \mathrm{Q}$

and $\mathrm{P} \times \mathrm{L} = (\mathrm{P} + \mathrm{Q})\, l$

or $\mathrm{Q}\, l = \mathrm{P}\,(\mathrm{L} - l)$

Now, approximately—

$$\mathrm{Q} = 5\,\mathrm{P}$$

and $l = \frac{\mathrm{L}}{6}$

Now if we suppose that L = 1·20m. then l = ·20m. This would permit the use of columns less than those proposed, as far as calculated strength is concerned. It is from æsthetic considerations that they are made of the size shown.

Stations.—These will be 400 metres apart, and the figure will show that it is not impossible to give them a certain elegance of form.

Velocity.—The velocity need have no limits, except those imposed by the frequency of stopping. If we suppose that forty seconds is taken up in passing between two stations, this will give a velocity of 36 kilometres per hour. Taking the duration of stoppage to be, as in London, thirty seconds, the resulting mean velocity will be 20 kilometres per hour, which is about two and a-half times quicker than an omnibus. Moreover, since the propelling force will be such that it may be drawn upon to almost any required extent, the velocity may be increased as much as may be considered necessary.

Traction.—The force of electricity, though little used for such a purpose, is that which I propose to apply. There is nothing so simple, sure, and economical as this mode of traction, and it only requires to be tried to be approved. Four years ago, before any one had thought of making any such thing, I tried to make a first application of electricity to this purpose, in constructing an electric tramway from the Porte Maillot to the Jardin d'Acclimatation. The director, M. Geoffroy St. Hilaire, assured a sufficient traffic, and it would have been made if it had been possible to obtain permission to lay it down. Already there are two such lines at Berlin and one at Portrush in Ireland. They are being made at Vienna, Wiesbaden, Turin, Milan, in Wales, at London, at Yandwoort in Holland, at the mines of Yankeroda in Saxony, and probably at various other places. Our turn must surely be soon. There is no doubt that electric machines will give better results when they are made of greater power. Our first results with machines of 2 to 4-horse power are satisfactory. When circumstances call for the use of them of 100-horse power and more, their results will certainly be much better.

Price of Places.—I have calculated that on a line of 5 or 6 kilometres length, 10c. would be a remunerative fare, such a line carrying from 60,000 to 80,000 passengers a day. With an elaborate system of connected lines, some parts of which would, of course, be less remunerative than others, I would recommend a uniform fare of 15c.

Expense of Establishment.—The estimated expense of making the viaduct and station is one million francs per kilometre, with the small spans of 15 metres. With the large spans of 50 metres it would be one and a-half millions. The cost of electricity, rolling stock, electrical conductors, &c., would be about 250,000f. per kilometre, the system being assumed of a certain extent.

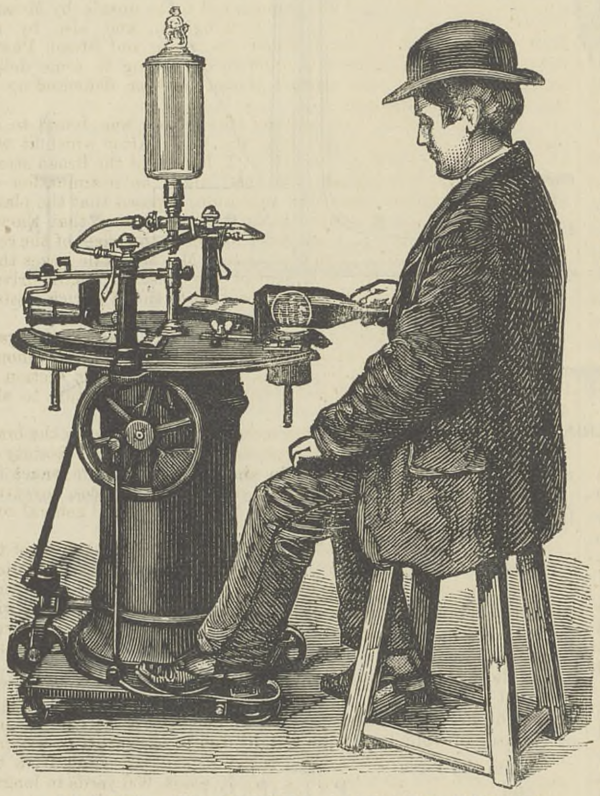
Working Expenses.—Under this head would be the *employés*, depending in number upon the number of stations and carriages in circulation, and the motive power. This latter would be supplied from large and economical steam engines. Placing the loss due to electricity at 50 per cent., this item would not exceed 3c. or 4c. per carriage and per kilometre.

Objections.—These may be expressed thus: (1) The columns would obstruct the traffic. (2) The aërial system would endanger the security of the passengers upon the road below. (3) The construction would affect the beauty of our capital. The projector combats these objections seriatim, and in a decidedly courageous manner.

Conclusions.—The system of transport described above has for essentials: (1) It is a means of locomotion of which the capacity is equal to any existing railway. (2) It supplies better than any other the requirements of the Parisian traffic, by the frequent succession of and the velocity of the carriages. (3) It is a means at once agreeable and economical. (4) It is immediately applicable to a large number of busy roads. (5) The offer made to the town, to make a first application of the system upon the boulevards Voltaire, Magenta, Richard Lenoir, and the Contrescarpe, expects no sort of subvention. The town, on the contrary, would draw a revenue from it, under the form of "*redevance percue.*"

THE BREWING EXHIBITION.

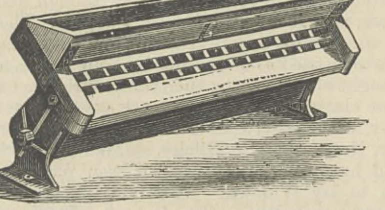
In the Exhibition was a large quantity of the machinery employed in the manufacture and bottling of aërated waters, a trade which seems still to be increasing with great strides. Amongst these were a few novelties, including a new and ingenious machine for labelling bottles was exhibited by Messrs. Barnett and Foster, who had a very fine display of machinery. This is illustrated by the annexed engrav-



BARNETT AND FOSTER'S LABELLING MACHINE.

ing. Operated by means of a treadle is a central spindle, to which is fixed a radial arm, seen in the engraving, carrying a conical roller. This roller alternately runs over the gum pads shown on the table of the machine and the packet of labels which are lightly held in the boxes on the opposite sides of the table, one being clearly seen under the bottle in the operator's hand. A supply of gum is placed in the vessel above the table, and the radial arm moves the valves of the gum delivery cocks at each revolution, and gets a small supply of gum. This is uniformly spread by rolling over the pads, and the conical roller then runs over the label and gums it. The operator then rolls a bottle over the label, and it comes away leaving the next label exposed to the roller. One operator may sit on each side of the machine.

The largest exhibition of machinery and apparatus was made by Messrs. H. Stopes and Co., of Southwark-street, who had a large stand of machinery inside the hall, and a separate central exhibition of drawings, apparatus and brewers' requirements, all illuminated by the Edison incandescent lamps driven by a

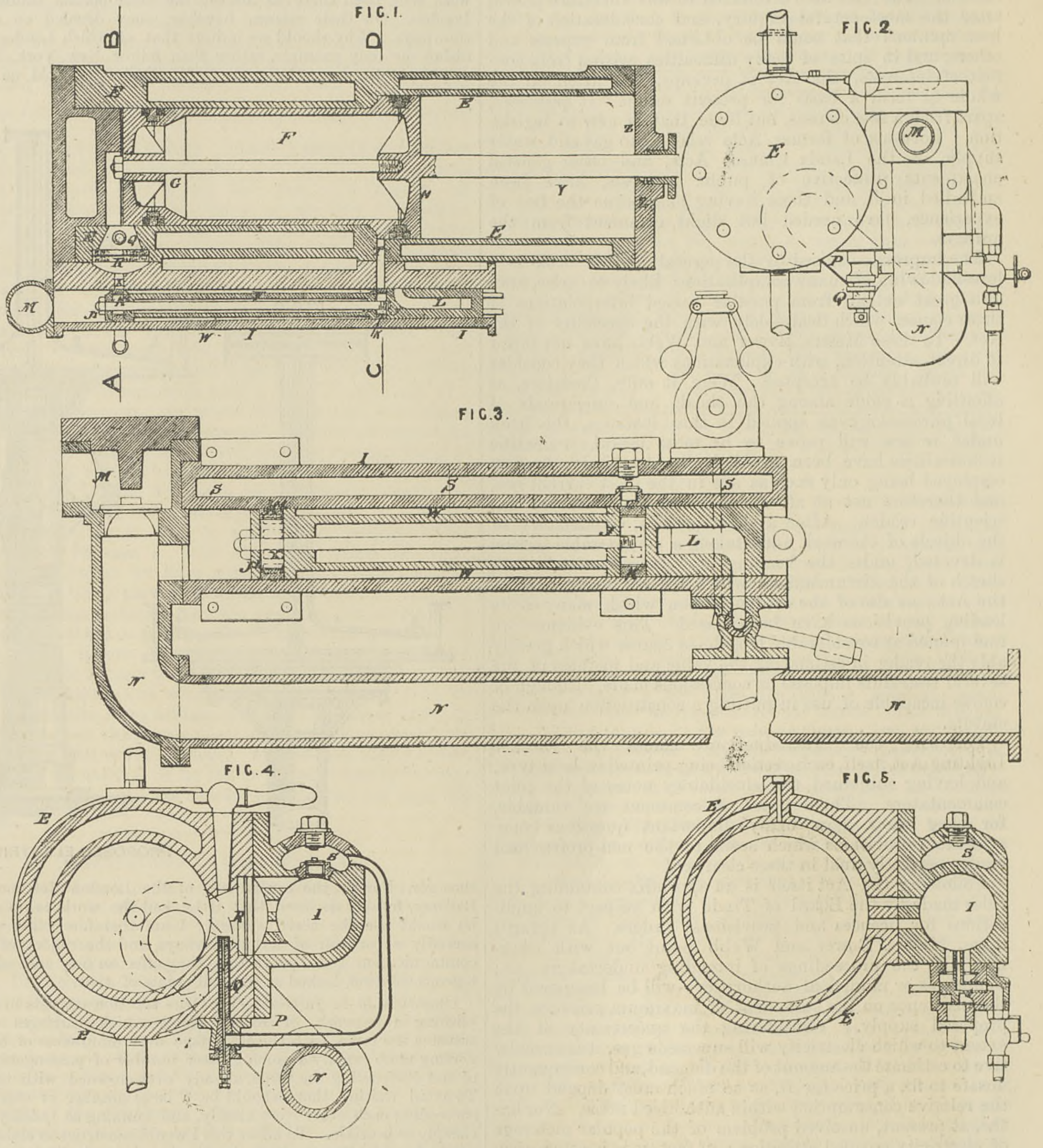


SCHAEFFER'S MAGNETIC SEPARATOR.

Clayton and Shuttleworth portable engine and an Edison dynamo. Messrs. Stopes and Co. are paying particular attention to the introduction of electric lighting into breweries and maltings, especially as electric motors may become very valuable for performing much of the work at present done by hand in different parts of maltings. Schaeffer's magnetic separating apparatus as illustrated herewith was shown in various sizes, and several boxes full of pieces of iron wire, nails, bolts, nuts, pieces of the drum and concave of peg and beater drum thrashing machines, as extracted from barley, maize, &c., before passing into the mash tun, were also shown, most of these specimens having been extracted during the previous week or two in London breweries, and showing that these magnetic screens, as they are called, are as necessary in the brewery and malting, for the prevention of the mixture of these substances with cattle food, as in the mill, except that in the mill they save not only the damage to the mill, machinery, and stones, but prevent dangerous sparking, which may lead to fatal explosions of mill dust. The separator consists of a number of permanent horseshoe magnets, which are embedded in the trough beneath the hopper, the poles of the magnets being seen just below the bottom of the hopper, as they pass through and are flush with the face of a nickel-plated sliding surface. The same firm exhibited a number of drawings of breweries and maltings, special attention being directed to the employment of double drying floors, and of conical-bottomed steeping tanks, by which the steeped barley may without labour be run on to the growing floors.

When the piston heads G H are at the half of their outward stroke the excentric moves the valve pistons J and J[1] outwards again, so that the ring K[1] on J[1] commences to close the communication between W and the port X, and to open a communication through the pipes N and P between the space in the cylinder E which is behind the piston head G, and between the space Y which lies in the cylinder E between the outer side of the piston head H and the cylinder cover Z. The exhaust products are forced by the back stroke of the piston head G and at the same time drawn by the inward stroke of the piston head H into this space Y, where they rapidly contract to below atmospheric pressure, forming a vacuum, which assists the piston on its next outstroke. The exhaust products may be led into a condenser and a more perfect vacuum obtained.

It will be seen that the essentially novel features of the engine consist in the arrangement of the two pistons J and J[1] and the ring valves K and K[1], and their method of action for determining the admission of a charge into one portion of a cylinder and for its transfer to another portion of the same cylinder, and regu-

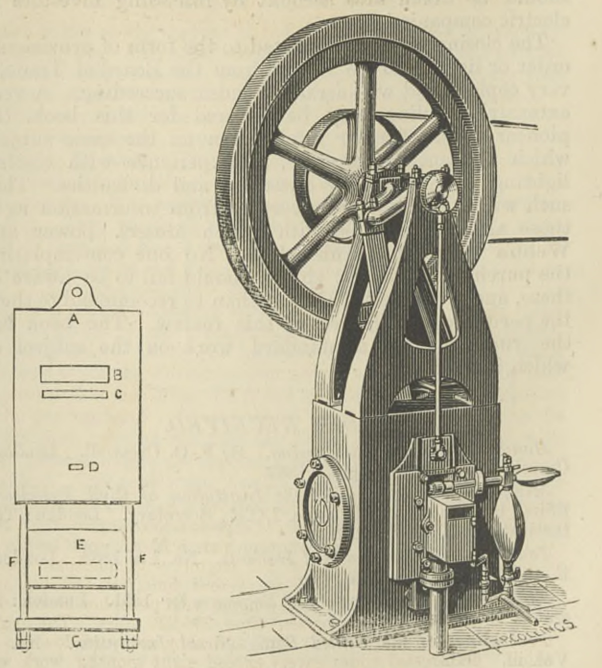


SIMON'S GAS ENGINE

Several new gas engines were exhibited; one by Mr. Louis Simon, of Nottingham, as made under the patent of himself and Francis Wertenbruch. The characteristic details of this engine we illustrate herewith. Fig. 1 is a horizontal section of the cylinder and valve box, and Fig. 2, an end view; Fig. 3, a vertical section of the valve box; Fig. 4, a vertical cross section along the line A B; and Fig. 5 is a vertical cross section along the line C D. The construction and working may be described at the same time:—When the trunk piston F travelling in the cylinder E travels outward, that is, towards the crank, gas and air pass into the space through between the trunk F and the walls of the cylinder, being drawn in through the port T, which is placed in communication with port L, into which gas and air are admitted by suitable pipes opened and closed by a rotating valve actuated by a governor. To form a communication between the ports L and T, the valve piston J bearing the ring valve K is moved inwards by means of an excentric suitably adjusted. On the back stroke of the piston this excentric moves the valve piston J outwards until by means of the ring K, which is somewhat wider than the port T, communication with L has been closed and communication through T with the space W between the trunk V and the walls of the valve box I established. The back stroke of the piston head H therefore compresses the gas and air previously drawn in by it into the space W. The excentric now imparts a backward movement to the pistons J and J[1] on the trunk V, and the contents of W are placed in communication through the port X with the cylinder E behind the power head G of the piston F. At the same time the port T is closed to W and opened to the port L by the inward movement of the valve piston J. Entering through the port X into the cylinder E the compressed mixture of gas and air traverses the perforated plates R, between which are layers of wire gauze to prevent the fire going back into the space W. At Q the mixture encounters a flame lighted before starting the engine and supplied with compressed gas and air from the receiver S by means of a pipe. In some cases the compressed mixture is exploded by means of an external flame lighting a travelling flame carried in one of the many forms of slide valves. The receiver S is fed from the space W through a small back pressure valve. When it reaches the flame the mixture is ignited and the consequent expansion impels the piston outwards. At the same time a fresh charge is being drawn in behind the piston head H in the manner already described.

lating the exhaust, and the utilisation of the contraction obtainable by transferring the exhaust products to a receiver or to the front end of the cylinder.

Another new gas engine was exhibited, which is the



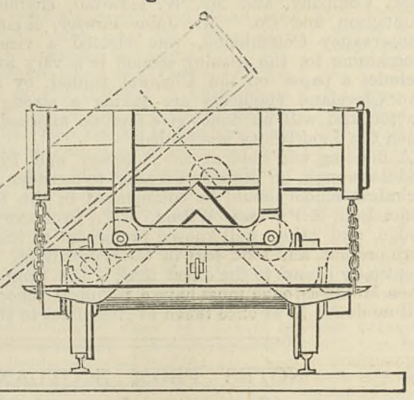
ATKINSON'S GAS ENGINE.

invention of Mr. J. Atkinson. It was exhibited by Messrs. Browne and Boby for the British Gas Engine Company. It is illustrated by the annexed engraving, from which it will be seen that it is of a simple character. It has one flat plate slide valve shown more in detail in the diagram annexed, and this is driven by a crank pin in a small disc on the end of the crankshaft, by shifting which the engine may at a few minutes' notice be made to run in either direction. The valve A has on it an air passage B, gas passage C, and igniting port D, the operation of which will be sufficiently evident. By means of steel rods F F, a bar G is carried below this valve, and an exhaust valve E held in any position by friction. This valve is operated alternately by the lower end of the valve A, and by the bar G, so that it remains stationary during a considerable part of the revolution of the engine. Air and gas having been drawn into the cylinder during the first part of the stroke of the engine through the ports B and C, air is allowed to pass into the cylinder through a valve in the cover on one side of the rectangular cistern in which the cylinder is placed, this air port being uncovered by the trunk piston and consisting of a number of small holes covered by a flat piece of india-rubber, with a movement of under $\frac{1}{16}$in. There is thus atmospheric pressure in the cylinder and not a partial vacuum at the time of ignition, as is sometimes the case, owing to the small area of the inlet ports and the quick movement of the piston. With this engine one ignition is made at every revolution. The exhaust valve covers and uncovers a port indicated by dotted lines and communicating with the pipe shown below the small square box on the valve case, in which is placed the igniting flame.

GRAFTON'S TIPPING TRUCK.

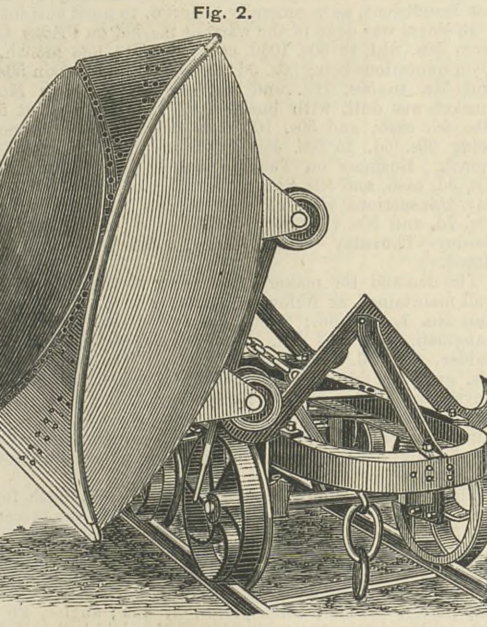
The accompanying engravings represent a new form of double tipping truck, designed specially for mining work, and such as that in the diamond fields of South Africa, where trucks of almost every shape and description are in extensive use, each being more or less applicable to the work to be performed, but none approaching anything like meeting the requirements.

