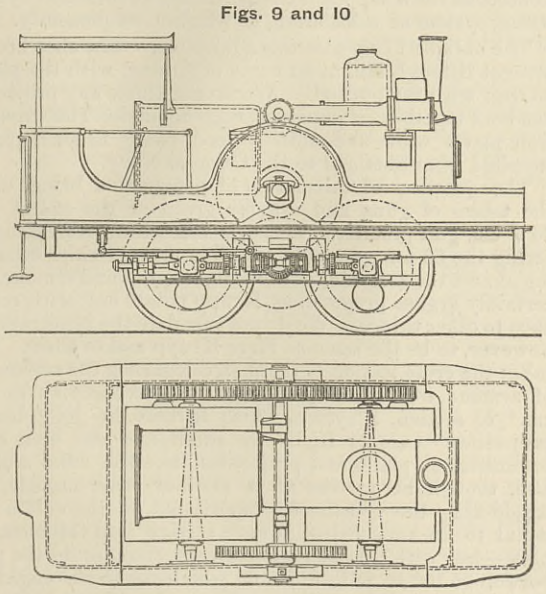
THE NATIONAL BAVARIAN EXHIBITION AT NUREMBERG.

No. II.

In machinery a good display is made, both in first movers and tools, although there does not appear to be much of special interest in either department as regards novelty. As might be expected, the national beverage is duly honoured, machines for malt-crushing, mashing, steeping, and cooling, and yeast presses, being well represented, and many of them in action. By far the larger number of contributions in this section are made by three or four firms, prominent among them being the Nürnberg Joint-Stock Engine Company, formerly Klett and Co., whose works on the glacis of the old fortifications cover about 33 acres, and employ on an average about 2200 hands, with a producing capacity of 600 to 700 passenger carriages and 3000 to 4000 goods wagons, the former being entirely completed, including the cabinet and upholstery work, on the spot. Flour-mill and brewery plant, pumping and factory engines, and station fittings, such as weigh-bridges, turn-tables, and traversers, are also largely produced. Another speciality is the Werder testing machine, which indicate changes of forms in the test pieces by a micrometric apparatus of extreme delicacy, while capable of exerting a maximum strain of 100 tons. This is exhibited in action by the Department of Public Works, and similar machines have been supplied to several of the great technical schools in Europe, and to the Creusot works, besides being in general use by the exhibitors themselves. The steam engine exhibited by this company is a compound horizontal one, with the ordinary tubular guide framing, the two cylinders working on the same fly-wheel shaft, with distribution by valves, which are governed by cam movements in a similar manner to the large winding engines that were exhibited in Paris in 1878. When working with 6 atmospheres initial pressure, 10-fold expansion in the two cylinders, and condensing, the effect developed is about 80-horse power. Engines of generally similar construction are exhibited in motion by the Augsburg Engine Company, with cylinders 305 and 450 mm. diameter and 700 mm. stroke, which, with the same initial pressure, develope 60-horse power at 80 revolutions. Some of the details of a large engine of the same kind now making for a spinning factory at Cologne are shown. This is from 500 to 700-horse power, with a driving fly-wheel of 7 metres diameter, weighing 25 tons, having the rim grooved for sixteen driving ropes. Another similar horizontal compound engine of 80 to 100-horse power, from Dingler's Works at Zweibrücken, is priced at £780, including the fly-wheel pulley. An exception to the foregoing construction, which is very generally adopted, is seen in the 90-horse power engine by L. A. Riedinger, who adopts the original Woolf arrangement, the small cylinder being in front of the large one, while the admission valves are commanded by a combination of link and radial motions, the tail of the excentric being formed into a curved link, in which slides a block connected with the valve rod, the position of the block, and with it the length of the admission period, being