Fig. 1.



The truck here illustrated has been made by Mr. Henry Grafton, of 113, Cannon-street, and its construction is clearly shown by the diagram and perspective view herewith. Fig. 1 is an end elevation; Fig. 2 shows the angle the truck body assumes when tipped. From these it will be seen that the body of the truck is mounted upon double incline $\wedge$ standards, terminating in upturned ends to limit the travel of the body while being tipped. At either end are placed lever catches, which securely lock the truck body in its central position, and at the centre of

Fig. 2.



the body is fixed a chain to limit the angle of tipping, by adjusting which the inclination of the truck body can be varied as required. The action of the truck and mode of discharging the load is as follows:—The attendant whose duty it is to tip the wagons first raises the lever—the one on the opposite side of the truck to that on which the load has to be discharged—and at the same moment pushes the body of the truck with sufficient force to start it; the remainder of the tipping having been effected by gravitation, the empty body returns and locks itself in its normal position. It will thus be seen that one man could tip a whole train of these wagons in but little more time than it would take him to walk along it, the empties righting themselves as soon as the load has been discharged.

Phosphor Bronze Slide Valves.—The Phosphor Bronze Co. exhibited some phosphor bronze slide valves at the North-east Coast Exhibition. Amongst them was a pair of slide valves, No. 845 express engine of the North-Eastern Railway Co., after six and a-half years' working, during which the engine has run 261,182 miles from Newcastle to Edinburgh, and *vice versâ*. They have now been taken out to replace the cylinders with a pair of a different type. Mr. Fletcher, assistant locomotive superintendent, gives the following upon these slides and another pair still at work in No. 844 express engine:—"Mileage of 845 engine with phosphor bronze slides, from March 30th, 1876, to present time, 4th October, 1882, 261,182 miles. Mileage of 844 engine with phosphor bronze slide, from April 20th, 1876, to present time, 236,229 miles." The original thickness of these slides was 1in., and they are worn down to $\frac{5}{8}$in. thick. Gun-metal slides rarely exceed eight months' work when they are worn out. The cylinder faces are, we are informed, in beautiful condition, the wearing being as it should be on the valves. The engines Nos. 844 and 845 are of the following dimensions:—Cylinders, 17in. diameter by 24in. stroke. Four coupled wheels, 7ft. diameter, working pressure 140 lb. per square inch. Weight of engine in working trim, 39 tons 16 cwt. Weight of tender, 26 tons 4 cwt.

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

(*From our own Correspondent.*)

Finished iron makers maintain a bold front in resisting the efforts of some merchants who are trying to "bear" the market; and this strength on the part of makers is by no means without effect; for on 'Change in Birmingham this—Thursday—afternoon, and in Wolverhampton yesterday, buyers were less reluctant to come to terms than a week ago. In cases in which the full advances declared at the quarterly meetings were not conceded by buyers, a proportion of the advance was given. This conceded proportion varied from 5s. up, occasionally, to 7s. 6d. per ton. When purchasers were unprepared to offer such a rise sellers very generally refused to book; and many demanded the full 10s. The firms other than those known as the "list" houses are mostly full of work, and can see some way ahead. They therefore prefer to wait for further orders, rather than accept old prices.

The makers of sheets for the galvanisers, and of ordinary merchant sheets, continue particularly strong. They quoted for galvanising sorts: Singles, £8 10s.; doubles, £9 10s.; and lattens, £10 10s. to £10 15s.

The new prices for the black sheets of Messrs. Morewood and Co., of Soho, Birmingham, one of the firms who have declared the 10s. advance, are as here:—"Woodford" brand up to 20 w.g., £9; 21 to 24 w.g., £10 10s.; 25 and 26 w.g., £12; 27 w.g., £12 10s.; and 28 w.g., £13. Close-annealed "Woodford B," up to 20 w.g., £13; 21 to 24 w.g., £14 10s.; 25, 26, and 27 w.g., £16; 28 w.g., £17; B.B., £14, £15 10s., £17, and £18, according to gauge; B.B.B., £15, £16 10s., £18, and £19, according to gauge. Their charcoal sheets are: 20 w.g., £20; 21 to 24 w.g., £21 10s.; 25 to 27 w.g., £23; and 28 w.g., £24. Their Siemens-Martin steel sheets—close-annealed—are: £17 10s., £19, £20 10s., and £21 10s., in gauges running the same as charcoals. These prices include delivery in Liverpool.

Plate makers reported a better demand alike for tank and boiler qualities. The quotation for the former was £8 10s. to £8 15s. per ton, and for the latter £9 to £9 10s.

The thin—stamping—sheet makers keep steadily employed on home and foreign account at £13 to £14 per ton.

The irregularity in the quotations of the marked bar houses continues, and this is the chief lever which the merchants are making use of in their efforts to "talk down the market." The firm, to whom I last week made reference as having followed the example of Messrs. Phillip Williams and Sons in declining to advance prices is the New British Iron Company.

I am now in receipt of a circular which has been issued by the firm, in which they say:—"We beg to inform you that our prices of 'Lion' iron for the present, and until further notice, will remain as follows, viz.:—'Lion' bars, £7 10s.; ditto hoops, £8; and ditto sheets and bars, £9 per ton at the works, subject to usual extras and approval of quantities and specifications."

A third "list" iron house who make no change in prices this quarter are Messrs. Jno. Bradley and Co. Throughout the past quarter they have been quoting their bars, which are of a special quality, at 10s. per ton in advance of other houses. The advance now declared by the bulk of the trade brings them up to Messrs. Bradley's price of £8, which remains without alteration. Marked bar prices of South Staffordshire were as varied to-day as from £7 10s. to £8 and £8 12s. 6d.

Messrs. Robert Heath and Sons, Stoke-on-Trent, who have also declared the 10s. rise, state their new prices as:—Flats, rounds, and squares, £7 10s.; best ditto, £8; double best ditto, £9; angle iron, £8; best ditto, £8 10s.; T-iron, £8; bridge or tank plates, £9; best boiler plates, £9 10s.; best hoops, £8; best waved hoops, £8 5s.; bridge and tram rails, £7 15s.; and best rivet iron, £10.

The medium and common bar trade is without much change on the week. Common bars are £6 10s. to £6 15s.; ordinary hoops, £7, and cooper's hoops, £7 5s. Gas strip is quoted £6 15s. easy, but with an improving inquiry.

Pigs were slow of sale both in Birmingham and Wolverhampton, yet vendors and makers upheld for recent quotations. All-mine sorts were held for from 67s. 6d. to 70s., part-mine at from 60s. down to 45s., according to the proportion of mine in the mixture; native cinder iron descended to 42s. 6d. The "Castle" brand rose from that figure to 47s. 6d. for medium and 55s. for best sorts. Thorncliffe was quoted firm at 62s. 6d., and Derbyshire 52s. 6d. to 55s. Tredegar hematites were 70s., which was about the price for nearly all the steel as well as the best iron-making hematites offered.

Coal was in more active demand, as well for smelting and general manufacturing as for household qualities. The supply has been sensibly curtailed by the heavy rain and snow of Tuesday, which have stopped several pits. By the same cause the thin sheet and the tin-plate works of Messrs. E. P. and W. Baldwin, on the banks of the Stour, have been temporarily suspended. 11s. continues to be the maximum price of furnace coal. The more general price is 10s. High-class mill coal is 9s. down to 8s., and from 8s. to 7s. is the price mostly asked for good forge coal.

The annual election of ten mineowners and occupiers to serve as South Staffordshire Mines Drainage Commissioners has been fixed to take place at the Commissioners' Offices in Wolverhampton on November 8th.

The Mayor of Birmingham, Alderman Avery, has intimated his willingness to accept the office of president of the Mill and Forge Wages' Board, and the Board has been summoned for Monday next, in Wolverhampton, to consider the notice which the ironworkers have handed in for an advance.

The engineering trades of Birmingham and the district keep active, though as to bridge and roofing and similar constructive work, new contracts are not taking the place of those executed with the alacrity which could be desired. A considerable proportion of the work of this sort just now under execution is on account of home railway companies. Engineers have generally full work up to the end of the year. Amongst the foreign bridge work under negotiation are contracts on account of New Zealand and Africa.

The Indian work which has this week left the yards has included the completion of the contract which Messrs. Carter, Ford, and Co., Limited, of Darlaston, have had on their books for large iron domes.

The current quotations for iron roof work on trucks in this district is £12 per ton and upwards; and for iron rivetted girders the price is £12 10s. per ton onwards.

The Roumanian Government have given out a contract for the manufacture of a good quantity of cartridge machinery, and the work has fallen to Messrs. James Archdale and Co., of Birmingham, the producers of machinery for gun manufacture.

Messrs. Tangye, Limited, continue busy at their Soho works. Among their orders are light pumps to the order of the South Staffordshire Mines Drainage Commissioners. The pumps are to be used in connection with the scheme of that body for pumping surface-water at five different stations, so as to drain a portion of the eleven square miles of surface which have been swagged by mining below the natural outfalls, the water from which now finds its way into the mines. The Commissioners have arranged to enlarge one station, erected two new stations, and attach surface pumps to three of the large pumps erected for underground drainage, making six surface pumps to be put into operation at once. The quantity of water which will be raised is great, but the lift is so small that it will not involve much steam power, hence the pumps which have been ordered from Messrs. Tangye are only about 4 to 6-horse power each.

The Commissioners had many offers of pumps before placing the order, but there was some difficulty in the selection, inasmuch as the pumps needed were not for pumping under the pressure of water equal to the steam pressure, but for throwing large quantities to a little height. The pumps, therefore, have to be twice the area of the pistons.

Messrs. Tangye are also active on heavy pumps, and on engine and boilers, the orders being alike to home and colonial orders. The colonial business of this firm, indeed, is steadily increasing and their machine tools are also in larger request, not only from the colonies, but from continental Europe, particularly Spain; the United States is also a good buyer.

Large pumping and marine engines are finding full employmen for Messrs. Watt and Co.; on steam engines of easy size, together with mechanical stokers and pumps, Messrs. Piercy and Co., of the Broad-street Engine Works, are steadily occupied; in hydraulic and lifting machinery, a big business at date is being done by Messrs. William Causer and Co., of Soho; and refrigerating machinery, gasometers, boilers, &c., are keeping the Atlas Works and the Spring Hill Works of Messrs. Thomas Piggott and Co. active.

Birmingham will shortly start its first steam tramway. The new line which is now nearly completed will connect Birmingham with Aston, a suburb some four miles out of the town, and the proprietors are the Birmingham and Aston Tramway Company, Limited. The line will be part double and part single, and the gauge is 3ft. 6in. The rails are of "Barker's patent," in which the groove is very narrow, and interferes less with the general vehicular traffic than that of the old form of rail. They have been supplied by the Darlington Iron Company, and the iron sleepers upon which they are laid by the Patent Nut and Bolt Company, Smethwick. The engines which will be used are those of Messrs. Kitson and Co., of Leeds, in which the machinery is entirely hidden from view. When loaded the engines weigh seven tons each. The rate of speed will not be allowed to exceed eight miles an hour.

Next Tuesday the Birmingham Corporation are to consider an exhaustive report which has been presented to them by their Gas Committee upon the subject of the electric light. In a word, the committee recommend to the Council that no application shall be made by them to the Board of Trade for the supply of electricity for lighting purposes, but that subject to satisfactory conditions being appointed, the Council should support applications by one or more of the electric lighting companies for power to supply one or more limited areas of the borough.

The General Purposes Committee of the Wolverhampton Corporation, on the contrary, recommend their Council to apply for the Provisional Order to supply the town if they deem well, in order to prevent a monopoly. This recommendation will be considered by the Wolverhampton Town Council also on Tuesday.

The coroner's inquiry on Monday into the boiler explosion of October 9th, at the Stephenson Tube Works, Birmingham, of Mr. Wm. E. Everitt, resulted in a verdict of manslaughter against Mr. Henry Mosedale, who for eighteen years had been Mr. Everitt's chief engineer. Mr. Everitt himself was also censured by the jury. Three men, including the engine-driver, lost their lives by the explosion. The evidence showed that the boiler was an old one, and that last July it was pronounced to be unsafe by Messrs. Piggott and Co., engineers, of Birmingham, and also by an inspector of the Manchester Boiler Insurance and Steam Power Company. A new boiler was ordered, but owing to some delay in the acceptance of the contract it had not been delivered up to the time of the explosion.

A fortnight before the accident the boiler was found to be leaking, and sharps were put into the water, after which it was allowed to go on working. Mr. H. G. T. Piercy, of the Broad-street Engine Works, Birmingham, who had made an examination on behalf of the coroner since the explosion, deposed that the plates on each side of the flue were greatly corroded, and that though they were originally $\frac{3}{8}$in. thick, they had near the edges of the rent worn to the thinness of an old sixpence. Mr. Mosedale urges that he had relied upon the judgment of the deceased engine-driver. On Tuesday Mr. Mosedale was committed to the Warwick assizes by the Birmingham stipendiary.

The "dollied" section of East Worcestershire chain-makers gave a fortnight's notice on Saturday for an advance of wages. Should they be successful in obtaining this increase, the other section of chain-makers will, it is believed, immediately take action to also secure an advance.

Circulars have this week been received by employers in the brass trade of Birmingham and district from the National Society of Amalgamated Brassworkers requesting an advance in wages for casting work, and submitting a new list of prices, involving considerable increases in chandelier, common gas, and general cock work.

The failure is announced of Messrs. Jones, ironmasters, of the Buffery Ironworks, Dudley; the Eagle Ironworks, Westbromwich; the Green-lane Furnaces, Walsall; the Buffery Colliery and Brickworks, Dudley; and the Bullfield Cokeworks, Rowley Regis, with liabilities estimated at £76,000. The greater portion is secured, and the assets, without including securities held by creditors, are estimated at £10,000.

The Hamstead Colliery Company, Limited, has just struck thick coal in its second shaft at a depth of 611 yards. It is of good quality, and is of the uniform thickness of 24ft. The preparatory gate roading has been driven from No. 1 shaft to within a short distance of the western boundary, about 800 yards from the shaft; and north of the shaft a pair of roads, 956 yards in length, have been made.

A representative conference of miners at Horseley Heath have made arrangements for a general conference to be held in November, and have promised also to help the Salop and Cannock miners in their efforts to secure an advance. A mass meeting of colliers, held to receive the report of this representative conference, passed a resolution against the evils of over-production, and urged the establishment of a union of all the men in South Staffordshire and East Worcestershire.

In accordance with our intimation of last week, the Local Board of Wednesbury have this week formally approved of the formation of a united drainage union for the towns of Wednesbury, Tipton, Darlaston, and a portion of Sedgley; and a special drainage committee of the Board has been appointed to meet the representatives from the other districts affected.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—In the iron trade of this district the course of business for some time past has been to come and go in fits and starts, and just at present the market has been pushed up by a rush of heavy buying, which has left makers, on the one hand, full of orders for the remainder of the year, and consumers, on the other hand, pretty well covered for a similar period. Prices, of course, have advanced, but the bulk of the actual business has been done at the old rates, and now that consumers are mostly well bought, there are very few orders offering at the increased prices. Makers, having as a rule three months' orders on hand, are not anxious to sell, but the outlook for the future would not seem to warrant a too strict adherence to full prices where business is wanted. It can scarcely be said that the top prices recently quoted are being firmly adhered to, and where makers have to come into the market they find that concessions are necessary to secure orders.

There was only a quiet market at Manchester on Tuesday, and during the week business generally has been dull; the limited transactions which have taken place have not been much test of prices, but the tendency has been to give way slightly. Lancashire makers of pig iron since their advance in prices have been doing very little, and they would now be open to book orders on the basis of about 50s. per ton, less $2\frac{1}{2}$ delivered equal to Manchester. For Lincolnshire iron the average price is 50s. to 51s. less $2\frac{1}{2}$, but for some of the Derbyshire brands 1s. to 2s. per ton above these figures is still being asked; in north country and Scotch iron there has been comparatively little or nothing doing, and for these brands prices are regulated by the Middlesbrough and Glasgow markets.

Finished iron makers are all very full of work, but there is still low selling in the market not only amongst merchants who are willing to come in at under the recent advance, but amongst manufacturers here and there. Prices consequently are very irregular. Some makers are asking £6 12s. 6d. up to £7 per ton for bars, whilst others are not quoting more than £6 10s., but for good local brands the average price at which business can be done is about £6 15s. delivered into the Manchester district. Hoops average £7 5s.; local made sheets, £8 12s. 6d. to £8 15s.; and good Staffordshire qualities about £9 per ton.

Founders generally appear to be fairly well engaged, but some of the local firms report a falling of in the quantity of work giving out.

There is no appreciable alteration to report in the condition of the engineering trades. Most branches continue actively employed, the only point to notice being that the new work in prospect is not so large in quantity. The slackening off in the iron shipbuilding trade, due to the fact that shipowners are not disposed to give out further contracts on the basis of present quotations, will, of course, have an effect upon other allied branches of industry.

The large locomotive building firms in this district continue very busy, both on home and foreign work, and I heard a report on 'Change that Messrs. Beyer and Peacock have orders in hand which will keep them fully going for several years to come. The firm have, I understand, recently received large orders from several English railway companies, and have in hand the construction of upwards of 100 engines for the Midland and the Lancashire and Yorkshire Companies. Other locomotive builders in the district are also full of work, including orders for the Continent, India, and South America.

As Warrington is, next to Manchester, the most important manufacturing centre directly affected by the proposed ship canal, a few particulars respecting the iron and engineering trades carried on in the district, which I gathered this week during a visit to some of the principal establishments, will be of interest. The importance of Warrington as an iron centre may be estimated from the fact that it contains finished ironworks which are second to none in the kingdom, the Dallam and Bewsey forges, owned by the Pearson and Knowles Iron and Coal Company, Limited, turning out a larger production of manufactured iron, apart from the rolling of rails, than any other similar works in the country. These forges occupy an area of about 24 acres, and give employment to about 2000 hands. Looking over one week's returns, I found that 1712 tons of finished iron were turned out from eighteen mills, sixty tons of castings from the foundries, with thirty sets of wheels and axles, besides a large quantity of bridge girders and general engineering work, and the total production of finished ironwork for one year was 82,000 tons. The works are laid out chiefly for finished iron work purely, a large proportion of the puddled bars being supplied from the furnaces at Wigan, and bars, hoops, sheets, and wire constitute the staple class of goods produced. I can only indicate very briefly the character of the works. At Bewsey there are three forges with forty puddling furnaces, three 19in. roll trains driven by three engines with 22in. cylinders, 3ft. 6in. stroke; three shingling hammers, two of three tons single-acting and one of three tons double-acting; one scrapping forge with four furnaces; 21in. roll train, 25in. cylinder engine with 3ft. 6in. stroke, and one four ton double-acting hammer; three hoop mills with six furnaces, and three pairs of coupled engines of from 18in. up to 24in. cylinders; four sheet mills with nine heating furnaces, four 30in. cylinder engines with 5ft. stroke, and having fly-wheels averaging the exceptionally heavy weight of sixty tons; one wire mill with two of Siemens' gas furnaces, a pair of 36in. cylinder engines with 3ft. 6in. stroke, and a 9in. roll train. The steam power throughout these works is raised by forty-four boilers, the whole of which, except five hand fired in the wire mill, are kept going by the waste heat from the furnaces. At the Dallam Works, where the plant includes twenty-eight boilers, there are two forges with thirty furnaces, two three ton hammers, two 17in. roll trains, two engines of 22in. and 25in. cylinders, four merchant mills with roll trains of from 8in. up to 14in., worked by eight furnaces, and driven by engines with cylinders ranging from 20in. up to 30in. diameter, with 2ft. 6in. stroke; a plate mill, with two furnaces, 21in. roll train, one 30in. cylinder engine, with 5ft. stroke, and fly-wheel weighing 60 tons; an axle forge, with one furnace and a helve or tilt hammer; a foundry, with three cupolas and 20 ton overhead crane; smithy, with sixteen hearths, brass foundry, fitting shop, pattern shop, and a large boiler shop. At the Dallam Forge engineering work, as well as the production of finished iron, is an important feature, and in bridge and tank construction the firm have turned out a large quantity of important work for which special plant is laid down, but this I have not space at present to notice in detail. Another important iron works in the district is that owned by Messrs. Monks, Hall, and Co., Limited, which from a comparatively small beginning in 1874 have enlarged gradually, and at the present time are being considerably extended with the view of rolling steel rods and hoops, whilst new fitting and engineers' shops are also being added. At present the works are laid out for producing 350 to 400 tons of finished iron per week, consisting of bars, hoops, and wire rods of the ordinary run of sizes. The plant consists of twenty-six puddling furnaces in two complete forges ranged in horseshoe form, three mills, a 9in. merchant mill, 8in. hoop mill, and a wire rod mill. Steam power is obtained from twenty-one boilers, in nineteen of which it is generated by the waste heat from the furnaces, the remaining two being hand-fired for occasional use. Amongst the plant I noticed a couple of the Gidlow rocking furnaces, which I understand have been found to work satisfactorily, and I may add, as a point which will probably interest other manufacturers, that Messrs. Monks and Hall, after an experience of driving by direct gearing, which was the constant cause of breakdowns, have now introduced almost throughout their works driving by cotton belts, a change which, I was informed, had been in every sense satisfactory. The works are admirably laid out for the quick despatch of work. Within twenty-four hours of an order being received, I was informed, the firm have been able to roll the iron and deliver it on board vessel at Liverpool; and with the extensions now in progress, which will increase the number of puddling furnaces to thirty-four, the output of the works will be increased to about 500 tons per week. Warrington is also a great centre of the wire-making trade, and the various works in the district turn out about 1000 tons per week. Amongst the principal firms may be mentioned the Whitecross Company, with works capable of turning out from 500 to 600 tons of wire rods per week; Messrs. Rylands Bros., the Hayebridge Company, Messrs. Wm. Smith and Sons, the Warrington Wire Rope Company, and W. D. Horton and Co. There are also considerable engineering works in the neighbourhood, including Messrs. Thewliss and Co., Galway and Bambridge, Stubbs and Co., Melvin and Whittle, Newell and Barker, R. Kitchen, and Smethurst. It will thus be seen that Warrington forms an important manufacturing centre on the line of the proposed improved navigation, and the scheme, which would no doubt give a great impetus to the local industries, is being warmly taken up in the district. It is even suggested that Warrington should form the port for Manchester, and be connected by a plate tramway for the transit of goods.

The threatened strike in the coal trade of this district, as I anticipated, has been averted by a compromise on the part of the masters. A general advance of 10 per cent. in wages is being offered to the men, and this, no doubt, will be accepted. So far as business is concerned, all classes of coal are in good demand, and still scarce, slack being the only description of fuel which at all hangs on the market. The advance in wages is being accompanied by an upward movement in prices of from 6d. to 1s. per ton, but the market for the present is in a state of transition which scarcely allows of any definite quotations being given.

Barrow.—In the hematite pig iron trade there is great firmness of tone, and the business done is of considerable extent. Makers are kept very busy, and the output of the works goes into immediate consumption by rail or sea. There are but a few furnaces out of blast, and there has been an augmentation in the number of those producing iron. There is little change in prices, No. 1 Bessemer being 59s. per ton net, and No. 3 forge 57s., but in some cases higher values are asked, owing to the large number of orders in hand, which will provide work for some time to come without any additional orders coming in. The stocks are small, and are likely to remain so on account of the heavy deliveries which are being made, both on home and foreign account. Steel makers are very active, and have just received new orders of importance. Prices firm. New orders are being booked by the iron shipbuilders, and inquiries about new work are numerous. There is a good demand for iron ore at improved prices, 14s. per ton being about the average. There is a good employment in the coal and coke trades, and shipping is moderately active.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

A CRITICAL stage has been reached in the coal dispute. The South Yorkshire coalowners have met and reiterated their assertions that the price of coal has not risen so as to justify the demands of the men for an advance of wages, but with the object of avoiding a strike in the district, they are willing to concede at once 5 per cent., this advance to continue in force till Christmas next; at that time the masters propose that the average selling price for the preceding three months shall be taken out and compared with any period of six months during the last two years that may be selected by the men, and such 5 per cent. already conceded shall be continued if an advance of 8d. per ton is shown over the basis price, and if the price be more or less than 8d. a ton, the wages to be advanced or reduced accordingly. The 5 per cent. is to be paid on the first pay day in November.

This resolution is practically a repetition of what the coalowners offered at the beginning of the agitation, with the important addition of 5 per cent. advance to be immediately conceded. Coalowners tell me that this is their ultimatum, and if the men are so ill-advised as to reject it there will be no alternative but to close their pits. The chairman of one of the largest colliery firms in South Yorkshire—as well as of a large iron and steel concern—stated at the meeting that after searching the books of his company very carefully, he found the total advance in the value of coal to be 1½d. per ton. This rise in value, of course, would not warrant the giving of a 5 per cent. increase; and the offer, coupled with the sliding scale—an advance of 2½ per cent. on every 4d. per ton increase in the selling price of coal—is clearly made as an earnest endeavour to prevent a strike, with all its attendant misery and loss.

I am doubtful if the miners, or rather the miners' delegates who lead them, will accept it. These leaders are committed by their utterances on public occasions, and the employers themselves have found matters complicated by the action of the coalowners in other districts, notably in Derbyshire and Lancashire. The Derbyshire firms were the first to give way, offering advances varying from 5 to 12½ per cent. Then West Lancashire and South-west Lancashire followed this week with 10 per cent. It is not true, however, that 10 per cent. has been offered in West Yorkshire. A meeting is called for the 27th at Leeds, when the question will be considered. All these concessions 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. At present 24,768 colliers in West and South Yorkshire have handed in notices demanding 15 per cent. advance.

From the Italian Admiralty a contract for 900 tons of iron deck-plates for the Lepanto, sister ship to the Italia, is expected this week. It will be divided equally between the Atlas and the Cyclops Works. The leading armour for this vessel will not be settled for some time. Italy is in the market for 4000 tons more —thin—steel ship-plates, angles, &c.

The Sheffield Corporation have appointed a committee to solicit an interview with Mr. Joseph Chamberlain, M.P., the President of the Board of Trade, in reference to the effect of the Electric Lighting Act, and the rules that have been issued in regard to applications for licences and provisional orders. Mr. Conrad Cooke, electrical engineer, has been retained to advise the committee on the best means of carrying out the resolutions of the council as to electric lighting.

For the Albion Steel and Wire Works, as a whole, no bid could be obtained, but very fair prices were got the other day for the fixed and loose machinery, working plant, tools, and materials. But a horizontal high-pressure steam engine, with 24in. cylinder, fetched £92; a pair ditto 21in. and 24in. cylinders, £140; roll turning lathe, £71; a pair of shears, £52; two sets of wire-drawing blocks, £100 each; 40 cwt. steam hammer, £27 10s.; and five boilers, only £9 each. For Brinsworth Ironworks, Rotherham, on Tuesday, the auctioneers failed to obtain a bid.

Sheffield cutlery manufacturers and dealers in hafting materials failed to obtain much ivory at the Liverpool sales last week. The quantity was the smallest ever offered, and prices were £2 and £4 higher for small and large teeth respectively.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE Cleveland iron market, held at Middlesbrough on Tuesday last, was well attended, and business was slightly more active than it had been during the previous week. The prices which have ruled steadily for a month past were fully maintained. There was a certain amount of inquiry for delivery over the first quarter of next year, and some business was done by makers outside the combination at 44s. 6d. per ton for No. 3 g.m.b. The leading smelters will not at present entertain offers for next year's delivery, and will not accept less than 45s. per ton for delivery during the remainder of the present year. Merchants will take 44s. 6d. to 44s. 9d. for No. 3, but neither they nor makers have much to sell for prompt delivery.

Warrants are still in poor request, and buyers will not give more for them than they offered last week, viz., 44s. 3d. per ton for Connal's No. 3 f.o.b. warrants.

The stock of Cleveland iron in Messrs. Connal's store on Monday night was 103,896 tons, being a decrease of 722 tons for the week.

The shipments coastwise and on foreign account continue good, and it is now probable that the amount exported during the month will exceed 100,000 tons, as they also did last month. Up to Monday night the quantity shipped from the Tees was close upon 76,000 tons.

The finished iron trade is still very quiet. What business is being transacted, however, is at somewhat higher prices. Bars have been advanced 5s. per ton, and are now £6 5s. per ton. Ship plates are £6 15s. to £7, and angles for shipbuilding are £6—all f.o.t. at makers' works, less 2½ per cent.

The dulness in the steel rail trade still continues. The prices quoted for heavy sections is £5 2s. 6d. to £5 5s. per ton.

The activity in the shipbuilding trade continues on the Tees, Wear, and Tyne. On the latter river there are at the present time upwards of fifty vessels being built between Scotswood and Shields. The yards are all fully occupied on the other rivers named.

The Council of the Northern Institute of Mining Engineers have accepted the invitation of Sir Edward Watkin to inspect the works of the Channel Tunnel at Dover, and have fixed Saturday, November the 18th, for their visit.

A meeting of the North of England Board of Arbitration and Conciliation was held at Darlington on Monday last, for the purpose of receiving Mr. Waterhouse's report as to the sales for the past quarter, and for discussing the steps to be taken with regard to the wages question. Mr. Waterhouse's ascertainment shows that the total quantity of iron of all classes sold during the three months ending September 30th was 159,855 tons. Of this 917 tons were rails; 113,215 tons plates; 14,326 tons bars; and 31,397 tons angles. The average net selling price was £6 8s. 6d. per ton. Excluding rails, the average price was £6 8s. 7d. per ton. This return shows an improvement on the previous quarter of 1s. 6d. on all classes of iron, and 1s. 7d. on bars, angles, and plates. After some discussion it was found that both employers and employed still held to their claims, the former for a reduction and the latter for an advance, and it was unanimously agreed to let the whole matter go before an arbitrator. The question as to who was to be asked to act in that capacity was then brought up, and it was found that the operative delegates had unanimously agreed to propose Sir J. W. Pease. The employers, after consulting together for a short time, decided to accept the arbitrator chosen by the men. After some further discussion, the following resolution was carried, viz.:—"That in view of the improbability of the arbitrator's decision being published by the termination of the present wages agreement on the 28th inst., the present rate of wages shall continue to be paid until such time as the award shall be given, and that the arbitrator shall have power to fix the date when any change he may make in wages shall take effect, provided that the date be not earlier than the 28th inst." Nothing definite was decided with regard to the period over which the arbitrator's award should extend, but it was understood that the operatives were to consider the matter, and be prepared to make a suggestion when they go before the arbitrator. The question of the re-establishment of a sliding scale is postponed until after the award shall have been given.

At a Council meeting of the Cleveland Institute of Engineers held on Tuesday last Mr. E. F. Jones, of the firm of Jones, Dunning, and Co., ironmasters, Middlesbrough, was elected president for the ensuing two years. Mr. Jones is one of the oldest members of the Institute, and has been always a constant attender at its meetings. He has given great attention latterly to the important question of breaking up of blast furnace slag and sending it out to sea at minimum cost. It is not unlikely that in his presidential address he will give the result of his experience in this direction. The old members of Council were mostly re-elected, together with Mr. Arthur Cooper, general manager of the North-Eastern Steel Company, and Mr. W. Hawden, engineer to Messrs. B. Samuelson and Co. Mr. John Fowler, engineer to the Tees Conservancy Commission, was elected a vice-president. The programme for the ensuing session is a very attractive one, and includes a paper on the Channel tunnel, by Major Beaumont. The Cleveland engineers are taking a strong interest in this matter, and will no doubt give forcible expression to their views when the opportunity is afforded.

A meeting was held at the Literary and Philosophical Hall, Middlesbrough, on Monday evening, to consider a proposal that a technical school should be commenced in the town. Messrs. B. Samuelson, M.P., Isaac Wilson, M.P., Professor Stuart, of Cambridge, and other well-known promoters of scientific education, were present, and took part in the proceedings. A resolution was eventually passed to the effect that, "the time had now arrived when Middlesbrough must have a technical school," and measures will no doubt be at once taken to give effect to this decision.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

THE pig iron trade continues very active, a large business being done both on home and foreign account. In warrants, however, there is a tendency to decline, owing to speculative causes. The shipping trade is very well maintained, and there are good orders coming to hand to be implemented in succeeding weeks. Since last report an additional furnace has been lighted at the Eglinton Ironworks, so that there are now 114 in blast, as compared with 105 at this date last year. Stocks have decreased during the week about 1300 tons in Connal's stores, and a further decrease is contemplated, the production, although it has been considerably increased, being yet insufficient, as is generally believed, to meet current wants.

Business was done in the warrant market on Friday forenoon at from 50s. 8½d. to 50s. 10½d. cash, and 51s. one month, the afternoon quotations being 50s. 9d. to 50s. 8d., and again 50s. 9d. cash, and 51s. to 50s. 11d. and 51s. one month. On Monday, the market was dull, with business in the forenoon at 50s. 8d. to 50s. 6d. cash, and 50s. 10d. one month, the afternoon's figures being 50s. 6d. to 50s. 4½d. cash, and 50s. 9½d. to 50s. 8d. one month. Business on Tuesday was at 50s. 6d. to 50s. 4d. and 50s. 5d. cash, and 50s. 8½d. to 50s. 7½d. one month. On Wednesday transactions were effected in the warrant market between 50s. 7d. and 50s. 11d. cash, and 50s. 11d. to 51s. 1½d. one month. To-day—Thursday—being a Church holiday the iron market was closed.

The demand for makers' iron being strong, the quotations are well maintained as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 65s. 6d.; No. 3, 55s.; Coltness, 69s. 6d. and 56s.; Langloan, 68s. and 56s. 6d.; Summerlee, 65s. and 54s. 9d.; Calder, 64s. 6d. and 54s.; Carnbroe, 59s. and 52s. 6d.; Clyde, 55s. and 52s. 6d.; Monkland, 52s. 6d. and 50s. 3d.; Quarter and Govan, each 52s. and 50s.; Shotts, at Leith, 66s. and 56s. 6d.; Carron, at Grangemouth, 53s. (specially selected, 57s. 6d.) and 52s.; Kinneil, at Bo'ness, 51s. and 49s. 6d.; Glengarnock, at Ardrossan, 58s. 6d. and 52s.; Eglinton, 53s. and 51s.; Dalmellington, 58s. and 51s. 6d.

The arrival of Middlesbrough pigs at Grangemouth for the week have been 3485 tons as compared with 6180 in the preceding week, and 3930 in the corresponding week of last year.

The malleable iron and steel trades continue busy, with perhaps not quite so many orders offering as has been usual of late. Common iron bars are quoted at £6 7s. 6d. per ton; best bars, £6 17s. 6d.; ship-plates, £7 10s.; boiler-plates, £7 15s.; angles, £6 5s. Steel ship angles, £9 per ton; ship-plates, £10; and boiler-plates, £11 5s. The general engineering trade is very brisk, a large supply of foreign orders being at present in course of execution, as well as a good business on home account. In the course of the past two weeks the iron and steel manufactures, other than pig iron, despatched from Glasgow alone, were valued at £120,000. They included large quantities of sugar making machinery, of railway locomotives, sleepers, &c., and a great variety of general hardware articles.

In the coal trade there is a very good business being done at the following f.o.b. quotations:—Main, 6s. 9d. to 7s. 3d.; ell, 7s. 3d. to 8s. 3d.; splint, 7s. 3d. to 8s.; steam, 7s. 6d. to 8s. 6d. These prices apply to the West of Scotland. In Fifeshire the f.o.b. quotations are given at an average of 6s. 9d. per ton in some quarters, but I have reason to believe that they are considerably higher. The miners have not been working quite so regularly as usual in the western districts, and this, together with a scarcity of railway wagons, has considerably interfered with shipments, which, however, are still on a large scale.

The wages question in the mining trade appears to be gradually approaching a settlement, and there now seems good ground for hoping that strikes will be averted. The demand of the miners in the different districts has been for an addition of 15 per cent. to their present wages. In the counties of Fife and Clackmannan the employers have conceded a rise of 10 per cent., and the probability is that in a short time a similar concession will be made all over the country.

The strike of ships' joiners in the Clyde shipbuilding trade has now existed for about ten weeks, both the masters and workmen showing much determination to carry their points. What the men want is an advance of a halfpenny per hour, making their pay 7½d. A few days ago some friends of the men approached Sir Donald Currie, M.P., at Perth, and requested him to interfere with the view of effecting a settlement. He expressed his readiness to place whatever influence he had at the disposal of both parties. It is greatly to be hoped that the difficulty may be speedily arranged, as it must impede the finishing of new vessels, and entail considerable hardships upon a large class of men. Of course the employers can hardly be held responsible for this, seeing that the operatives left their employment of their own accord.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

The steel works are all busy, and several of the larger ones hold substantial orders that will take them until March to execute. I am told that there is a slight falling off lately in the receipt of fresh business, so that some degree of doubt exists as to what may happen after March. At present we are safe for plenty of work, and prices are stiff, and looking up. It is possibly owing to an increased stiffness in price that new orders are slow in coming in. This a little time will prove, or otherwise. Cargoes left this week for Canada, America, and India, and a good deal of home trade is being done, as well as with the Colonies and foreign markets.

Tin-plate is flagging again, and so far I have not heard that the decision of the Birmingham meeting to advance 1s. a box has been carried. This may be owing in part to a lack of union amongst makers, but principally to a slackness in requirement.

There has been a good deal of work at the new steel works at Tredegar this week, and it is said that extra hands will shortly be required in the mills. Good iron orders are also coming in at these works.

Three furnaces on the newest principle are now well advanced at Cyfarthfa, and operations are beginning for further changes.

The management at the new steel works, Landore, have offered to take charge of the hammers by contract, and this appears to have had a salutary effect on the men who are still remaining out on strike. The manager had previously offered these men a fair advance, on what appears a reasonably adjusted scale, and now refuses to deviate from this offer, so a settlement may be regarded as certain.

The "Earl Spencer Steamship Company" has been launched; capital £23,000, in £235 shares. The subscribers are all leading Cardiff shippers.

A movement has been started by the Taff Vale Railway workmen to obtain a reduction in their hours of labour, and this has been favourably received by the chairman of directors. It is certain that in cases where proved hardship exists that some concession will be made.