Figs. 9 and 10

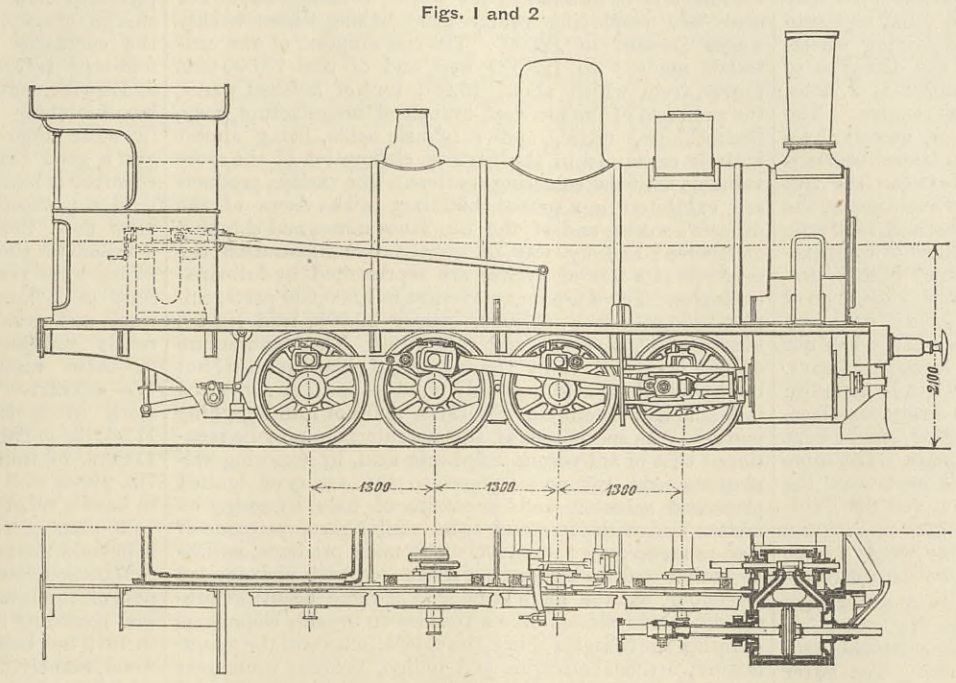


varied by a weigh-shaft in connection with the governor. By this arrangement the valves are kept continuously under the pull of their rods, and the dash pots or other contrivances necessary when releasing catches are used are dispensed with. The lowest steam consumption hitherto attained, of 14·52 lb. per indicated horse-power per hour, is claimed for this engine.

The steam required by the engines in motion is supplied by boilers exhibited by the Nürnberg and Dingler's Works. The former are of the reversed flame elephant pattern, the flame passing first under the main boiler and returning round the smaller heater below, with Tenbrinks furnace, in which the grate, inclined at about 50 deg., is enclosed in a third short cylindrical water tube. The Dingler boiler is on MacNicol's plan; the lower heating tube being connected with the main boiler by a system of parallel tubes of small diameter, like those of a Root boiler, placed immediately above the fire, which gives a very rapid circulation. In this an inclined step grate is used, and the furnace door is reduced to a mere slit like a letter-box, the firing being done with a rectangular scoop holding but a small quantity of fuel, which in this case is small, wet, and dirty slack, such as under ordinary conditions of firing could scarcely be used at all.

Much attention has been paid by the Bavarian engineers to water power, and more especially to turbines. Outside of the machinery hall a fine specimen of a heavy complicated casting is shown by the Nürnberg Company in the shape of a Jonval turbine of 117in. diameter, with three concentric rings of buckets, intended to develope 275-horse power with 225 cubic feet of water per minute, under a fall of 13ft. F. Haag, of Nürnberg, has a novelty in the shape of turbines with ventilated guide rings, which allow the water to be cleared of air before entering the wheel. This is shown as applied to vertical as well as horizontal wheels. The largest work of this kind, though only shown in drawings, is contributed by the Augsburg Company in the large wheels erected at the Krahnholm Cotton

Figs. 1 and 2



Figs. 5 and 6

Fig. 3 Fig. 4

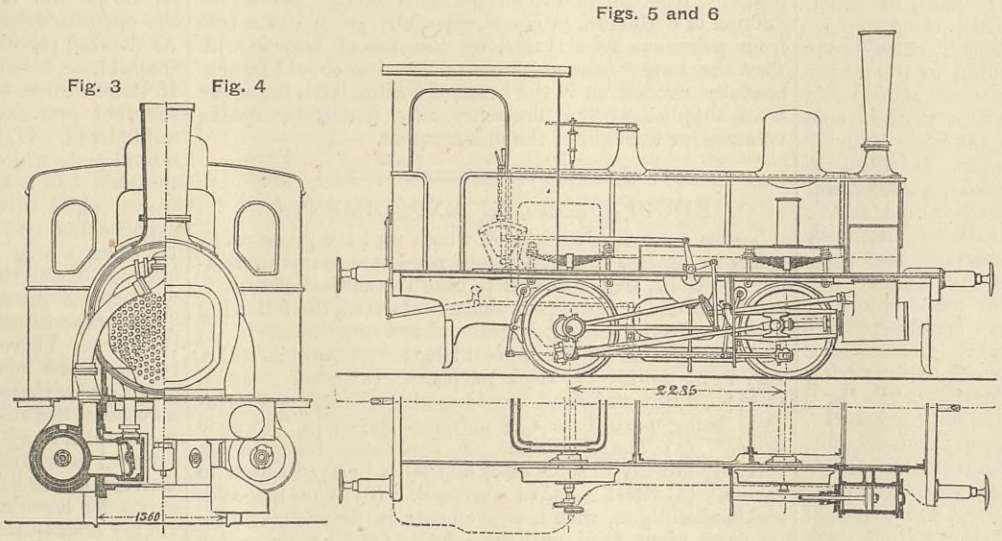
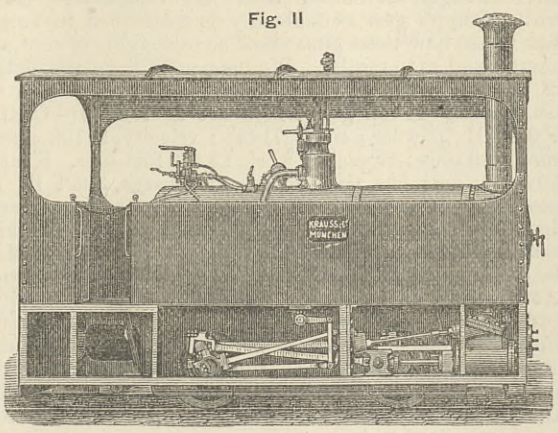


Fig. 11



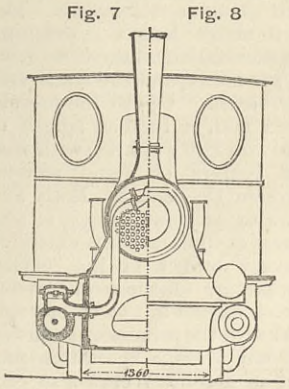
Spinning and Weaving Mills, on the Narowa River at Narva, in Russia, which, at the present time, contain 239,632 spindles and 1674 looms, driven by two turbines of 450-horse power and three of 1200-horse power each; a further addition of 100,000 spindles is now being made, and it is ultimately intended to build three other mills also with 100,000 spindles each. When these shall have been completed the driving power of the works will be 9300-horse power. The large wheels of 1200-horse power, which are of simple construction, regulated by sliding sluices on the tail fall, are about 13ft. diameter, and utilise 5700 cubic feet of water under a head of 28ft. per minute, the weight being about 140 tons. This is perhaps the largest water power establishment in Europe.

In railway plant, the most prominent object is the goods engine for the St. Gothard line, by J. A. Maffei, of Munich, whose name is well known in connection with the original Semmering engines, represented in Figs. 1—4. It is of the eight-coupled type usual on the South German and Austrian mountain lines, with horizontal outside cylinders of 520 mm. diameter and 610 mm. stroke, the piston rods being carried through the forward cylinder covers, the excentrics and valve gear being all inside the frames; the direct-heating surface is 95 square metres, that of the tubes 148·5 square metres, and the grate 2·15 square metres; the working pressure is 10 atmospheres; the effective diameter of wheel tread is 1·170 m., the length of wheel base 3·900 metres, the length over all 9·700 m., breadth 3·100 m., and height 4·100 m.; the weight in running order is 54 tons. The outer shell of the boiler is 1·500 m. in diameter, and the copper fire-box being unusually broad could not be lifted into its place from below, but was pushed in from behind, for which purpose the hinder plate of the boiler, as will be seen in Fig. 2, was flanged outwards. Two of these engines take a train of twenty loaded wagons of 17 tons gross weight each, or 340 tons exclusive of the weight of engines and tenders, upon a rising gradient of 1 in 37-38, and curves of 300 metres radius, at 15 or 16 kilometres speed per hour, under which conditions the work developed by each engine is about 500 horse-power. In order to prevent slipping in foggy or frosty weather, water jets for washing the rails are placed in front of the leading wheels, which are fed by a special pair of injectors taking their supply directly from the tender; and under the driver's cab are fixed two air boxes with india-rubber mouthpieces, intended to supply the driver and fireman with respirable air when passing through the tunnels, the boxes being refilled by an aspirator when running in the open. In contrast with the preceding, the same maker has a four-wheeled tank engine for light branch traffic — *Vicinal bahn betrieb*—in the collection of the State Railway department. This, represented in Figs. 5 to 8, has four coupled wheels of 976 mm. diameter, and a wheel base of 2·285 m. The boiler, constructed for a working pressure of 12 atmospheres, is 850 mm. in external diameter, and 2 450 m. long, with ninety-two tubes, giving 25·38 square metres heating surface, that of the fire-box being 3·12 sq. met, or together 28·5 sq. met., which is 40·7 times the grate area of 0·7 sq. met. In the St. Gothard engine the ratio of grate to heating surface is as 1 : 73. The cylinders are 266 mm.—10in.—in diameter, and 508 mm.—19·6in.—stroke. The engine, which is 6·860 m. long, 3·600 m. high, and 2·780 m. broad, when in running order, with 1·8 cubic metres of water in the tank, and 600 kilogs. of coal, weighs 17 tons. Another contribution from Maffei's works is the road roller shown in Figs. 9 and 10. This has two coupled wheels of 1·400 m. diameter, and the same breadth of face, which are adjustable radially to be able to travel on streets of 10 metres curvature. This adjustment is effected by the engine itself by means of toothed gearing, and right and left-handed set screws, on one side of the framing. When the rollers have attained the extreme radial displacement, the gearing mechanism is automatically released, and the regulating lever is at the same time pushed back. The following are the principal dimensions :—