All the Welsh railways and industries generally are looking up. This satisfactory state of things is owing to the prosperous condition of the coal trade. In one branch only of the trade has there been any flagging during the week, and that is in anthracite, which is generally dull about this time of the year. Extreme briskness has characterised the ports of Cardiff, Swansea, and Newport, and the total exports have amounted to 214,753 tons. This, in addition to a very heavy transport over railways, shows the healthy vitality at present existing in the coal trade of Wales. Coalowners are watching the action of the Northern coalowners, and quite prepared to utilise the advantages. Merthyr Vale with its double shaft, Harris Navigation and others will soon increase their outputs.

I saw a fine train of coal this week from Penrhiwceiber, Mountain Ash. This is proving a magnificent taking.

In proof of the prosperity at present existing amongst Cardiff coalowners and shipowners, I am told of one, from excellent authority, who is now realising £50,000 per annum. He has command of fine coals, has agents in all parts of the world, and, in fact, commands the situation.

The movement for buying up the Bute Docks and forming a Cardiff Harbour Trust has received a check. It has been intimated by the Marquess of Bute that he cannot enter into the negotiations proposed by the Mayor and Corporation of Cardiff, but it would seem from the tenour of his letter that if a thoroughly well-grounded scheme were formulated the creation of the Harbour Trust would not be impossible. As it is, it must, in the course of things, be some years before the movers can see their dreams realised. The Bute Docks are already worth several millions sterling, and have not reached either their full development or highest remunerative capacity. There have been many old abuses to sweep away, vested privileges to be put aside, and "system" to come into earnest operation. It is not often that one sees a going and prosperous concern looking for a buyer.

Pit timber is steadily advancing. Latterly the demand has been very great, and imports small.

Patent fuel is doing well. Last week the export from Swansea was considerable.

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.

17th October, 1882.

4928. Dynamo-electric Machine, A. Elliott, London.
4929. Friction Clutches, D. Frisbie, New Haven, U.S.
4930. Electric Arc Lamp, C. S. Snell, Saltash.
4931. Electric Motors, A. G. de Neeff and E. Desfossés, Paris.
4932. Clogs, &c., D. Pickles, Halifax.
4933. Buckles, F. J. Candy, Highfield Fen Ditton.
4934. Trusses, H. Haddan.—(*L. Barrère, Sauternes.*)
4935. Paper Pulp, H. Dufrené.—(*H. da C. Leite, Paris.*)
4936. Water Connections, P. M. Justice.—(*C. Lightbody, Brooklyn, U.S.*)
4937. Clipping Horses, &c., W. Greenwood, Honley.
4938. Printing, J. F. Haskins, London.
4939. Sewing Machines, W. P. Thompson.—(*Morley Sewing Machine Company, Boston, U.S.*)
4940. Millstone Balance, A. J. Boult.—(*J. C. E. Theirrion, Passy Grigny, France.*)
4941. Wick-trimmers, A. J. Boult.—(*W. C. Seaton, Quebec, Canada.*)
4942. Stays, W. G. W. Reynolds, Leicester.
4943. Writing Slates, J. and W. Williams, Llanfair.
4944. Treating Wood, J. H. Johnson.—(*J. Evans, Copenhagen.*)
4945. Blasting Coals, M. Settle, Bolton.

18th October, 1882.

4946. Furnaces, &c., J. C. Brentnall, Timperley.
4947. Casting Pig Metal, J. T. King.—(*G. A. Leishman, Pittsburg, U.S.*)
4948. Motive Power Engines, D. Clerk, Glasgow.
4949. Fluids for Washing Sheep, B. Nickels, London.
4950. Postal Wrapper, A. Savage, London.
4951. Registering Apparatus for Closet Doors, J. M. Hart, London.
4952. Pulley Blocks, C. J. Gullyes, Roath.
4953. Tenter Hooks, A. E. Gorse, Birmingham.
4954. Utilising Balloons for Photography, &c., J. Templer.—(*H. Elsdale, Halifax, Nova Scotia.*)
4955. Means for the Prevention of Watch Snatching, M. Stuart, Seaforth.
4956. Steam Boilers, G. G. M. Hardingham, London.
4957. Road Vehicles, J. Macdonald, Wimbledon.
4958. Adjustable Coverings for Locks, H. Fleming, Halifax, Yorkshire.
4959. Combing Machinery, P. Kelly, Bradford.
4960. Tricycles, A. H. Alldridge, Birmingham.
4961. Oil Cans, J. Kaye, Kirkstall.
4962. Cocks or Valves, J. N. Sperrin, London.
4963. Grinding Mills, H. J. Haddan.—(*E. Schmeja, Biala-Bielitz, Austria-Hungary.*)
4964. Beverages, A. Hogg & M. Gingell, High Ongar.
4965. Looms, H. J. Haddan.—(*H. Vassart, Roubaix.*)
4966. Wheels for Traction Engines, &c., J. and H. McLaren and C. Morris, Leeds.
4967. Illuminating Composition, J. Darling, Glasgow.
4968. Razor Blades, W. R. Lake.—(*J. D. Frary, Bridgeport, U.S.*)
4969. Inverted Direct-acting Marine Engines, W. Allan, Sunderland.
4970. Sheep-wash, W. G. Little, Sleaford.
4971. Electric Alarm, M. H. Kerner, London.

19th October, 1882.

4972. Brakes, E. C. and T. Blackmore, Cardiff.
4973. Paper-cutting Machines, W. Crosland, Newton Heath, Lancaster.
4974. Apparatus for Reducing Iron Ore, W. E. Gedge.—(*L. Durand and D. Waller, New York, U.S.*)
4975. Construction of Stringed Musical Instruments, F. C. Glaser.—(*F. Steinbrecher, Kirn an der Nahe, Germany.*)
4976. Ships' Compasses, R. E. Melsheimer, London.
4977. Bungs and Vent-pegs, W. Rose, Halesowen.
4978. Feed Pumps of Steam Engines, A. W. Robertson, West Ham.
4979. Machinery for Preparing Flax, &c., C. and C. Murland, and J. Montgomery, Castle Wellan.
4980. Cooking Ranges, H. McRuer, Glasgow.
4981. Governing, &c., the Flow of Fluids, W. Key, Glasgow.
4982. Gas-heated Furnaces, C. Madge, Swansea.
4983. Lamp Glasses, &c., H. J. Haddan.—(*Stelzig, Kittel and Company, Steinschönau, Austria-Hungary.*)
4984. Chloride of Lime, G. W. von Nawrocki.—(*C. Opl, Kruschau, Austria-Hungary.*)
4985. Actuating Sewing Machines, J. Templeton and J. Hilson, London.
4986. Making Iron, C. Cochrane, Stourbridge.
4987. Obtaining Salts from Mineral Waters, A. J. Boult.—(*E. Kuhn, Clermont Ferrant, France.*)
4988. Electric Arc Lamps, A. Serraillier, London.
4989. Lamps for Bicycles, &c., J. Slater, Birmingham.
4990. Moulds for Casting Hollow-ware, J. V. Hope, Wednesbury.
4991. Secondary Batteries, J. E. Liardet, Brockley, and T. Donnithorne, London.

20th October, 1882.

4992. Manufacture of Fatty Matter from Wool Fat, F. C. Glaser.—(*O. Braun and O. Liebreich, Berlin.*)
4993. Cocks, &c., J. Hayes.—(*E. Remy, Paris.*)
4994. Roving, &c., Fibrous Substances, H. Illingworth, Bradford.
4995. Warming Rooms, T. Kay, Stockport.
4996. Compound Armour-plates, T. D. Clare.—(*F. Yates Ukel-on-the-Rhine, Prussia.*)
4997. Coupling, &c., Carriages, J. Anderson and J. Darling, Glasgow.
4998. Generation, &c., of Artificial Light, A. W. Kershaw, Lancaster.
4999. Administration of Alimentary Fluids, L. A. V. Pellegrin, London.
5000. Apparatus for Making Confectionery, C. F. Müller, Magdeburg.
5001. Telephonic Instruments, G. Anders, London.
5002. Fittings for Incandescent Electric Lamps, M. Evans, Wemyss Bay, Renfrew.
5003. Producing Signals on Vehicles, A. S. Clerk and F. Dowling, London.
5004. Type-composing Machines, E. P. Alexander.—(*E. Saulé and M. Durozoi, Paris.*)
5005. Rope Tramways, H. Smith.—(*A. Hallidie, U.S.*

21st October, 1882.

5006. Application of Lids to Boxes, W. Staniforth, Sheffield.
5007. Looms, F. Sykes and J. Hinchliffe, Holmfirth.
5008. Filters, F. G. Lynde, Melton Mowbray.
5009. Destroying Solid Impurities, O. Imray.—(*La Société Harmel Frères, Val des Bois, Marne, France.*)
5010. Permanent Way, F. Nowell and A. K. Smith, Shepherd's Bush.
5011. Slide Valves, J. Dunbar, Southampton.
5012. Ploughs, E. Edwards.—(*P. Jacotot, Orgeux.*)
5013. Wheels, E. Hora, London.
5014. Regulating Electric Currents, L. Campbell, Glasgow.
5015. Electro-magnetic Engines, C. F. Varley, Bexley Heath.
5016. Magneto-electric Engines, C. F. Varley, Bexley Heath.
5017. Electro-magnetic Engines, C. F. Varley, Bexley Heath.
5018. Treating Small Coal, C. E. Hall, Sheffield.
5019. Iron, &c., Telegraph Poles, J. C. Johnson, Wednesbury, and R. Martin, West Bromwich.
5020. Mechanical Musical Instrument Motors, G. D. Garvie and G. Wood, New York, U.S.
5021. Compound for Mixing with Wines, J. Prosser, Upper Clapton.
5022. Harrows, A. Clarke, Stevenage.
5023. Carbons for Incandescent Electric Lamps, M. Bailey, London.
5024. Machinery for Shearing Ingots, B. Walker, Leeds.
5025. Separating Copper from Matt, &c., J. Plaisted, London.
5026. Tips for Boots, G. Chambers, London.
5027. Regulating Water Supply, G. Biddis, Newbury.
5028. Surgical Appliance, H. Parson, Guildford.

23rd October, 1882.

5029. Envelopes, R. B. Hayward, London.
5030. Manufacturing Anhydrous Alumina, H. A. Bonneville.—(*F. Gardair and T. Gladysz, Marseilles.*)
5031. Velocipedes, E. Brydges.—(*J. Ring, Vienna.*)
5032. Dry Distillation, J. Jameson, Newcastle-on-Tyne.
5033. Controlling Horses, J. C. Mewburn.—(*C. von Schwarz, Vienna.*)
5034. Product from Coffee-beans, H. J. Haddan.—(*E. Charnaux, Vichy, France.*)
5035. Lightning Conductors, H. J. Haddan.—(*J. Kernaul, Munich.*)
5036. Water Purifiers, G. F. Redfern.—(*D. Hanna, Ogdensburg. U.S.*)
5037. Governors, W. P. Thompson.—(*F. D. Cummer, Detroit, U.S.*)
5038. Permanent Way, J. Morrison and R. Armstrong, Dalkeith.
5039. Parallel Rulers, C. R. Baillie-Hamilton, Grove Park, Kent.
5040. Apparatus Employed in Treating Rags, P. P. Hepworth, Leeds.
5041. Sewage Trap, &c., E. Green, Halifax.
5042. Rotary Gas Engines, W. E. Gedge.—(*F. Marti and J. Quaglio, Paris.*)
5043. Braces, F. Hovenden, West Dulwich.
5044. Cleaning Fats, F. Glaser.—(*H. Schlinck, Baden.*)
5045. Brushes, J. Culmer, London.
5046. Carriage Bodies, J. S. G. F. Hörcher, Altona.
5047. Locomotive Engines, &c., M. P. W. Boulton, Tew Park, Oxford, and E. Perrett, London.
5048. Fastening Umbrellas, &c., H. H. Lake.—(*A. Iehl, Mazamet, France.*)
5049. Looms, T. Singleton, Over Darwen.
5050. Electric Lighting Apparatus, H. H. Lake.—(*S. F. V. Choate, New York, U.S.*)
5051. Registering Apparatus, W. H. Beck.—(*X. Portafax, Paris.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

4930. Electric Arc Lamps, C. S. Snell, Culver Park, Cornwall.—17*th October*, 1882.
4992. Manufacture of Fatty Matter from Wool Fat, F. C. Glaser, Berlin.—A communication from O. Braun and O. Liebreich, Berlin.—20*th October*, 1882.

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

4211. Counter Stays, &c. H. H. Lake, London.—17*th October*, 1879.
4259. Urinals, &c., G. Jennings, Stangate.—21*st October*, 1879.
4467. Purifying Corn, &c., F. Thompson and W. H. Williamson, Wakefield.—1*st November*, 1879.
5208. Charging, &c., Retorts, A. Q. Ross, Cincinnati, U.S.—20*th December*, 1879.
3765. Lid for Oil Cans, J. Kaye, Kirkstall.—19*th September*, 1879.
4205. Permanent Way, J. Kerr, London.—17*th October*, 1879.
4216. Steam Navvies, J. T. Parlour, London.—17*th October*, 1879.
4217. Lamps for Mining, W. E. Teale, Worsley.—17*th October*, 1879.
4429. Shawl Straps, H. J. Haddan, London.—30*th October*, 1879.
4487. Cotton Cords, J. H. Openshaw, Bury.—4*th November*, 1879.
4241. Steam Hoisting Machinery, T. Davison, Glasgow.—20*th October*, 1879.
4450. Apparatus for Classifying, &c., Papers, W. Morgan-Rrown, London.—31*st October*, 1879.
4458. Vehicles Propelled by Manual Power, W. J. Fraser, Haverstock Hill.—1*st November*, 1879.
4239. Sizing, &c., Healds, S. Cook, sen., and S. Cook, jun., Bury.—20*th October*, 1879.
4274. Grinding, &c., Caustic Alkalies, W. J. Menzies, St. Helens.—21*st October*, 1879.
4290. Making Gas, G. Smith, Shepherd's Bush.—22*nd October*, 1879.
4323. Printing Textile Fabrics, W. Mather, Salford.—23*rd October*, 1879.
4435. Coverings for Walls, &c., C. Smith, Muswell Hill.—30*th October*, 1879.
4273. Securing Tubes in Plates, W. Tully, London.—21*st October*, 1879.
4278. Doubling, &c., Yarns, J. and J. Horrocks, Manchester.—22*nd October*, 1879.
4311. Corset, &c., C. Rubens, Notting-hill.—23*rd October*, 1879.
4330. Nails, W. R. Lake, London.—23*rd October*, 1879.

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

3675. Applying India-rubber to Fabrics, J. Barrow, Clayton.—22*nd October*, 1875.
3620. Bridges, F. Barnett, London.—19*th October*, 1875.
3626. Safes, &c., S. Chatwood, Bolton.—19*th October*, 1875.
3702. Indicators for Steam Engines, E. T. Darke, London.—25*th October*, 1875.
3762. Autographic Printing, T. A. Edison, Newark, U.S.—29*th October*, 1875.
3679. Treating Hides, J. M. Jones, Wrexham.—23*rd October*, 1875.
3740. Sinking Pit Shafts, W. Galloway, Paisley.—28*th October*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 10th November, 1882.

2099. Combined Sofa or Chair with Bed, C. Klemetsen, Christiania, Norway.—4*th May*, 1882.
2716. Tram-cars, T. E. Knightley, London.—9*th June*, 1882.
2796. Buoyant Speed Wheel, W. Teague, jun., Tincroft, Redruth.—14*th June*, 1882.
2803. Dynamo-electric Machines, F. L. Willard, London.—14*th June*, 1882.
2805. Ornamenting, &c., Designs upon Tin-plates, A. N. Hopkins, T. Baker, and T. W. Burt, Birmingham.—14*th June*, 1882.
2828. Attaching Door, &c., Handles on their Spindles, E. H. Baxter, Birmingham.—15*th June*, 1882.
2830. Construction and Government of Electro-motors, &c., W. E. Ayrton and J. Perry, London.—15*th June*, 1882.
2832. Flap Valves, E. Edwards, London.—A communication from E. Roche.—15*th June*, 1882.
2833. Breech-loading Fire-arms, J. Robertson, London.—15*th June*, 1882.
2840. Measurement and Regulation of Velocity, H. S. H. Shaw, Bristol.—16*th June*, 1882.
2852. Weaving Sacks, &c., W., A., A., A., E., and J. Briggs, Whitworth, near Rochdale.—16*th June*, 1882.
2854. Vehicles for Conveying Injured Persons, J. U. Burt, London.—16*th June*, 1882.
2857. Meteorological Indicating and Air-testing Instruments, F. H. F. Engel, Hamburg.—A communication from W. Klinkerfues.—16*th June*, 1882.
2857. Injectors, A. H. Smith, Nottingham.—17*th June*, 1882.
2861. Storing, &c., Food, E. Edwards, London.—A communication from S. Schreiber.—17*th June*, 1882.
2867. Gas Regulators, &c., A. J. Boult, London.—A communication from P. Parsy.—17*th June*, 1882.
2868. Cutting, &c., Stone, J. Thomas, Bangor.—17*th June*, 1882.
2873. Producing Pressed Coke, &c., in Coke Furnaces, G. E. Vaughan, London.—A communication from F. Lürmann.—17*th June*, 1882.
2874. Umbrellas, &c., R. B. Avery, Manchester.—17*th June*, 1882.
2878. Dry Centre Valves, E. M. Simpson, London.—A communication from F. Weck.—17*th June*, 1882.
2893. Fitting Artificial Teeth, E. Reading, London.—A communication from Dr. H. Buttner.—19*th June*, 1882.
2895. Explosive Materials, W. R. Lake, London.—A communication from F. J. Petri.—19*th June*, 1882.
2908. Drying Apparatus, W. Combe, Glasgow.—20*th June*, 1882.
2912. Regulation of Electric Currents, S. H. Emmens, London.—20*th June*, 1882.
2913. Secondary Batteries, S. H. Emmens, London.—20*th June*, 1882.
2914. Electric Lamps, S. H. Emmens, London.—20*th June*, 1882.
2915. Hoisting Gear, W. J. Brewer, London.—20*th June*, 1882.
2932. Artificial Manure, H. J. Haddan, London.—A communication from T. Richters. 20*th June*, 1882.
2938. Actions of Pianofortes, J. Mallinson, Selby.—20*th June*, 1882.
2949. Cardboard Boxes, M. D. Wood, Stafford, and E. P. Smyth, London.—21*st June*, 1882.
2967. Shoe, &c., Fasteners, H. J. Haddan, London.—A communication from H. J. Dieler.—22*nd June*, 1882.
2993. Preventing and Removing Incrustation, &c., in Boilers, E. Field and W. L. Thompson, London.—24*th June*, 1882.
3007. Regulating Speed in Machinery Driven by Electricity, F. Jenkin, Edinburgh.—24*th June*, 1882.
3103. Bricks and Tiles, W. A. M. Valon, Ramsgate.—1*st July*, 1882.
3176. Insulating Compounds, M. Mackay, London.—5*th July*, 1882.
3570. Electric Arc-lamps, F. M. Newton, Barton Grange, near Taunton.—27*th July*, 1882.
3927. Rope Tramways, H. H. M. Smith, London.—Com. from A. S. Hallidie.—16*th August*, 1882.
4001. Rotary Engines and Pumps, A. W. L. Reddie, London.—A communication from N. Tverskoy and P. Weiner.—21*st August*, 1882.
4028. Filters, E. Perrett, London.—22*nd August*, 1882.
4176. Printing Machines, W. S. Hope, London.—1*st September*, 1882.
4355. Galvanic Batteries, O. C. D. Ross, London.—13*th September*, 1882.
4421. Telegraphic, &c., Apparatus, H. C. Brown and H. A. C. Saunders, London.—16*th September*, 1882.
4930. Electric Arc-lamp, C. S. Snell, Culver Park, Cornwall.—17*th October*, 1882.

Last day for filing opposition, 14th November, 1882.

2503. Leads for Pencils, G. Daubenspeck, London.—26*th May*, 1882.
2603. Valves or Cocks, J. Hitch, London.—2*nd June*, 1882.
2883. Automatic Lubricating Apparatus, E. A. Brydges, London.—A communication from F. Tovote.—19*th June*, 1882.
2894. Cloth, &c., T. Isherwood, Westerly, U.S.—19*th June*, 1882.
2901. Producing a Continuous Current of Air, &c., E. Edwards, London.—A communication from E. Uigreux.—19*th June*, 1882.
2902. Electric Meters, &c., J. T. Sprague, Birmingham.—19*th June*, 1882.
2906. Reel Appliances for Reaping Machines, T. Culpin, London.—20*th June*, 1882.
2916. Children's Cots, G. W. Moon, London.—20*th June*, 1882.
2920. Cleansing, &c., Skins from Potatoes, C. L. Hancock, Dudley.—20*th June*, 1882.
2926. Cooking Ranges and Stoves, A. K. Robinson, Leeds.—20*th June*, 1882.
2927. Raising Water, W. R. Lake, London.—Com. from F. A. Grunow and H. Meyer.—20*th June*, 1882.
2937. Umbrellas, J. Feldman, London.—20*th June*, 1882.
2943. Bier for Conveying Coffins, C. D. Goldie, St. Ives.—21*st June*, 1882.
2944. Carts, &c., W. March, London.—21*st June*, 1882.
2947. Bicycles, &c., J. S. Edge, jun., and F. W. Ticehurst, Birmingham.—21*st June*, 1882.
2954. Measuring Electric Currents, C. A. Carus-Wilson, London.—21*st June*, 1882.
2956. Separating, &c., Dust from Air, J. F. Stewart, London.—A communication from A. H. Kirke and W. J. Fender.—21*st June*, 1882.
2957. Impregnating, &c., Soft Wood, G. J. Cross, London.—21*st June*, 1882.
2958. Valves or Cocks, T. Penn, London.—21*st June*, 1882.
2964. Velocipedes, &c., W. Morgan-Brown, London.—A communication from F. White.—22*nd June*, 1882.
2977. Supplying Feed-water to Steam Boilers, E. de Pass, London.—A communication from La Société Volpp Schwarz et Compagnie.—23*rd June*, 1882.
2983. Trowels, A. Reaney, Sheffield.—23*rd June*, 1882.
3015. Edge Mills, B. J. B. Mills, London.—A communication from F. Wanneveich.—26*th June*, 1882.
3029. Glass Furnaces, E. de Pass, London.—A communication from H. Quennec.—27*th June*, 1882.
3038. Stable Fittings, D. McGill, London.—27*th June*, 1882.
3055. Cartridges, H. E. Newton, London.—A communication from La Société Anonyme Dynamite Nobel.—28*th June*, 1882.
3072. Hyposulphide of Soda, G. W. von Nawrocki, Berlin.—A communication from the Verein chemischer Fabriken.—29*th June*, 1882.
3125. Carbonate of Soda, C. Wigg, Liverpool.—3*rd July*, 1882.
3162. Dressing, &c., Ores, F. Wirth, Germany.—A communication from H. Hochstrate.—4*th July*, 1882.
3223. Filtering Water, J. H. Topham, Manchester.—7*th July*, 1882.
3229. Cisterns, &c., U. Bromley, G. Crowe, and W. James, Chester.—7*th July*, 1882.
3324. Gas Stoves, C. Portway, Halstead.—13*th July*, 1882.
3437. Cocks and Valves, D. R. Ashton, London.—19*th July*, 1882.
3458. Telephonic Apparatus, J. E. Chaster, Manchester.—20*th July*, 1882.
3588. Safety or Miners' Lamps, W. L. Wise, London.—A communication from La Compagnie Houillère de Bessèges.—28*th July*, 1882.
3602. Cleaning Wool, &c., O. Imray, London.—A communication from La Société Hamel Frères.—29*th July*, 1882.
3794. Lids of Fuel Economisers, E. Green, Wakefield.—9*th August*, 1882.
3877. Breech-loading Fire-arms, W. Rogers, London.—14*th August*, 1882.
3897. Regenerative Hot Blast Stoves, B. Ford, London, and J. Moncur, Cumberland.—15*th August*, 1882.
3951. Water-motors, S. S. Allin, London.—18*th August*, 1882.
4097. Wheels, J. Fry, London.—26*th August*, 1882.
4102. Cranes, A. Grafton, London.—28*th August*, 1882.
4112. Baths, W. Morgan-Brown, London.—A communication from W. W. Rosenfield.—29*th August*, 1882.
4126. Speed Accelerating Driving Mechanism, W. R. Lake, London.—A communication from L. S. Fithian.—29*th August*, 1882.
4145. Marine, &c., Structures, J. G. Tongue, London.—Com. from C. J. Keenan.—30*th August*, 1882.
4164. Working Hydraulic Lifts, J. M. Day, W. R. Green, H. C. Walker, and R. Carey, London.—31*st August*, 1882.
4179. Ventilators for Vehicles, R. H. Brandon, Paris.—A communication from P. J. P. d'Aragon.—1*st September*, 1882.
4198. Galvanic Batteries, E. B. Burr, Walthamstow, and W. T. Scott, Stratford.—2*nd September*, 1882.
4258. Setting-up and Distributing Type, J. C. Mewburn, London.—A communication from A. A. Low and L. K. Johnson.—7*th September*, 1882.
4262. Purifying Gas, W. W. Box, Crayford.—7*th September*, 1882.
4279. Loom Shuttles, J. Riley and A. Orrell, Bradford.—8*th September*, 1882.
4304. Electric Lamps, J. G. Statter, Snapethorpe, near Wakefield.—9*th September*, 1882.
4312. Carbonisation of Coal, &c., J. Hardman, Milton, near Stoke-on-Trent.—11*th September*, 1882.
4378. Gas Engines, J. Atkinson, London.—14*th September*, 1882.
4388. Gas Engines, J. Atkinson, London.—15*th September*, 1882.
4398. Pickers Employed in Weaving, I. Sowden, Bradford.—15*th September*, 1882.
4406. Moulds for Metal Castings, J. V. Hope, Wednesbury.—15*th September*, 1882.
4490. Secondary, &c., Batteries, A. Khotinsky, London.—20*th September*, 1882.
4508. Treating Steel, &c., P. M. Justice, London.—A communication from A. Cooper.—21*st September*, 1882.
4512. Portable Voltaic Batteries, J. Mackenzie, London.—21*st September*, 1882.
4515. Looms for Weaving, W. Smith, Heywood.—21*st September*, 1882.
4518. Shipping, &c., the Rudders of Ships, M. Horsley, Hartlepool.—21*st September*, 1882.
4625. Planté's Secondary Batteries, St. G. L. Fox, London.—28*th September*, 1882.
4635. Stoppers for Bottles, &c., N. Thompson, Brooklyn.—29*th September*, 1882.
4687. Transmission, &c., of Power, Force or Motion, W. P. Thompson, London.—A communication from J. D. Wright.—2*nd October*, 1882.
4691. Generating, &c., Electric Energy, F. C. Phillips, London.—2*nd October*, 1882.

4697. Making Gas, A. Wilson, Handsworth.—*3rd October*, 1882.
4785. Treating Linseed, &c., G. G. B. Casero, France. —*7th October*, 1882.

Patents Sealed.

List of Letters Patent which passed the Great Seal on the 20th October, 1882.)

1916. Bricks, &c., T. A. Riggs, Aldeburgh.—*22nd April*, 1882.
1917. Tires for Vehicles, &c., G. W. Knox, Sheffield. —*22nd April*, 1882.
1921. "Mordant" for Dyeing Blues, S. Musgrave, Leeds.—*22nd April*, 1882.
1925. Treating, &c., Lace Fabrics, J. Tuffnell, Manchester.—*22nd April*, 1882.
1930. Exhibiting Advertisements on Tramcars, &c., F. H. F. Engel, Hamburg.—*22nd April*, 1882.
1935. Plumbers' Furnaces, W. S. Cooper, Liverpool. —*24th April*, 1882.
1936. Hutches or Wagons, J. McCulloch and W. Cook, Glasgow.—*24th April*, 1882.
1942. Fastenings for Gloves, &c., W. Bown, Birmingham.—*24th April*, 1882.
1947. Coke, J. Jameson, Akenside Hill.—*25th April*, 1882.
1948. Converting Liquid into Spray, L. H. Armour, Gateshead.—*25th April*, 1882.
1962. Copying Presses, E. Behrens, East Greenwich. —*25th April*, 1882.
2111. Tubular, &c., Steam Boilers, A. F. Yarrow, London.—*4th May*, 1882.
2183. Dressing Silk, &c., A. M. Clark, London.—*9th May*, 1882.
2234. Life-preserving Bed or Mattress, A. M. Clark, London.—*11th May*, 1882.
3183. Preparing Malt Extract, &c., L. Hoff, London. —*3rd July*, 1882.
3198. Walls of Houses, &c., T. N. Sully, Wellington. —*6th July*, 1882.
3230. Tricycles, &c., W. T. Shaw and W. Sydenham, London.—*7th July*, 1882.
3371. Pulleys for Rollers, H. A. Williams, Lincoln. —*15th July*, 1882.
3425. Ball Valves, H. A. Cutler, Upton.—*19th July*, 1882.
3477. Treating, &c., Clay, J. Gillespie, Garnkirk.— *21st July*, 1882.
3592. Secondary Batteries, F. J. Bolton, London.— *28th July*, 1882.

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

1458. Rendering Tissues, &c., Uninflammable, L. A. Groth, London.—*27th March*, 1882.
1691. Connecting, &c., Tobacco Pipes, W. Rest, London.—*6th April*, 1882.
1951. Hooping Casks, &c., A. J. Boult, London.—*25th April*, 1882.
1954. Heating, &c., Metal Ware, H. F. Taylor Glamorgan.—*25th April*, 1882.
1959. Ornamental Surfaces for Building, J. Noad, Essex, and H. Salomon, London.—*25th April*, 1882.
1968. Combined Steam Engine and Boiler, E. Edwards, London.—*26th April*, 1882.
1969. Explosive Compound, C. W. Siemens, London. —*26th April*, 1882.
1977. Valves, J. Baldwin, Keighley.—*26th April*, 1882.
1985. Low-water Alarm Apparatus, J. W. Kenyon, Manchester.—*27th April*, 1882.
1991. Cutting Pipes or Tubes, C. D. Abel, London.— *27th April*, 1882.
1995. Heating and Rolling Metals, H. H. Andrew, Sheffield.—*27th April*, 1882.
1996. Moleskin Cloth, H. W. and H. King, Hebden Bridge.—*27th April*, 1882.
1998. Vessels for Containing Liquids, J. Robinson, Bradford.—*27th April*, 1882.
1999. Storing Electric Currents, J. B. Rogers, London.—*27th April*, 1882.
2007. Sorting Potatoes, C. D. Abel, London.—*28th April*, 1882.
2011. Diminishing the Liability to Corrosion of Screw-propeller Blades, D. Johnston, Govan.— *28th April*, 1882.
2014. Treating Rice, &c., J. T. Armstrong, Newcastle-under-Lyme.—*28th April*, 1882.
2019. Gas-burners, T. Fletcher, Warrington.—*28th April*, 1882.
2033. Securing the Blades of Knives, &c., M. Merichenski, London.—*29th April*, 1882.
2034. Raising Beer, &c., J. J. Harrop, Manchester. — *29th April*, 1882.
2039. Writing and Drawing Pens, M. Fischer, Prussia. —*29th April*, 1882.
2041. Boots, &c., T. J. Handford, London.—*29th April*, 1882.
2046. Windlasses, &c., A. B. Brown, Edinburgh.—*1st May*, 1882.
2049. Automatic Fire Extinguishers, J. R. Brown, Providence, U.S.—*1st May*, 1882.
2058. Gas Engines, A. N. Porteous, Edinburgh.—*1st May*, 1882.
2072. Electric Lights, T. J. Handford, London.—*2nd May*, 1882.
2120. Urinals, W. McGill, London.—*5th May*, 1882.
2122. Treating Textile Materials, G. Jaeger, Germany.—*5th May*, 1882.
2135. Forming or Preparing Lead, T. Cuttriss, Leeds. —*6th May*, 1882.
2136. Incandescent Lamps, J. Rapieff, London.—*6th May*, 1882.
2180. Recording Distances Travelled by Vessels, G. C. Lilley, London.—*9th May*, 1882.
2245. Life-buoys, &c., J. R. Hodgson, London.—*12th May*, 1882.
2252. Steel-pinned Covering for Rag-tearing, &c., Machines, T. R. and T. Harding, Leeds.—*12th May*, 1882.
2317. Power Wheels or Pulleys, A. W. L. Reddie, London.—*17th May*, 1882.
2385. Hose and Pipe Couplings, T. L. Daltry, Stretford.—*20th May*, 1882.
2649. Pique Glove Sewing Machine, J. Helyar, Yeovil.—*6th June*, 1882.
2811. Lubricators, B. J. B. Mills, London.—*14th June*, 1882.
2971. Furnaces for Melting Glass, R. Potter, Stairfoot.—*22nd June*, 1882.
3163. Spinning Frames, A. M. Clark, London.—*4th July*, 1882.
3328. Lamps, C. W. Siemens, London.—*13th July*, 1882.
3424. Mallets or Hammers, A. S. Kershaw, Rochdale. —*19th July*, 1882.
3543. Wheels for Grinding, &c., J. Robinson, Manchester.—*26th July*, 1882.
3697. Cleaning Intestines, E. de Pass, London.—*3rd August*, 1882.

List of Specifications published during the week ending October 21st, 1882.

322, 2d.; 332, 2d.; 370, 2d.; 394, 2d.; 636, 2d.; 642, 2d.; 644, 2d.; 846, 6d.; 930, 2d.; 1014, 8d.; 1072, 6d.; 1092, 6d.; 1096, 6d.; 1127, 2d.; 1128, 2d.; 1137, 1s.; 1138, 2d.; 1142, 6d.; 1145, 2d.; 1152, 6d.; 1164, 6d.; 1171, 8d.; 1173, 2d.; 1174, 1s. 8d.; 1175, 2d.; 1176, 6d.; 1178, 2d.; 1179, 4d.; 1181, 6d.; 1182, 6d.; 1185, 4d.; 1189, 6d.; 1195, 6d.; 1204, 2d.; 1212, 6d.; 1215, 10d.; 1219, 8d.; 1223, 6d.; 1225, 6d.; 1226, 6d.; 1227, 2d.; 1231, 6d.; 1232, 2d.; 1235, 6d.; 1243, 6d.; 1246, 8d.; 1247, 2d.; 1248, 4d.; 1250, 2d.; 1254, 4d.; 1256, 6d.; 1257, 4d.; 1258, 6d.; 1260, 8d.; 1267, 2d.; 1269, 6d.; 1270, 2d.; 1271, 4d.; 1273, 2d.; 1274, 2d.; 1275, 2d.; 1276, 2d.; 1277, 2d.; 1279, 2d.; 1280, 2d.; 1281, 6d.; 1283, 6d.; 1284, 6d.; 1286, 2d.; 1287, 2d.; 1288, 6d.; 1290, 2d.; 1291, 4d.; 1294, 6d.; 1295, 2d.; 1296, 2d.; 1298, 4d.; 1299, 6d.; 1301, 6d.; 1302, 6d.; 1303, 6d.; 1304, 6d.; 1305, 4d.; 1306, 2d.; 1308, 4d.; 1309, 8d.; 1310, 4d.; 1311, 2d.; 1312, 2d.; 1313, 2d.; 1316, 2d.; 1317, 2d.; 1318, 6d.; 1319, 2d.; 1321, 6d.; 1324, 6d.; 1325, 4d.; 1326, 2d.; 1327, 6d.; 1329, 2d.; 1330, 6d.; 1331, 6d.; 1332, 2d.; 1333, 6d.; 1338, 2d.; 1340, 6d.; 1346, 6d.; 1348, 6d.; 1356, 2d.; 1358, 6d.; 1359, 6d.; 1362, 6d.; 1337, 6d.; 1388, 6d.; 1417, 10d.; 1439, 8d.; 1478, 6d.; 1511, 8d.; 1577, 4d.; 2238, 6d.; 2452, 6d.

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

ABSTRACTS OF SPECIFICATIONS.

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

322. Gloves, *W. Dibble, Regent-street.—21st January, 1882.—(Provisional protection not allowed.)* 2d.

This consists in the formation of a pocket in the palm of the glove for the reception of money or railway or other tickets.

332. Athletic Boots and Shoes, *H. and T. Craston, London—23rd January, 1882.—(Provisional protection not allowed.)* 2d.

This consists in making such boots and shoes of moleskin.

370. Finishing the Surface of Concrete Floors, *A. Cordingley, Bradford.—25th January, 1882.—(Provisional protection not allowed.)* 2d.

This consists in rolling concrete surfaces with a roller formed with grooves so as to produce a series of projections on the surface of same, and thus prevent slipping.

394. Isolating Fire and Smoke from the Auditorium in Theatres, &c., *H. M. Bennett, Liverpool.—26th January, 1882.—(Provisional protection not allowed.)* 2d.

This consists in placing a perforated water pipe along the top of the curtain drop, so that when the latter is lowered and the water supply turned on a sheet of water runs over the same and separates the stage from the auditorium.

636. Portable Urinal for Infants, *E. S. and E. M. Howell, Notting Hill.—9th February, 1882.—(Provisional protection not allowed.)* 2d.

This relates to a chamber to be attached to the child, and so formed as to prevent the liquid flowing out therefrom.

642. Bread, *J., D., J., and J. Beatty, Belfast.—10th February, 1882. — (Provisional protection not allowed.)* 2d.

The object is to dispense with much of the labour in moulding dough and placing it in the oven, and it consists in the use of suitable apparatus for effecting the above.

644. Braces for Trousers, *J. H. Johnson, London.— 10th February, 1882.—(A communication from J. C. Garand, Paris. — (Provisional protection not allowed.)* 2d.

The object is to prevent the dragging or falling out of shape of trousers, and it consists in the use of braces formed so as to support both the trousers and the drawers or other garment.

846. Weldless Tubes, &c., *R. Elliott, Newcastle-on-Tyne.—21st February, 1882.* 6d.

This relates to machinery for producing tubes, rods, or bars with the fibre of the metal in a helical direction to prevent the longitudinal splitting of the tubes. According to one arrangement the metal in a molten or plastic condition is placed in vessel A, the end or head piece X of which carries a hollow die Y formed with helical grooves. The rod B projects through the

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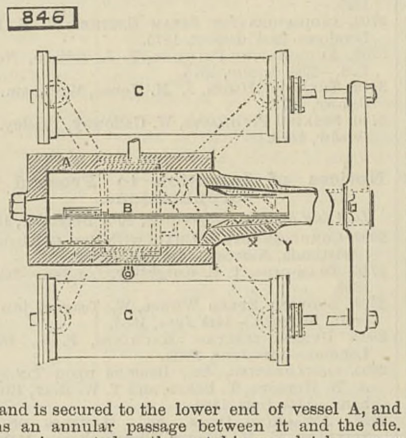

die and is secured to the lower end of vessel A, and forms an annular passage between it and the die. Pressure is exerted on the metal in vessel A by means of hydraulic rams C, which force the head piece X into vessel A, thereby causing the metal to issue in the form of a tube between the die Y and rod B, the fibre of the metal having a helical twist imparted to it. The die may also be caused to rotate.