Diameter of bearing rollers	1·400 m.
Breadth of bearing rollers	1·400 m.
Wheel base	1·900 m.
Diameter of steam cylinder	240 mm.
Length of stroke of piston	300 mm.
Ratio of change of gearing wheels	1 : 8·25
Heating surface of fire-box	2·8 sq. metres.
Heating surface of tubes	14·7 sq. metres.
Total heating surface	17·5 sq. metres.
Surface of grate	0·63 sq. metres.
Ratio of grate to heating surface	1 : 27·7
Working steam pressure	12 atmospheres.
Water in tank	1000 litres.
Coal	300 kilogs.
Weight empty	14·9 tons.
Weight in working order	16 tons.
Pressure on either roller	8 tons.

Another Munich firm—Messrs. Krauss and Co.—contribute a tank engine for express service, having the water tank below the boiler. This has four-coupled driving wheels of 1·500 m. diameter, and outside cylinders of 400 mm. diameter and 600 mm. stroke; the water capacity is 6000 litres, and that for coal 2000 litres; the running weight is 36 tons. This engine is constructed for the Werra line in Thuringen, where several of the same kind are already in use. They are found to save 24 per cent. of the fuel required when working trains of the same weight with tender engines. Fig. 11 is a tank engine by the same makers intended for works and mineral lines. It has four coupled wheels of 910 mm. diameter, cylinders of 280 mm. diameter, and 500 mm. stroke, weighs 18½ tons in working order, and with a steam pressure of 12 atmospheres, has an effective tractive power of 2850 kilogs., or will take a load of 150 tons in addition to its own weight

Fig. 7 Fig. 8



up a gradient of 1 in 100 at a speed of 15 kilometres per hour, corresponding to a useful effect of 125-horse power. At the latter rate the heating surface per effective horse-power is 0·37 square metres. A more powerful engine of similar construction, 150-horse power, is largely supplied by the makers for secondary lines in Germany and Austria, which under similar conditions to those given above will draw trains of 175 tons. The greatest novelty in locomotives exhibited by Krauss and Co. is a curious combination called a steam omnibus, intended for branch lines in very sparsely populated districts. It has a long two-storied body, in which a room is formed for 67 passengers in two classes, and which is supported at one end on a group of four low wheels, while a similar group at the other end supports the engine. This has four coupled driving wheels and a short boiler placed transversely to the direction of the line. The weight of this strange monster is 27 tons, of which 13 tons are contributed by the engine. The carriage body is supported on three points, namely, by a central pin on the engine frame, and two lateral bearings on the carriage frame. The distance between the two bogey pins is 7660 mm., while the rigid wheel base of the engine is only 1700 mm., and that of the carriage 1500 mm. The proportions adopted are such as to allow of comparatively high travelling speed. On the journey from Wurzburg to Nürnberg, on rather a heavy line, a distance of 103 kilometres was run in about two hours, or about 32 miles an hour. We believe that this vehicle has not yet been adopted in practice by any of the German railways. The great objection to its use is obviously to be found in the necessity of having an engine for every carriage, while under ordinary conditions the latter can be kept running when the engine is laid off for repairs. The same makers have also contributed the engines that work the tramway trains between the railway station and the Exhibition, which draw three or four loaded cars up rather a steep line for a portion of the distance. They weigh 6 tons, and work at the high steam pressure of 15 atmospheres.

Passenger carriages for the ordinary railway service are contributed by the State line, by Messrs. Rathgeber, of Munich; and a sleeping carriage for the International Company, is shown by the Nürnberg Works. The latter have also a train for the East Coast of Spain, Taragona, Barcelona, and French frontier line, in which the American plan of a through communication is adopted, but without the short coupling, which is almost essential to the proper use of the method of construction. The most remarkable series of objects in this section, and perhaps in the whole exhibition, is the collection shown by the State Railway departments, in which it has been sought to illustrate every detail connected with the construction, working, and management of a great railway. The State lines at the end of 1881 included about 2650 miles, with a rolling stock of 1013 locomotives, 7429 passenger carriages and post-office tenders, and 15,962 wagons of all kinds. The collection is so voluminous that the mere enumeration of the objects occupies ten closely-printed columns of small type in the catalogue. Commencing with laying out, the instruments used in surveying are shown, together with excavating or mining tools, a train of narrow gauge trucks and engine for earthworks, examples of difficult construction in mountainous regions, among which is particularly to be noticed a system of iron frames or centreing used in a tunnel through very loose ground in the Fichtelgebirge, plans of all the principal stations and repairing shops, &c. In the rolling stock department the details of engine and wagon construction are shown by individual examples in various states of completion, together with a very interesting series of objects worn out in service. Among these are some very primitive arrangements used in early times, such as axle boxes with wooden springs, and buffers packed with straw. A full-size locomotive boiler, built in 1852 and put out of use in 1879, is shown in complete longitudinal section, the cutting having been so carefully done that the scale on the tubes and fire-box surfaces is not disturbed; the condition of the boiler as it was when last at work being faithfully represented. Outside the main building the method of laying iron permanent way is represented by a construction train, consisting of traversing crane wagon, with winch for hauling the lengths of rail with their longitudinal bearers attached; a rail wagon, in which twenty lengths of rails are carried in racks, and a second wagon with cross sleepers, tie rods, bolts, and small stores. The crane is 18·2 metres long, with a lifting power of 1650 kilogs., and by its use a gang of thirty to forty men are able to lay and finish about 1200 metres of single line daily. The system adopted is that of a continuous longitudinal bearing, the ends of the rails being separated by cross pieces of four-armed angle section, the fourth arm only projecting about ½in. from the slot between the rail ends. The gauge is kept by tying the rails together with a tension rod, connecting their stems in mid-length. The rails are steel headed, in 9 metre lengths, weighing 25·7 kilos. per metre; the longitudinal iron sleepers without a middle rib weigh 23 kilogs. per metre, and the transverse angle iron stops 14·4 kilogs. each. Up to the present time 57 kilometres have been laid, a further length of 319 kilometres having been laid on Hilf's system, with iron longitudinal and transverse bearers of equal section. Another system with transverse sleepers, by Roth and Schüler, which is still in the experimental stage, is also shown. The same completeness of illustration is extended to the working details of every branch of the service, and the whole forms a telling picture of the requirements of a great railway system, which cannot fail to be of value to those who are unacquainted with the principle of railway management, as nine out of ten average spectators probably are. The Department of Public Works also contributes an interesting series of illustrations of the management of the ordinary roads, navigable and other rivers, among which are to be noticed instruments for gauging the wear of the surface of macadamised roads, and for measuring the depths of navigable watercourses, both being self-registering and plotting their sections automatically.

It would be digressing too much for the purpose of the present notice to enter into detail of the smaller and finer metal work for which Nürnberg and Augsburg have been so long famous, as these objects owe their excellence as much to their artistic proportions as to their technical qualities. This is especially the case with the work of the Augsburg bell-founders, who are unequalled in the beauty of the surface ornament and finish of their wares. One special exhibit must, however, be noticed. It is that of the Baden Aniline and Soda Works, whose principal establishment is actually in Bavaria, at Ludwigshafen, on the Rhine—Lake of Constance—although the headquarters of the business are at Stuttgart. This is the largest chemical manufactory of its kind in the world, covering about 100 acres, and employing nearly 2200 hands, whose weekly wages amount to £2000. The consumption of raw materials amount to 125,000 tons, and of coal 75,000 tons yearly, from which about 15,000 tons of finished wares, the products of the heaviest branch of manufacture, soda, hydrochloric, nitric, and sulphuric acids, being almost entirely consumed in the further elaboration of the more valuable artificial colouring matters. The various products are exhibited in a special building, with views of the different works, and of the Rio Tinto mines and shipping at Huelva; and by way of quantitative illustration the products of a ton of pyrites are represented by full-sized examples. There are on an average in 1,000,000 parts, sulphur 495,000, iron 435,000, copper 30,000, lead 10,000, bismuth 130, silver 26, and gold 0·180. The manufacture of soda is carried on by the ordinary Leblanc process, but the hydrochloric acid is mainly used as such, or converted into zinc and aluminium chlorides, and not into bleaching powder. As specialities of the manufacture may be mentioned that of anhydrous sulphuric acid, by exposing sulphurous acid gas and oxygen to the action of ignited platinised asbestos, and of nitrite of soda, by acting on molten lead with nitrate of soda, which gives peroxide of lead as an accessory product. The main products, aniline and other coal tar colours, are illustrated with unexampled splendour, but the mere catalogue of these beautiful substances reads almost like a treatise on organic chemistry, or rather the contents of one, the chief triumphs of the manufacture, artificial alizarine and indigo, holding prominent places. Another branch of the manufacture is the production of chromium products, especially green oxide free from poisonous admixtures, by the use of boracic acid. That the largest establishment of the class should be successfully carried on in the heart of Switzerland, far away from supplies of the necessary raw materials, speaks volumes for the skill of the management.