930. Indicating the Length of Piece Goods when Rolled, Folded, &c., *A. Akeroyd, York.—25th February, 1882. — (Provisional protection not allowed.)* 2d.

This consists in marking the back of the goods from end to end so as to show the number of yards remaining on the roll or folded up.

1014. Producing Caustic Barium and Strontium from the Sulphates, *J. G. Tongue, London.—2nd March, 1882.—(A communication from R. Riomezynski, Germany.)* 8d.

This consists, First, in expelling sulphur from the sulphate of strontium and barium by the application of a pit or chamber stove heated by burning gases, into which superheated steam of such a temperature is conducted that the alkaline earths are reduced to a thick liquid mass; Secondly, in introducing the superheated steam at two different levels, that is at the upper level by blast pipes in the stove wall, and at the lower level by cross pipes provided with holes and protected by masonry; and Thirdly, in heating the floor so as to fit it for drawing out the melted mass.

1085. Electro-magnets and Armatures therefor, *W. P. Thompson, Liverpool.—7th March, 1882.— (A communication from C. Smith, Astoria, U.S.)* 8d.

Describes a method of causing the armature of an electro-magnet to vibrate between stops; also armature inductively magnetised in frictional contact with the surfaces of iron discs, with mechanism for communicating motion to the armature.

1092. Machinery employed in Knitting Machines, *T. Priestley, Bradford.—7th March, 1882.* 6d.

This relates to cloth knitting machines, the object being to produce firmer knitted fabrics which cannot be pulled out or stretched in the width, and which have a better appearance and finish, and it consists in a combination of parts for placing a thread at the back of the knitted fabric during the process of knitting, in such a manner so as to fasten the longitudinal threads together and prevent elasticity in the direction of the width.

1096. Machinery for Actuating Capstans by Water-pressure, &c., *W. L. Williams, London.— 7th March, 1882.* 6d.

As applied to an ordinary capstan it consists in forming a crank on the lower end of its shaft, the pin being received in a slot formed in a piece connecting the plungers of two hydraulic cylinders placed on opposite sides of the shaft, but not in the same line. Two other hydraulic cylinders placed below the others and at right angles thereto also have their plungers connected and a slot formed to embrace the crank pin, which is so prolonged as to enter the same. The water is admitted to the four cylinders in succession, and acts on the crank so as to cause it to revolve.

1072. Carriages for Naval and Field Ordnance, *T. Nordenfelt, London.—6th March, 1882.* 6d.

The object is to check the recoil from guns, and to carry them quickly back again to firing position with moderated rebound. To obtain this a spring is combined with a hydraulic buffer. The trunnions of the gun are carried upon a lever A, of which the fulcrum is at A¹, so that the lower end of the lever is drawn

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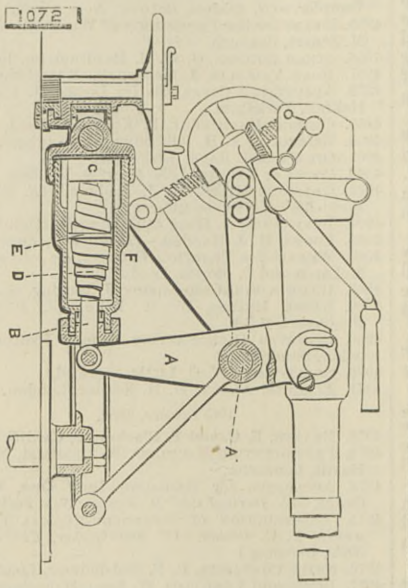

forward by the recoil. The lever A is here jointed to the piston rod B of the piston C. The piston rod is surrounded by the spiral springs D D, and E is a disc, through which the rod freely passes. F is a cylinder, in which the piston, the springs, and the disc are contained. The end cover of the cylinder F is secured to the gun carriage by a bolt, on which the cylinder is able to rock slightly to accommodate itself to the position of the lever A.

1127. Antiseptic Material for the Preservation of Flesh and other Animal Matter, *J. Imray, London.—8th March, 1882.—(A communication from F. Artinini, Florence.)* 2d.

The material consists of a solution of a compound of boric acid and malic acid.

1128. Controlling the Flow of Water from Cisterns, &c., *J. Rawson, Worcester.—8th March, 1882.—(Not proceeded with.)* 2d.

A syphon tube is fixed on the cistern, and its longer leg has a short stand pipe at the lower end fitted with a balanced valve to which the pull wire is connected. Upon the head of the syphon is an air valve balanced to its seating, and to it a lever is attached and actuated by a float and line, so that the valve may be adjusted to allow any desired flow of water from the cistern before the action of the float in descending opens the valve, and thus admits air to the syphon and prevents any further flow of water.

1137. Improvements in Telegraphic Apparatus, especially for Street Fire Alarms, *W. H. Davies and F. H. W. Higgins, London.—8th March, 1882.* 1s.

The object of this invention is to render the signals made from street fire alarm boxes self-interpreting. The system consists of a normally closed battery circuit, including a station instrument in which an electro-magnet actuating a propelment moves an index or indicator each time that the circuit is opened, and a series of signal posts with cams which intermit the current a pre-arranged number of times when a pull is drawn out. Also a receiving instrument, with arrangements for acknowledging the call by reversal of the current through the line, without affecting the propelment.

1138. Transmission of Power by Endless Belts of Rope, &c., *J. Thomson, Glasgow.—9th March, 1882. —(Not proceeded with.)* 2d.

This consists in causing the rope to pass from one grooved drum to another, so as to leave every alternate groove empty when coiling in one direction, and then leading the rope back from one drum to the other in the opposite direction, and filling up the vacant grooves.

1142. Improvements in Means for Regulating the Generative Capacity of Dynamo or Magneto-electric Machines, *T. J. Handford, London —9th March, 1882.—(A communication from T. A. Edison, Menlo Park, New Jersey, U.S.)* 6d.

The illustration herewith shows one mode of carrying out this invention. In this illustration the current is supposed to be normal in the conductors 1 and 2. Suppose it were to increase in electro-motive force, then E would attract F, so closing the circuit through I and D; lever H is then caused to vibrate, the circuit being alternately broken by the electro-magnet attracting H, and thus throwing the circuit controller N to one side, and made by the action of spring L

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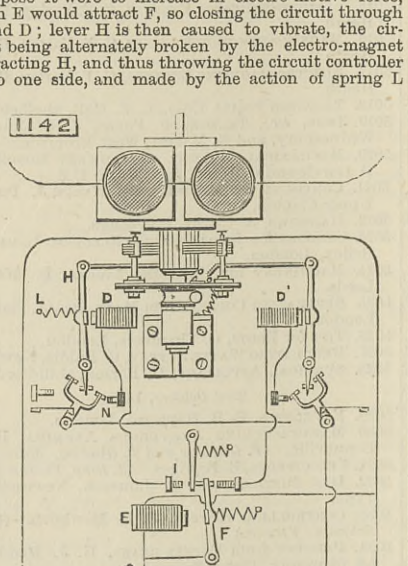

drawing back H, and thus throwing N to the opposite side. The vibration of H will, through the pawl, ratchet wheel, and worm wheel shown, move the brushes away from the line of maximum generation until the normal current and candle power is restored, and F resumes the central position shown in the drawing. A decrease in E M F will weaken E and close the circuit through D¹, and so restore the normal current.

1145. Motive Apparatus, *S. P. Wilding, London.— 9th March, 1882.—(A communication from J. I. Caso, Paris.)—(Not proceeded with.)* 2d.

This relates to the use of weight suspended by a cord or chain from the drum, the axle of which is connected by a train of wheels to the machine to be driven.

1152. Reaping and Mowing Machines, *J. S. Macgregor, Edinburgh, and G. Redfern, Berwick-on-Tweed.—9th March, 1882.* 6d.

The principal object is to enable the machine to cut in both going and returning along the same side or edge of the crop; and it consists, First, in constructing the machine to accomplish this by making the cutting and delivery apparatus capable of pivotting on the frame, so as to be capable of being turned over together with the cutter bar from one side of the machine to the other; Secondly, in making the finger bar and reciprocating cutter bar capable of working either side upwards; and Thirdly, in the constructing the delivery apparatus so that when a sufficient quantity of the cut crop is delivered to the platform—which is counterbalanced—the latter falls, and endless belts convey the sheaf to the rear of the machine.

1163. Electric Lighting Apparatus, *W. R. Lake, London.—(A communication from E. Weston, Newark, U.S.)—10th March, 1882.* 6d.

In this arrangement Mr. Weston has one set of feed-regulating magnets with two sets of carbons, the latter being brought into circuit as required. The feed and adjustment is by means of clutch mechanism.

1164. Protecting the Interior of Graves, &c., *J. Walters, Devon.—10th March, 1882.* 6d.

This consists of a metal lining for protecting the interior of graves.

1171. Improvements in Mechanism for Regulating the Burning of Carbon or other Electrodes in Electric Lighting Apparatus, *A. Graham, Camberwell.—10th March, 1882.* 8d.

The figure shows one form of the inventor's lamp. The carbons are separated by attraction of armature F by magnet G. When the arc is too long the fine

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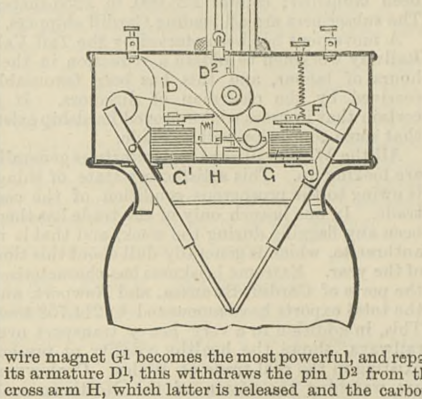

wire magnet G¹ becomes the most powerful, and repels its armature D¹, this withdraws the pin D² from the cross arm H, which latter is released and the carbons are allowed to descend. As they approach the current through the thick wire of G¹ becomes the strongest, D¹ is again attracted, and D² arrests H.

1172. Incandescent Electric Lamps, *J. Wauthier, Clerkenwell.—10th March, 1882.* 6d.

The improvement is said to be in the reducing the number of joints between the platinum and glass. The neck of the glass is constructed with a tube of glass inserted therein forming a kind of inner neck.

1173. Improvements in Secondary Batteries or Electric Accumulators, *J. H. Johnson, London. —10th March, 1882.—(A communication from A. de Meritens, Paris.)—(Not proceeded with.)* 2d.

This relates to improvements in secondary batteries, whereby oxidation of the binding screws, clamps, &c., and consequent imperfect contact and sparking are avoided. It consists mainly in forming each plate so that it constitutes one element with one pole on one side and the other on the other side.

1174. Improvements in and Relating to the Generation, Distribution, &c., of Electricity, and Apparatus or Means therefor, *J. S. Williams, Riverton, New Jersey, U.S.A., and London. —10th March, 1882.* 1s. 8d.

The inventor proposes to use the water reservoirs and pipes for supplying water in towns, as a means of driving turbines, which in turn drive dynamo machines; the current so generated is then led to accumulators, and distributed therefrom as required.

1175. Roofing Materials, &c., *E. B. Edwards, Liverpool.—10th March, 1882.—(Not proceeded with.)* 2d.

This consists in forming slates of an artificial fictile ware composed of well vitrified silicate of alumina and silica with or without other ingredients.

1176. Spoons, *T. F. D. Heap and J. Rettie, London.— 10th March, 1882.* 6d.

This relates to a spoon for more easily and effectually administering food or medicine, and consists in forming it in the shape of a scoop, and making the bottom movable, so that when drawn back the food or medicine falls into the mouth.

1177. Telephones, *J. D. Husbands, London.—10th March, 1882.* 6d.

A tubular mouthpiece in combination with a loose contact consisting of carbon or other suitable material, so placed between the electrodes as to microphonically regulate the strength of the currents without a diaphragm.

1178. Heating in Chemical and Manufacturing Operations, *A. M. Clark, London.—10th March, 1882.—(A communication from P. and E. Depoully, Paris.)—(Not proceeded with.)* 2d.

The method of heating consists in enclosing the apparatus containing the matters to be heated in an envelope or jacket to which steam is supplied, the jacket being heated by a fire.

1179. Machinery for Dyeing, *A. M. Clark, London. —10th March, 1882.—(A communication from J. Hanson, Philadelphia.)—(Not proceeded with.)* 4d.

This relates to the use, in combination with the dyeing vat, of vertically moving frames carrying the rollers to support the skeins to be dyed, and mechanism for raising and lowering such frames to introduce and remove the yarn, with clamping devices to clamp the skeins, while the rollers are being raised. A stirrer is placed in the vat and serves to keep the dye at a uniform strength in all parts of the vat.

1181. Implements for Pruning, &c., *J. Ridal, Crosspool, Yorkshire.—11th March, 1882.* 6d.

The object is to obtain greater cutting power and produce a cleaner cutting action, and it consists in fitting at the tail end of the top blade a pin projecting into a long slot in the bottom blade, so that as the latter is moved up and down it actuates the top blade so as to cause it to move in the opposite direction.

1182. Bottling Aerated Waters, *J. T. Hayes, Walthamstow.—11th March, 1882.* 6d.

On one part of a suitable frame is mounted a machine for bottles with patent stoppers, and fitted with a cup which, by means of a screw, is brought to bear on the top of the bottle, the cup having a rubber ring within it. The waterway to the cup oscillates in a bearing in the frame, and is connected with the duct leading from cylinder by a stuffing box, and the waterway from the cup surrounds and oscillates around the duct leading from the cylinder. The passage of the water through the stuffing-box, and the waterway therein, is governed by a spring or other valve actuated by lever. A machine for bottling syphons and an ordinary rack bottling machine may be mounted on the same frame and supplied from the same cylinder.

1185. Clarifying Syrups and other Fluids, &c., *S. Pitt, Sutton.*—11*th March*, 1882.—(*A communication from G. A. Drummond, Montreal.*) 4*d.*

This consists in forcing the syrup up through a suitable filtering medium, and then inverting the vessel and admitting a cleansing fluid at the top, which following on the syrup, will pass through the medium and thoroughly cleanse it.

1189. Purifying Coal Gas, *W. Watson, jun., near Leeds.*—11*th March*, 1882. 6*d.*

This refers more particularly to apparatus for washing or scrubbing coal gas, and consists of cylindrical vessel with end covers, to each of which a pipe is attached to admit and discharge the gas, whilst other pipes serve to admit and discharge water. The interior of the vessel is divided into compartments filled with gravel, stones, or pebbles, and the whole is caused to revolve.

1195. Improvements in Relation to Electric Circuits, and in Apparatus for Protecting Buildings, &c., from Burglars, *W. P. Thompson, Liverpool and London.*—11*th March*, 1882.—(*A communication from M. H. Kerner, New York.*) 6*d.*

This relates to that class of electric burglar alarms in which a normally closed circuit extends through the building, and which circuit is connected with a station, so that any opening of door or window will cause the strength of the current to be increased or diminished, and so produce a signal at the station. The object of the present invention is to provide apparatus which is more easily worked, and also means whereby the circuit can be subjected to continuous test.

1199 A New or Improved Electric Lamp of the Arc Type, *R. Kennedy, Glasgow.*—13*th March*, 1882. 6*d.*

This invention consists in making the regulating apparatus of two coils, one fixed and of thick wire forming a solenoid, the other wound on a soft iron tube and of fine wire. This tube slides easily inside the solenoid. To the lower end of the tube is fixed the upper carbon; a cross bar carrying two pulleys acting against two guide rods may be used to steady this carbon. The lower carbon is also fixed in a cross bar running on pulleys on the guide bars; the upper and lower cross bars are attached to each other by cords passing over pulleys, so that when the upper carbon rises the lower one falls and *vice versâ*.

1204. Saving Persons and Goods at Sea, *H. J. Haddan, Kensington.*—13*th March*, 1882.—(*A communication from P. Malherbe, Nantes.*)—(*Provisional protection not allowed.*) 2*d.*

This consists of a rope with knots at one end to enable persons to hold on, and with two lighter ropes, one carrying a piece of cork at its end, and the other a piece of cork strengthened by a disc of wood. To the other end of the large rope a metallic ring is attached, and from it several hooks are suspended.

1212. Gas for Illuminating Purposes, *A. W. L. Reddie, London.*—13*th March*, 1882.—(*A communication from E. Boulliez, Paris.*) 6*d.*

This consists in submitting the hydrocarburets which escape from the retorts to frictional contact with surfaces of a temperature higher than that at which the distillation proper is effected, so that by such superheating they may be completely gasified, and in this state will not be condensed in the ordinary apparatus in which the gas is treated to eliminate the tarry and ammoniacal matters. The apparatus employed is placed between the conducting pipes and condensing apparatus, and the gas and the hydrocarburets are caused to enter chambers heated by a separate furnace, and filled with balls of burnt clay pierced with holes.

1215. Looms for Weaving, *J. and F. Leeming and R. Wilkinson, Bradford.*—13*th March*, 1882. 10*d.*

This relates, First, to improvements in the construction and arrangement of the knives and drawbars of "positive dobby," so that they may form either single or double catches at will or as determined by the card or pattern mechanism; Secondly, to an improved combination of lever and catches, operated by slide bar, whereby the tumblers are held in proper position, admitting of the cylinder being turned without affecting the position of the tumblers so far as relates to the two last indicated picks; Thirdly, to improved apparatus for levelling the healds; Fourthly, to improved construction of pattern peg and appliance for securing same in the lags, barrel, or other pattern mechanism; Fifthly, to improved mechanism for gauze or "cross" weaving.

1219. Smith's Forge, *W. Roberts, South Wales.*—14*th March*, 1882. 8*d.*

This relates to forges in which anthracite coal is used, and it consists in forming the hearth with a blast chamber beneath it extending across from back to front, and with a gap in the hearth immediately above the blast chamber, perforated fire-bricks being fitted into the gap and covering the blast chamber, and through which the blast issues, whereby a fire may be made, and a welding heat obtained over the whole length and width of the gap, or any less extent, by stopping up some of the holes so as to lessen the area of the blast as may be desired. The blast chamber has an inlet for a jet of steam, which it is necessary should accompany the blast of air so as to ensure complete combustion of anthracite coal, and which may be used independently of the air blast when desired. The blast chamber is also provided with a valve to regulate the blast and a door to rake out the ashes.

1222. An Improved Method of and Apparatus for Transmitting and Receiving Telegraphic Messages, *H. H. Lake, London.*—14*th March*, 1882. —(*A communication from A. L. Parcelle, U.S.*) 8*d.*

This relates to improvements in a system of autographic or *fac simile* telegraphy in which the mechanism is actuated by harmonic electrical pulsations traversing a single conductor, and other improvements in automatic printing telegraphs.

1223. Malting, Kiln Drying and Turning Grain, &c., *A. Perry, Roscrea.*—14*th March*, 1882. 6*d.*

This consists in the use of a travelling wheel, shaft, or cylinder with buckets or blades attached thereto, which as it revolves works the substance circumferentially over the wheel, thereby turning it. The blades are preferably radial and parallel with the axis, and revolve at a far greater speed than that at which the shaft travels horizontally.

1225. Apparatus for Gauging Carbon Filaments, Wire, &c., *M. Evans, Wemyss Bay, N.B.* — 14*th March*, 1882. 6*d.*

This relates to apparatus for gauging fine articles, and consists of a movable jaw and a fixed jaw or stop between which the article is held, the greater or less proximity of the two jaws, as determined by the thickness of the article, regulating the angle or positions of a mirror, which reflects a pencil or beam of light upon a screen or scale.

1227. Paste for use in Washing Linen, &c., *E. L. Loxton, near Wakefield.*—14*th March*, 1882.—(*Void.*) 2*d.*

The paste is made by dissolving soap in pure water, or in water in which borax or pipeclay has been dissolved, and spirits of ammonia and spirits of turpentine are then added in equal or suitable proportions until it is of the consistency of thick cream, in which state it is ready for use.

1231. Grinding Mills, *L. Gathmann, Chicago.*—14*th March*, 1882. 6*d.*

This relates to apparatus in which discs are used for grinding, and it consists in supplying the material to be ground between the discs through a central aperture in the top disc, which is formed with a depressed portion in the middle surrounded by the annular working face. The bottom disc has also a central depression and a marginal working face of the same width as that of the upper disc. The lower disc is preferably the runner, and in its depression are fixed a number of wings inclined so as to throw the material outward, while its working face is formed with furrows leading outward from the depression and terminating a short distance inside the periphery of the disc. Alternating with these furrows are recesses passing to the periphery but stopping short of the depression. The working face of the upper disc may be either plain or provided with a series of fluted or rounded grooves located close to each other at their inner ends.

1226. Apparatus for Auxiliary Propulsion of Ships, &c., *W. T. Lithgow, Glasgow.*—14*th March*, 1882. 6*d.*

The invention consists essentially in fitting a propeller or propellers on swing frames or on brackets at each side of the ship in such a manner that they can

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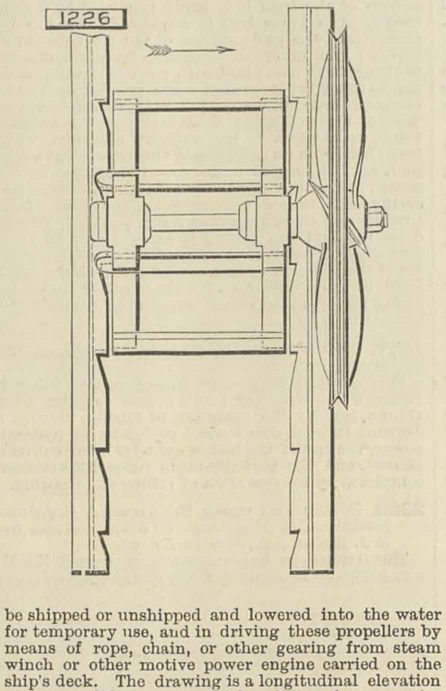

be shipped or unshipped and lowered into the water for temporary use, and in driving these propellers by means of rope, chain, or other gearing from steam winch or other motive power engine carried on the ship's deck. The drawing is a longitudinal elevation of one modification, in which a sliding frame carries the propeller at one side of the ship.

1232. Bricks or Blocks for Building Walls, &c., *J. H. Johnson, London.*—14*th March*, 1882.—(*A communication from F. Bander, Paris.*)—(*Not proceeded with.*) 2*d.*

The object is to enable a structure to be built with great solidity, economy, and rapidity, without the use of mortar or binding cement, and it consists in the use of bricks or blocks formed with projections and recesses so as to interlock.

1235. Rousing and Aerating Beer, *H. Long, Bristol, and H. Aplin, Redfield, Gloucester.*—14*th March*, 1882. 6*d.*

A vertical cylinder is arranged in the vat, and in its centre is an axis carrying a screw at its lower end, while pipes pass from an air reservoir to the bottom of the vat. The screw is caused to revolve by suitable means.

1243. Looms for Weaving, *J. C. Fielden, Manchester, and R. H. Harrison, Duckinfield, Cheshire.*—14*th March*, 1882. 6*d.*

This relates to "letting-off motions," the object being to increase the regularity of letting off the yarns from the warp beam. To one end of the beam a toothed worm wheel is attached, and is driven by a worm on a shaft fitted with two ratchet wheels set in opposite directions, and between which a pawl lever can turn freely and carries two pawls, one movement of the lever actuating both. The lever is moved in one direction by a small crank on a shaft geared with the tappet shaft of the loom, and in the opposite direction by a spring or weight. The yarn presses on a stop pawl, and if the pressure increases raises the same, when the spring or weight drives forward the ratchet, and so lets off the required length of yarn.

1246. Automatic or Mechanical Musical Instrument, *H. H. Lake, London.*—14*th March*, 1882.—(*A communication from G. W. Turner, Boston, U.S.*) 8*d.*

This relates to mechanical musical instruments, the playing of which is automatically effected by the passage of a perforated strip or sheet, and it consists partly in an instrument with bellows, wind chest, reeds, and chambers, with passages communicating with the reeds, and with a series of valve-actuating fingers controlled by the perforated sheet, and with valves hinged to each of the fingers and flexibly connected to a support, and each arranged to roll over on its seat and in its movements to open and close the air passage leading to the reed pertaining to such valve.

1247. Cutting Shafts or Bars of Metal, &c., *W. Cook, Glasgow.*—15*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to apparatus specially applicable for cutting off the ends of boiler stays, studs, &c., after they are fixed and tightened in position, and one arrangement consists of a ring to be fixed by screws to the part to be cut off, and over which a second ring is mounted, so that it may be rotated. The second ring carries the cutter, which is forced inwards by a screw, wedge, or spring.

1248. Rotating Drum for Tobacco-cutting Machines, *T. Cope and W. Brewer, Liverpool.*—15*th March*, 1882. 4*d.*

The object is to provide a drum with a smooth, yielding, and durable surface, easily renewable and adapted to preserve the cutting edge of the knife, to largely reduce noise in working, and to prevent chipping and uneven cutting away. The body of the drum is of metal and covered with a ring of caoutchouc or other elastic yielding material.

1250. Water Brushes, *J. T. Todd, Edinburgh.*—15*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to brushes in which it is required to supply water while using the brush, and it consists in making the handle of the brush hollow, and connecting it by a flexible tube to the water supply.

1254. An Improved Telegraph Relay, *J. Ebel, New Charlton.*—15*th March*, 1882. 4*d.*

In carrying out this invention the inventor employs an electro-magnet with one bobbin of insulated wire, within which he places a compound soft iron core. The centre part of this soft iron core moves freely on pivots, and is prolonged on both ends in the form of tongues or armatures. Adjacent to each of the upper and lower armatures he arranges steel horseshoe magnets, which are so placed with regard to the armatures that they can vibrate between their poles. If a feeble current is produced in the wire bobbin it will magnetise and induce magnetism in the iron centre core and armatures, and will consequently, according to their polarity, be attracted or repulsed by the poles of the magnets.

1256. Looms for Weaving, *L. Greenwood, Hawick, N.B.*—15*th March*, 1882. 6*d.*

This relates more especially to the arrangement of the shelves or shuttle boxes in which the shuttles rest at each side of the loom, and to forming the shuttles to suit the improved boxes, and it consists in forming the shelves so that the weft threads cannot enter between the flanges and the shuttles and the cutting of the weft is altogether avoided. The outer retaining flanges are turned down instead of up, so that the shelves have the appearance of being inverted, and the shuttle rests on the upper side of the shelf. The eye through which the weft thread passes from the shuttle is made in the centre of the shuttle at its lower edge. The shuttle is formed wider at the lower face than at its upper face, so that the outer edge projects over the flange of the shelf below. The picker is also inverted or cut on its upper side to clear the flanges of the shelves of shuttle boxes.

1257. Stop Valve, *W. Whiteley, near Huddersfield.*—15*th March*, 1882.—(*A communication from R. N. Pratt, Hartford, U.S.*)—(*Complete.*) 4*d.*

The drawing is a section showing the valve closed. A is the shell, which contains the parts forming the valve, the valve seating B being placed by preference at an angle of about 45 deg. C is a clapper, which is

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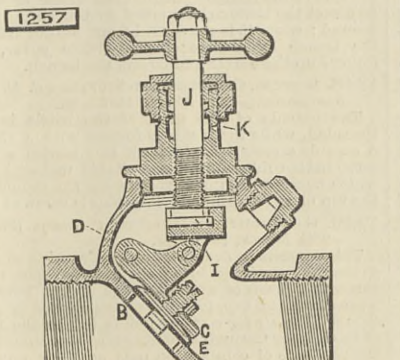

hinged on a pin D passing through the shell from the outside. E is a rotating disc, constituting the part of the valve which rests upon the valve seat. The clapper C is secured to a link, the upper part of which is grooved or milled to receive a collar I formed at the bottom of the valve spindle J, passing through the stuffing-box K.

1258. Treating Diseases of the Throat, Lungs, and Chest, *E. Chabôt, Camberwell-road.*—15*th March*, 1882. 6*d.*

The object is the curative treatment of diseases of the lungs by inhaling heated unmoistened air medicated by drugs and medicines.

1260. Stamping Type Moulds, *E. A. Brydges, Berlin.* —15*th March*, 1882.—(*A communication from H. Hagemann, Vienna.*) 8*d.*

The object is to avoid having to set the work up in type and taking a mould therefrom from which to produce the stereotype plates, and it consists in the use of a machine in which the different letters, &c., are successively impressed in the material to form the mould.

1267. Tools for Cutting or Finishing Boiler Stays, *R. Davidson, Glasgow.*—16*th March*, 1882. —(*Not proceeded with.*) 2*d.*

A frame can be fixed in position on the stay and carries a movable tool holder which can be revolved or reciprocated so as to cause the tool to cut the projecting end of the stay.

1269. Fitting the Tuning Pins of Pianofortes, *G. Wilde, Nottingham.*—16*th March*, 1882. 6*d.*

The object is to render the pins less liable to turn in their holes after the strings have been tightened up, and it consists in causing a pinching plate actuated by screws to bind on the stems of the pins, and hold them so as to prevent them from turning back.

1270. Tent Peg, *J. Jaques, London.*—16*th March*, 1882.—(*A communication from J. Wixler, Switzerland.*)—(*Not proceeded with.*) 2*d.*

This relates to the construction of a tent peg for fastening cords, ropes, chains, or the like to the ground.

1271. Improvements in Telephones, *A. W. Rose, London.*—16*th March*, 1882. 4*d.*

This relates to a combined transmitter and receiver, as well as magnetic signalling apparatus, the parts of which are arranged so that they can be readily made in the factory, and so placed as to be convenient for manipulation.

1273. Looms for Weaving, *T. Knowles, Blackburn.*—16*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to an arrangement of the swell so that its action upon the shuttle may be more gradual and uniform than heretofore.

1274. Improvements in Incandescent Electric Lamps, *F. Wright and M. W. W. Mackie, London.* —16*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to various proposed improvements in the details of an incandescent lamp. The carbon is made of a fibre of any suitable plant, especially grown in distilled water, and so free from mineral and inorganic impurities.

1275. Lamps for Bicycles, &c., *H. F. D. Miller, Birmingham.*—16*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This refers to apparatus for attaching lamps to bicycles and tricycles, &c., so that the lamp may always be kept in an upright position.

1276. Gas Burners, *J. W. Willmot, Brixton, and T. Leehmann, Camden-square.*—16*th March*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to construct the burner or the holder thereof, or the usual bend elbow, or equivalent part adjacent thereto, in such a manner as that upon the gas flame being blown out or otherwise extinguished, or upon the main cock being turned off, the exit of the gas shall be automatically cut off at the burner.

1277. Obtaining Valuable Products from Furnace Gases, *J. and J. Addie, Glasgow.*—16*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This refers to a process for utilising the nitrogen contained in the gases of or from furnaces, such as of blast and other furnaces, or of Siemens gas-producers, by converting it into various valuable and saleable products.

1279. Lifting Jacks, *F. H. F. Engel, Hamburg.*—16*th March*, 1882.—(*A communication from J. F. W. Schultze, Hamburg.*)—(*Not proceeded with.*) 2*d.*

This relates to rack and pinion jacks, and has for its object to reduce the friction of the rack in its guides by using two pinions instead of one as formerly applied to jacks.

1280. Production of a Scarlet Colouring Matter upon Vegetable or Silk Fibre, &c., *D. Dawson, Milnsbridge.*—16*th March*, 1882.—(*Not proceeded with.*) 2*d.*

The invention consists in producing a new scarlet colouring matter upon vegetable or silk fibre, also in producing the said new colouring matter in a precipitate form, so that it may be employed in paper staining, calico printing, and similar purposes.

1281. Effecting the Compression in Moulds and Delivery of Substances to be used as Fuel, *E. W. Harding and W. Watkins, Sunderland.*—16*th March*, 1882. 6*d.*

This relates to the construction of a machine, in which a revolving table is employed, and which is capable of a step-by-step motion in suitable framing. This table is provided with moulds.

1283. Apparatus for Placing Fog Signals in Position on Railways, *J. Natt, London.*—16*th March*, 1882. 6*d.*

The apparatus consists in a suitable case with a guide or tube capable of holding a number of fog signal cartridges, and provided with a spring operated pusher for feeding the cartridges successively to the point where they are removed from the case and placed on the line, the said case being combined with a longitudinally sliding push rod or cartridge carrier working through a guide or barrel transversely to the direction in which the cartridges are fed, and provided with means of holding the cartridge, whereby the cartridge is removed from the case and held upon the rail whenever and for any length of time required

1284. Pianofortes, *H. Witton, Stoke Newington*—16*th March*, 1882. 6*d.*

The principal object is to secure a certain and uniform action of the hopper fly, so that when the relative positions of it and the lever are once properly adjusted, the hopper fly must infallibly be brought by the motion of the key to its correct point of escapement under all possible conditions of frictional variation.

1286. Dyeing or Sizing Hanks, &c., *J. Conlong, Blackburn.*—16*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to improvements in the general construction of apparatus for dyeing or sizing hanks, &c., and for expelling the superfluous dye or size.

1287. Apparatus for Removing Pistons from Piston Rods, *J. Tobin, Poplar.*—16*th March*, 1882. —(*Not proceeded with.*) 2*d.*

This consists of a sling bolt or set screw shackle, which is fitted in a nut which envelopes the end of the piston rod, and is attached to the piston by means of a flange and set screws or otherwise.

1288. Improvements in Incandescent Lamps and in Fittings and Switches for Electric Light Apparatus, *J. B. Rogers, London.*—16*th March*, 1882. 6*d.*

This relates to improvements in the attachment of the carbons to the platinum wires; an improved socket and means of fitting the lamps to ordinary gas brackets, &c.

1290. Process for Manufacturing Sparkling Grogs, &c, *H. A. Bonneville, London.*—17*th March*, 1882.—(*A communication from D. Cornilliac, Paris.*) —(*Not proceeded with.*) 2*d.*

Sparkling punches are prepared with rum, brandy, or any other kind of alcohol reduced to about 25 deg., and to which is added per 100 litres, concentrated essence of lemon, 13 centilitres; citric acid, 60 grammes; Hysurn tea, 100 grammes; sugar, 10 kilos.

1291. Fruit Flavoured with Alcoholic Beverages, *H. A. Bonneville, London.*—17*th March*, 1882.—(*A communication from D. Cornilliac, Paris.*)—(*Not proceeded with.*) 4*d.*

This relates to the manufacture of alcoholic beverages containing the pure aroma of any kind of the fruit in a concentrated aërated form.

1294. Breech-loading Fire-arms, *H. W. Holland, London.*—17*th March*, 1882. 6*d.*

The chief object is to provide novel means whereby the lock or lock mechanism may be placed at full cock with greater facility than is possible in top lever hammerless guns as hitherto constructed.

1295. Adjustable Folding Chair, *E. Smith, West Dulwich.*—17*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the general construction of the chair.

1296. Machinery for Getting Coal, *W. H. Harbottle and C. M. Percy, Lancaster.*—17*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the employment of a rotating disc for cutting.

1298. Metal Lasts, *J. Markie, London.*—17*th March*, 1882.—(*Not proceeded with.*) 4*d.*

This relates to the shape or construction of the metal last.

1299. Apparatus for use in Drafting Patterns for Ladies' Dresses, *W. T. Philpott, Colchester.*—17*th March*, 1882.—(*A communication from J. A. Wilson, California.*) 6*d.*

This relates to the employment of a scale and marker.

1301. Metallic Boxes for Holding Alimentary Substances, &c., *G. F. Griffen, London.*—17*th March*, 1882. 6*d.*

This relates to the construction of part of a metal box, and of the lid or cover thereof, in such a way that when they are in combination, that is to say when the lid is soldered to the box, the body forms a fulcrum for any kind of lever to break the solder should a soldered joint be used and lift the lid.

1302. An Improved Electrolier, *Hon. R. Brougham, London.*—17*th March*, 1882. 6*d.*

This relates to an electrolier so constructed that the insertion of incandescent lamps places them in contact with the conducting wires by springs, and so lights them.

1303. Improvements in and Connected with Telegraphic and Telephonic Systems, and Apparatus therefor, *P. M. Justice, London.*—17*th March*, 1882.—(*A communication from F. van Rysselberghe, Scharbeek, Belgium.*) 6*d.*

The object of this invention is to enable one or more wires of a system to be used for telephony whilst the others are being used for telegraphic purposes, and to avoid the effect of induced currents. This is accomplished by the following means:—(1) The intensity of the undulatory currents of the microphone and induction coil is increased by employing an electric source of extremely feeble internal resistance, such as Plante's or Faure's accumulators; (2) microphones with multiple contacts, and these coupled in quantity are used; (3) the small carbon cylinders of the microphone are, except at their points of contact, covered with a metallic coating to render them better conductors; (4) a key is used whose mission is to put the receiver or the secondary wire of the induction coil out of circuit, as may be required; (5) the construction of the coils of the telephone receiver and the secondary wire of the induction coil is modified to considerably increase their resistances; (6) a condenser is connected with line and earth, so as to receive part of the charge, and only allow it to enter the line gradually, thus graduating the current; or a key may be employed which first closes the circuit through a resistance, and then gradually reduces this resistance.

1304. Thrashing Machines, *T. and W. Nalder, Wantage.*—17*th March*, 1882. 6*d.*

This consists in the arrangement for giving motion to the shoes from the shaker boxes by direct connections without intervening levers and connecting rods.

1305. Purification of Copper Precipitate and Ores, &c., *D. Watson, Manchester.*—17*th March*, 1882. 4*d.*

The inventor claims, First, the treatment of copper precipitate by solutions of alkaline sulphides; Secondly, the treatment of specified varieties of copper ores by solutions of alkaline hydrates, carbonates, or sulphides, for the removal of arsenic and chlorine.

1306. Ingredients for Manufacture of Hearthstone, *W. Simmons, Maidstone.*—17*th March*, 1882. 2*d.*

Eight parts Hassack stone, 2 parts chalk, and 1 part Portland cement are mixed together with water.

1308. Artificial Hatching Machine, *M. Arnold, Acton.*—17*th March*, 1882. 4*d.*

This relates to a means for cooling the eggs.