KRUPP'S MEPPEN EXPERIMENTS.

These remarkable trials, of which we have given particulars in our last two impressions, present so many interesting questions, that it is well to take the subject of experiment in order. Apart from matters of detail, the following appear to be the leading features of the experiments:—(1) The employment of guns of great length—35 calibres. (2) A very light mortar for siege purposes. (3) Steel common shell with thin walls and large bursting charges, the principle being pushed to the extreme length in "torpedo shells." (4) The regulation of percussion fuses to act specially quickly in some cases and with delayed action in others. (5) Steel vertical shrapnel. (6) The ball-and-socket shield gun, with improvements in detail. (7) Gun on fixed pivot, fired without recoil. (8) Gun on spring pivot mounting.

The two long guns, that is, the 30·5 cm.—12in.—and the 15 cm.—5·9in.—guns are remarkable pieces of ordnance, and have attained very great results. Krupp gives his reasons for the adoption of such length, and the reasons are sound. The question, however, is one of a balance of advantages offered by different proportions. We naturally compare our own new 43-ton 12in. breech-loading gun with the larger Krupp. The two guns are interesting as containing features which contrast most strongly with each other. All new type guns are long, and all new type guns have slightly enlarged powder chambers; but the Gun-factory gun has the latter feature more strongly developed than any comparable piece; while Krupp's gun undoubtedly is unrivalled in length. Let us see how these guns stand as to weights of shot, and charge, and as to results. We happen to have the details of the best result yet obtained at Shoeburyness with the Gun-factory 43-ton gun, which are as follows:—Charge, 400 lb. H_3 powder; shell, 714 lb.; velocity, 2170ft.; pressure, 18·9 tons; stored up work, 23,320 foot-tons. Krupp's 30·5 cm. gun has the following:—charge, 324·1 lb. H_3 powder; shell, 1003·1 lb.; velocity, 1725·8ft.; pressure, 18·3 tons; stored up work, 20,715 foot-tons. We have taken the best round fired by the gun of Colonel Maitland's department, and the round put forward by Krupp. At the same time we are not sure that we are doing quite justice to Krupp, because it appears to us that this round in the Gun-factory gun was more above the average than Krupp's. We are inclined, therefore, to mention another round, which may be regarded as normal, perhaps, in which the velocity was 2050ft. and the stored up-work 20,810 foot-tons; we do not know the exact pressure. Comparing these it will be seen that Krupp gets rather less stored-up work, and his gun is 48 tons 18 cwt., against 43 tons. On the other hand, the pressure in Krupp's bore is less. He certainly would obtain the advantage of a much less violent zone of gas pressure at the muzzle, which is to be considered in the case of firing over decks, &c., for his charge is much less and his gun very much longer. Of course the inconvenience of this last feature may be found too great a price to pay for the advantage claimed. The Gun-factory gun would have the flatter trajectory at shorter ranges. Krupp's increased weight would reverse this at very long ranges. The feature, we think, Krupp might best urge in favour of his gun is decrease of strain. It may appear at first sight as if this was questionable. The pressures, 18·3 and 18·9 tons, are not widely removed, and if the Gun-factory gun had not more stored-up work, the pressures might be the same or even slightly below that in Krupp's gun. The point, however, to notice is the size of chamber. The Gun-factory chamber is 15·5 diameter, while Krupp's is very little larger than the bore of his gun. Equal pressures, then, mean a considerably greater strain on the Gun-factory gun, whose breech, however, it should be observed, is made specially thick—*vide* The Engineer, April 1st, 1881—and then comes the question, How is it that we have a gun consisting, in a great part, of wrought iron subjected to a greater strain than one made wholly of steel? Perhaps this is to be explained by the fact that great increase in length of cartridge involves irregular wave pressures of great magnitude. Thus, moderate as Krupp's pressures now are, it might be unwise to increase the charge greatly. We may by the way observe that the enormous quantity of stored-up energy of 27,460 foot-tons is *calculated* for a 43-ton steel riband gun at Elswick, *vide* Engineer, July 29th, 1881; but we have heard nothing more of this gun, and we do not know in what stage it may be. The other Armstrong 43-ton gun a good deal resembles the Gun-factory gun, but its chamber is less.