1309. Instruments Used for Measuring Distances, *J. P. Nolan, Ballinderry, Tuam.*—17*th March*, 1882. 8*d.*

This relates to the general construction of an instrument for ascertaining distances other than astronomical.

1310. Circular Bobbin Net Machines, *W. H. Beck, London.*—17*th March*, 1882.—(*A communication from W. Dawson, St. Pierre les Calais.*)—(*Void.*) 4*d.*

This relates to machines to produce tissues with true lace grounds, whereas those produced in existing machines are only imitations.

1311. Self-acting Mules, *W. T. Watts, Stalybridge.*—18*th March*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to move the driving belt from the fast to the loose pulley as the carriage is going out when it arrives near the end of the stretch, and also to arrange the mechanism so that when the main driving belt on the countershaft is traversed on to the loose pulley to stop the mule by means of the stopping and starting handle, the first-mentioned belt will in the act of stopping the mule be traversed from the fast to the loose pulley.

1312. Opening and Closing Carriage Heads, *T. C. Towns, Birmingham.*—18*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This consists of a lever working from the head pillar and head prop on to the cant rail, and bent so as admit the fall-back of the cant rail in which it works by means of a slot and pin.

1313. Wire Rope Couplings, *E. A. Leitzmann and O. Borchart, Germany.*—18*th March*, 1882.—(*Not proceeded with.*) 2*d.*

Two caps are screwed, one on to the end of each rope, and shaped so as to form a hook and eye, by means of which they can be coupled.

1316. Founding and Setting Type, *W. A. Barlow, London.*—18*th March*, 1882.—(*A communication from J. Liwczak, Vienna.*)—(*Not proceeded with.*) 2*d.*

This relates, First, to apparatus for forming the types in a continuous band or chain, each link of which consists of one type of a letter, the connections of the links being formed by the insertion of several threads or wires running parallel through the whole chain; Secondly, to apparatus for setting type, and consists in winding the chain of each letter on a roll, and by touching a key, feeding one type forward, when a small saw severs it from the chain. A composing stick then catches the type and places it in the desired position.

1317. Application of Ornamental Devices to Metallic Capsules, *H. Haltwasser, Hamburg.*—18*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to ornamenting in colours a circular part (or two or more parts) of the sides of metallic capsules, which part is afterwards stamped with a name, trade mark, or other design.

1318. Gas Motor Engines, *C. G. Beechey, Liverpool.*—18*th March*, 1882. 6*d.*

The primary object is to remove the whole of the products of combustion from the cylinder after each explosion, and at the same time provide sufficient space behind the piston when at the end of its in-stroke to contain the charge of compressed combustible mixture for the next explosion, and this is effected by displacing by a small charge of combustible mixture, the products of combustion which the working piston is unable to drive out of the cylinder. The invention further consists in equalising the rotary motion of the crank shaft by forming a partial vacuum behind the working piston and the compression piston during the out-strokes, so as to aid the momentum of the fly-wheel during the in-strokes.

1319. Fire-escapes, *G. Lakeman, Exeter, and G. Jelly, Liverpool.*—18*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a portable fire-escape arranged for use as a bedstead, but which in the case of fire, by attaching one end to the window-sill and putting the other part out of window, will unfold and form a ladder.

1321. Scoring or Marking in Cricket and other Games, *F. Dening, Chard.*—18*th March*, 1882. 6*d.*

The telegraph board is made so that it can be readily taken to pieces and packed up in a small compass, and the numbers are exhibited on such boards when in use by causing strips of canvas (on which the requisite numbers are written) to travel in front of orifices in the board.

1324 Improvements in Electric Lamps, *J. D. F. Andrews, Glasgow.*—18*th March*, 1882. 6*d.*

This relates to improvements on the inventors patent No. 1526 (1881) for regulating the carbons in arc lamps by means of a plate clutch for the holder of the upper carbon operated in conjunction with a friction brake, by a solenoid core carrying the lower carbon. Also to an incandescent lamp consisting of a thin plate of carbon clamped at opposite edges between loops of the conducting wires.

1325. Drain and Sewer Pipes, *C. Slagg, Leeds.*—18*th March*, 1882. 4*d.*

This consists in forming a projection inside the socket of each pipe so as to form a support for the spigot when inserted therein, and thus enable a better joint to be made.

1326. Traps for Drains, *C. Slagg, Leeds.*—18*th March*, 1882.—(*Not proceeded with.*) 2*d.*

The objects are, First, to construct a continuous flushing trap by permanently reducing the sectional area of the throat so as to cause a sufficient velocity through the trap with the ordinary run of sewage, and thereby proportionately increase the velocity and the head of water which causes it; and Secondly, in making the mouth of the trap with a continuous inclination upwards from the throat, in order that if necessary to remove any substance from it which the flow of sewage cannot carry through, it may be reached from the surface by a hook and withdrawn.

1327. Improvements in Means or Apparatus to be Used in Connection with the Transmission of Electric Currents of High Tension, *L. J. Crossley, Halifax, J. F. Harrison, Bradford, and W. Emmott, Halifax.*—18*th March*, 1882. 6*d.*

This relates to an arrangement of relays and switches, whereby high tension currents can be sent along telephone wires without interfering with the telephones in circuit.

1329. Woven Fabrics, *R. Bailey and W. Walker, Ovenden, and L. J. Crossley, Halifax.*—18*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in the manufacture of certain woven fabrics of partially or entirely of curled or wavy threads twisted in a special and peculiar manner, and also in the method of producing designs with a number of varied colours by a peculiar manner of dyeing.

1330. Machinery Employed in the Manufacture of Driving Bands, Straps, &c., *J. Appleyard, Bradford.*—18*th March*, 1882. 6*d.*

This relates to improvements in apparatus for rivetting two or more thicknesses of leather or other suitable material together by means of rivets that become hooked and are firmly clenched in the material; and it consists in the employment of a wheel or wheels working on the edge of the material and combined with the take-up rollers allowing of putting the rivets in at the very beginning of the material.

1331. Removable Tires for the Wheels of Vehicles, *J. Haynes, near Barnsley.*—18*th March*, 1882. 6*d.*

According to one arrangement the tire is of U-section, the recess being large enough to fit over the ordinary tire of the wheel, and the side flanges projecting outwards. The tire may be in one piece or in two sections, and the meeting ends are drawn together by screws passing through lugs on the flanges. In passing over soft ground the central part of the tire will be embedded therein, and so bring the enlarged surface of the flanges into action.

1332. Braces, *M. Stellmann, Whitechapel.*—18*th March*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in plaiting brace ends of silk, cotton, or other material, so as to leave button-holes at one end, while the fibres at the other end are gathered up to receive clips which connect the ends to the braces.

1333. Receptacles for Ink Holders, &c., *B. G. Brewer, London.*—18*th March*, 1882.—(*A communication from C. S. Bleton and A. Maleville, Paris.*) 6*d.*

This relates to a case or receptacle for ink-holders having the form of a simple tube, without any indication of the mode of opening or closing the same. Several arrangements are shown.

1338. Helmets, Hats, Caps, &c., *J. W. Towell, Regent-street.*—18*th March*, 1882. 2*d.*

The object is to make such head covering lighter and more durable, and to avoid cracking, and it consists in making them of a foundation of a sheet of cork with an outer covering of cloth, and a lining of horsehair fabric attached to the cork by means of an india-rubber solution.

1340. Excavating Trenches, &c., *J. W. Wailes, Walsall.*—20*th March*, 1882. 6*d.*

The object is to facilitate the construction of trenches for draining land and other purposes, and it consists in the use of a cutter arranged vertically, and the blades of which are of screw form and section. The cutter is caused to revolve while it is moved along the line of the trench. Behind the cutter is a shield to direct the material removed to the surface of the ground; when it is prevented from falling back into the trench by a shoe or plough-like cover, which follows up the cutter and covers the trench.

1346. Bottles, Capsules, and Stoppers, *C. M. Taylor, Snaresbrook.*—20*th March*, 1882. 6*d.*

The outside of the neck of the bottle is screw-threaded, while the inside is formed with a shoulder. A capsule screws over the neck and carries a disc of cork, india-rubber, or other suitable material inside, which becomes compressed between the shoulder and the top of the capsule, as the latter is screwed home.

1348. Gas Light and Heating, *T. Thorp, Whitefield.*—20*th March*, 1882. 6*d.*

This consists in constructing gas-burning apparatus so that the gas is led into a chamber, whence it flows through a series of upright tubes and is burnt as it issues from the top, forming a ring-shaped or Argand flame. The air for combustion is led to the interior of the burner through a heating chamber round which the products of combustion pass on their way to the chimney, and is then deflected upward, so as to enter into combustion with the outcoming gas. A circular deflector surrounds the air supply tubes and is inside the flame, while another is outside and above the flame, which does not require a chimney.

1356. Improvements in Telephonic Receiving Apparatus, *R. and M. Theiler, Islington.*—21*st March*, 1882.—(*Not proceeded with.*) 2*d.*

The inventors' telephone receiver consists of an electro-magnet, to one pole of which is fixed a stem or knob, which can be conveniently inserted in the ear. The vibrations are thus communicated directly to the walls of the ear, doing away with a diaphragm.

1358. Cutting Mortise Holes in Wood, *J. and W. Hall, Nottingham.*—21*st March*, 1882. 6*d.*

A template of the required length, and with the mortise holes in the desired positions, is placed on the side of the wood abutting upon the fence of the machine. The fence has a stop projecting the width equal to the space occupied by the chisel when in the position to cut the ends of the mortise holes. This stop projects from the face of the fence into the openings in the templates, by which means the piece of wood can have the mortises completed without marking the wood as usual. The reversal of the chisel is effected automatically by the falling of the bed of the machine to its lowest position.

1359. Brakes for Railway Vehicles, *H. Ivey, Battersea, and J. H. Craddock, London.*—21*st March*, 1882. 6*d.*

In the vehicle on which the brake mechanism is mounted, a hand wheel is arranged, and actuates a lever through a chain, the lever being connected to one arm of a bell-crank lever pivotted to the under frame of the vehicle, and the other arm of which is connected by two rods to a longitudinally sliding bar. To the latter are attached two other rods united to and adapted to move a crank on a transverse shaft under the vehicle frame, and carrying two other double-crank levers, each arm of which is by a rod connected to a bell-crank lever. These last levers are by each connected by a rod and intermediate arms to two brake blocks.

1362. Railways and Tramways, *A. Riche, Brixton.*—21*st March*, 1882. 6*d.*

This relates, First, to the employment of a metallic

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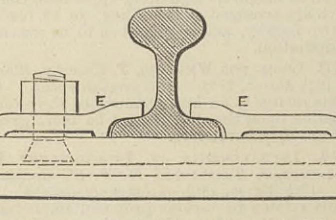

sleeper; and, Secondly, to the employment of the grip plates E. Modifications are described.

1387. Valves for Air Compressors, *W. Teague, Illogan, Cornwall.*—22*nd March*, 1882. 6*d.*

The object is to form a valve for air compressors which will be simple in its action and have but little friction, and as applied to the inlet valve it consists of a lever, one end of which moves on a fixed pivot on the end oi the compressor. The lever is also pivotted to a slide with suitable ports, and which works behind inlet ports in the compressor. The outer end of the lever is actuated by a cam driven from the fly-wheel shaft of the engine.

1388. Chimney Tops or Ventilators, *G. Kent, Portsea.*—22*nd March*, 1882. 6*d.*

This consists in forming chimney tops or ventilators of a series of frustra of cones surrounded by an envelope, placed so that any draught caused by the wind is converted into a current upward or downward outside the central shaft of the chimney.

1417. Excavating or Dredging Under Water, *W. Smith, Aberdeen.*—24*th March*, 1882. 10*d.*

This relates, First, to a system of dredging resembling ploughing, by means of two winding engines hauling a plough to and fro between them by ropes, the plough being replaced by a suitable excavating plough in the form of an open truck, by means of which the material is taken from the bed of the channel and deposited alternately at opposite sides, as it is drawn to and fro. The material is removed from the sides by steam dredging hopper barges, consisting of a basket-shaped digger nearly hemispherical in shape, and lowered open by gravitation and closed by hydraulic pressure.

1439. Suspending Portable Machines for Punching, Rivetting, &c., *J. Fielding, Gloucester.*—25*th March*, 1882. 8*d.*

On a trunnion on either side of the machine at or near the centre of gravity, a sleeve is fitted so that the trunnion can revolve therein, and to this sleeve is jointed, by means of two parallel links, a bar projecting beyond the links, such a distance that its end is nearly above the centre of gravity of the machine. The machine being suspended by a swivel attached to the end of this bar can be turned into various attitudes, so that its tools can be presented at any required point and in any required direction within the limits permitted by the jointing. If driven by hydraulic or other fluid pressure, the same may be supplied through the trunnion, to which it may be conducted along the bar, either links made hollow for this purpose.

1478. Sugar, *J. H. Johnson, London.*—27*th March*, 1882.—(*A communication from M. Weinrich, Vienna.*) 6*d.*

The object is to effect the quick and economical manufacture of refined sugar in rectangular sticks, simultaneously with sugar in lumps, in and by means of centrifugal machines. The sticks are made in moulds divided by suitable partitions, and secured to the drum of the centrifugal machine, the space between them being filled in with raw or mashed or squeezed sugar; and while the machine is in motion either water or sugar solutions or steam is employed for the operation of liquoring.

1511. Breech-loading Small-arms, *T. W. Webley, Birmingham.*—29*th March*, 1882. 8*d.*

This relates, First, to the employment in double drop-down guns of a side hand lever acting through the under side of the body, and the depression of which draws back the lower bolt, which takes into the lump on the under side of the barrel, the return motion of the such bolt being produced by a coiled spring. The lower bolt is connected to a top bolt taking into the prolongation of the rib between the barrels; and in order to secure its more effectual working it is also fitted with a coiled spring, which assists in urging it forward when the breech ends of the barrel are shut down; Secondly, to safety apparatus for breech-loading small-arms, and consists in using, in addition to the ordinary gear and bent, a small bolt with its acting head turned at right angles, such bolt sliding in recesses in the bridle and lock plates, and being urged towards the tumbler by a spring, the turned end crossing the back of the tumbler and engaging with a notch therein. To withdraw the bolt the trigger is made to act on a lever connected therewith. Another form of safety apparatus is also described, and consists of a sliding bolt in front of the tumbler, and formed partly round and partly flat, so as to either bear on the tumbler or to leave it free.

1577. Copper Tubes, *T. Walker, Birmingham.*—31*st March*, 1882. 4*d.*

This consists in manufacturing copper tubes by raising a disc of copper into a hollow cylinder, closed at one end by the operation of raising, forcing, or drawing through dies worked preferably by hydraulic power, the end of the hollow cylinder being cut off or pierced, and the partially-made tubes thus obtained completed by the operation of rolling and drawing.

2238. Boiler and other Furnaces, *J. H. Johnson, London.*—11*th May*, 1882.—(*A communication from E. J. Mallet, jun., New York.*) 6*d.*

This relates to improvements on patent No. 737, A.D. 1882, and it consists, First, in the employment of

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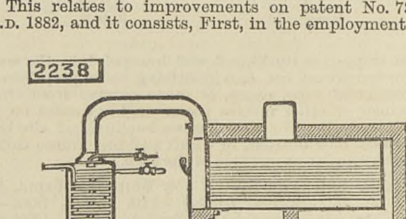
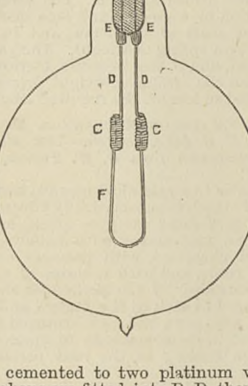


a damper or system of dampers; Secondly, in the employment in conjunction with a suction fan or air exhauster of certain forms of condensers; Thirdly, to the application and use of exhaust steam for heating and ventilating purposes. The drawing shows a longitudinal section of the furnace.

2452. Improvements in Incandescent Electric Lamps, *J. Wetter, New Wandsworth.*—24*th May*, 1882.—(*A communication from L. Nothomb, Brussels.*) 6*d.*

The carbon in this lamp is made of cellulose; preferably Spanish cane hydraulicly compressed, and afterwards carbonised, is made use of. In the accompanying illustration, the filament F is fixed on copper conductors D D terminating in coils C C; these con-

2452



ductors are cemented to two platinum wires E E. When the carbons are fitted into D D they are fixed by a cement composed as follows: graphite, 50 parts; calcined borax, 17 parts; linseed oil varnish, 13 parts; refractory clay, 20 parts. Carbon is subsequently deposited in the pores of the filament by various means.

2744. Improvements in Dynamo-electric Machines, &c., *J. Imray, London.*—10*th June*, 1882.—(*A communication from J. J. and T. J. McTighe, Pittsburgh, U.S.*) 6*d.*

This relates to the construction of dynamo machines, and is designed to improve the method of making and fitting the parts. The inventor claims improvements in the construction of the armature, which is annular, and consists of a core composed of a number of slitted rings each capable of independent adjustment round its axis, and modifications of this armature; also a commutator composed of a single cylinder of insulating material having one or more integral collars perforated longitudinally with a circular series of holes in combination with a series of metal rods placed in said perforations and retained by the collar or collars; also in the construction and disposition of the field magnet.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

265,423. Method of Operating Gas Engines in Torpedo Boats, *Edward W. Kellogg, Hartford, Conn.*—*Filed December* 21*st*, 1880.

Claim.—(1) The method herein described for using gas in connection with the torpedo boat, which consists in taking liquid from the reservoir and expanding it into gas in pipes exposed to the sea water, and then passing it to the engine, substantially as described. (2) The combination, with a torpedo boat, engine, and liquid reservoir, of coiled pipes arranged to come in contact with the sea water, as described. (3) The combination of a torpedo boat with an expansion chamber, consisting of a series of pipes arranged

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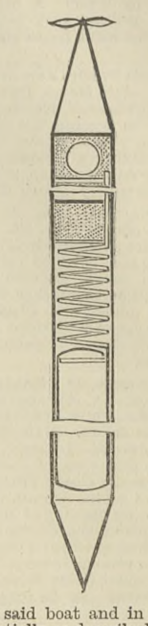

on the outside of said boat and in contact with the sea water, substantially as described.

265,775. Electric Arc Light, *Thomas A. Edison, Menlo Park, N.J.*—*Filed* 28*th November*, 1881.—*Renewed* 14*th August*, 1882.

Claim.—(1) In an electric arc lamp, the combinatio of the main circuit containing the carbons and an electro-magnet or solenoid, with a shunt around th arc, containing a heating coil adapted to oppose by it action the action of the magnet, substantially as se forth. (2) In an electric arc lamp, the combination

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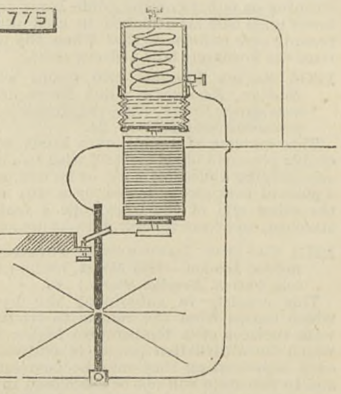

the main circuit containing the carbons and an electro-magnet or solenoid, a shunt around the arc, containing a heating coil, and an expansible chamber, substantially as and for the purpose set forth. (3) In regulating mechanism for electric arc lights, the electric heating coil and expansible inclosing chamber, substantially as and for the purpose set forth.

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The Engineer, Oct. 27th, 1882.