The performances of the 15 cm.—5·9in.—gun were very good indeed. In its general character, of course, it resembles the larger gun. The results it obtained against plates were remarkable. It is almost startling to see a shot of 5·9in. diameter pass clean through 14in. of iron, and pass on up the range unbroken and apparently uninjured. Of course, as there is no magic in these matters they must admit of explanation. We calculate the projectile as having 2418 foot-tons work in it, its velocity being 1765ft., and its weight 112·4 lb. This, we find, would give a penetration of 11·84in. of iron in a single unbacked plate. Now, two 7in. plates well put together ought, by Colonel Inglis's rule, to have a resistance bearing a relation to that of a single 14in. plate of 96 to 100. This would give 13·4in., which is beyond the power of this shot. The explanation of its penetration, however, is, we believe, to be found in the thickness of the intermediate layer of wood. As we noticed in first recording this result, Krupp's plate-upon-plate target in 1879 has been objected to for having too thin a layer of wood, namely 2in. It looks, therefore, as if we were determined to find fault in objecting to this one as having the opposite defect. The matter, however, is very simple. As the shot penetrates the front plate it tears a star or cross-shaped hole, bending back the corners of metal in front of it. If these corners find room in the wood layer, the point of the shot gets clear of them, and so enters the next plate unhindered. If, however, they come in contact with the second plate while the shot's point is still in front of them, the shot has a much greater difficulty in acting on the second plate through them, as it were. A long series of experiments was made on this matter at Shoeburyness. In cases where the plates had sufficiently thin wood between them the corners or moulds of the front plate were found pressed and flattened against the hinder one. These experiments led to the adoption of 5in. as a good thickness. There ought to be some relation between the radius of the hole and this distance, so it might be supposed; or perhaps, so long as there is sufficient wood to form a cushion, the distance between the plates should not be increased for any calibre. However this may be, the 10in. interval in this case allowed the front plate to suit its own convenience in getting out of the shot's path. Hence it is a question how closely the work approaches the case of being simply double that of perforating a single 7in. plate. To perforate a single 7in. plate only about 1081ft. velocity would be needed by this projectile of 112·4 lb. weight, implying 908 foot-tons stored-up work. As the projectile had 2418 foot-tons, this would allow a margin of 602 foot-tons over the double of 908 foot-tons. This margin might cover the increased resistance due to backing and target and the continued flight of the shot. At all events, the shot was an excellent one. We wish cordially to admire its behaviour. What we are anxious to guard against is the tendency either to underrate the resistance of properly-made plate-upon-plate targets or of endeavouring to account for a supposed extraordinary penetration by any wrong system of calculation, of which more presently.

The oblique firing also was admirable. The shot broke, but got through 8in. at an angle of 55 deg. with the plate, 35 deg. with the normal. We do not think any projectile has held together on impact at such an angle. The wrought iron plates were undoubtedly good, being English plates supplied from Sheffield to the German Navy.

The question of calculation of penetration brings us to the tables of guns and armour given at the end of the 30·5 cm. gun practice. There is something refreshing in seeing the 80-ton gun and Inflexible class of ships occupying almost the zero ends of the scales of guns and armour. It certainly argues progress, as Krupp points out, with reference to other things. We do not calculate the penetrations, however, to be the same as Herr Krupp makes them. He takes the cross section of the shot, calculating the resistance of armour to shot in proportion to a certain *vis viva* per cm.^{2} of section, a system which favours his long, heavy projectiles. Colonel Inglis, we admit, and our own sub-committee on plates and projectiles, take the cross section also, though he arrives at it another way, namely, by considering the resistance proportional to the volume of metal to be removed—*i.e.*, cross section into thickness of plate—but with this he systematically changes, in the proportion of 100 to 281, a factor which we think ought to be a constant, in a really good formula. This enormous change of factor is found necessary to give correct results showing how very wide of the mark a calculation based on the cross section has been found by the committee who concluded a series of experiments on perforation of plates of varying thickness which is unparalleled in its completeness. Now we do not presume to find fault with the calculated results obtained by the committee which accord with actual experiment. But while it would be fighting against facts to do this, it is equally a matter of fact that the formula has, as it were, to be "cooked" to the extent of a correction of 180 per cent. in extreme cases. Now, if the old formula be applied $t = \sqrt{\frac{W v^2}{2 g D \pi}} \times C$,

or, putting the constants into one factor K; thus

$$t = \sqrt{\frac{W v^2}{D}} \times K,$$

it will be found that the same results which our own committee obtain are got by a change of K to the extent of about 42 per cent. This appears to show that while either formula can be made to yield good results over known ground with an empirical correction, the second one is much nearer the truth than the first; and the former depends wholly on its corrections to give results even approaching the truth, and Krupp certainly does not apply the same corrections. Taking Krupp's velocities, &c., for the 80 and 100-ton guns and the 30·5 cm., we calculate a penetration respectively of 25·4in., 28·6in., and 24·6in. We observe Colonel Inglis obtains about 25·2in. and 28·1in. for the first two guns maximum penetration, which is practically the same as our own calculation. We should calculate the 43-ton gun's penetration as 24·7in. No doubt Colonel Inglis would have nearly the same, but probably not Herr Krupp, who no doubt prefers his own basis. At all events, we have fairly explained our objection, and in general terms how we should proceed on a system which is based on the very extensive series of experiments made in this country. One word more. Though actually taking the results of our own committee, we have undoubtedly expressed disagreement with them as to the mechanical conditions of the problem. We consider that their own corrections prove our case for us. Reason also, we think, goes with the conclusion to which we have been brought, namely, that in *wrought iron* the principal resistance is due to, and work is performed in, the tearing asunder of the armour by the sharp point and ogival wedge head. Everything supports this view; the sharper the point the better it gets to its work, commencing the tear at the back of the plate before the full resistance is felt by the shot's head.* With steel we admit the case is quite different, but there experience shows that the cracking up of the steel bears very little relation to the diameter of the shot. Where the shot does not bury its head in the armour but breaks it up, the diameter can only affect it in the act of breaking, and common sense seems to us to suggest that the injury is proportional to the stored-up work in the shot, which is in some shape impressed on the plate. In no case can we admit that either facts or theory supports the cross section system of calculation. A system which depends wholly on volume implies that the resistance is simply that of inertia; that is, a resistance of the same nature as that of water. The old system implies only a resistance of cohesion. Neither is correct, but surely the latter is the nearer to the truth.

It follows from what we have said that we reject the table of the series of armoured ships given by Krupp. But we object to other things than the column we have referred to. Herr Krupp, for example, does not explain on what principle he assigns a resistance of 6·4 to 17·7in. of "steel probably" and only 5·5 to 18in. of compound armour. As a matter of fact, we should absolutely prefer the latter shield to the former, except for a single blow. We are indebted, however, to him for calling attention to the fact that foreign armour is rapidly outgrowing our own, though such armour is applied only to limited parts of the ships.

We now come to No. 2, the light 21 cm. mortar. The work done with this is admirable. The accuracy is great, though we do not observe anything so striking as the practice at the Inflexible deck target in 1879. We regard mortar fire as capable of forming a defence to a harbour which would make it suicidal for ships to anchor and engage as they did at Alexandria. The steel common shells are so obviously good that it appears to us to be a mere matter of time before they come in generally, including the "torpedo shell." The regulation of percussion fuses deserves still more attention than we have given it in this country. It is difficult to make fuses act to a nicety on service. At Alexandria we would have compounded for our shell all exploding at all, without contending for the exact rate of the process. This is owing to the velocity being imparted more gradually to projectiles in new type guns, so that the fuse is not put in action. These fuses were made for old type guns, and require a little modification. In the Royal Laboratory, however, considerable attention has been given to the perfecting of delayed action fuses for firing at armoured structures. The subject is a difficult one. The vertical shrapnel was proposed in this country in 1870, but never got a fair trial till now. It has been recently tried at Lydd. We believe that it is also a mere matter of time when it is adopted. Let us hope that no stage of the process of instruction will consist in Krupp's vertical shrapnel being fired at us when we have none ourselves. The idea of the strong steel envelope acting as a gun is an improved form of what General Boxer spoke of. The question is whether it does not need very great skill and accuracy, for its success for the steel envelope certainly causes the shrapnel bullets to carry close, and at high angles it appears to us there might be a good deal of uncertainty as to the direction of the axis of the shell at the moment when it behaves like a gun, and discharges its bullets. At present we should think it a very uncertain thing on service, and should perhaps, prefer the shell to break up in vertical fire. The ball-and-socket muzzle pivotting gun we "believe in," and have done so since we first saw it at Meppen. The speed, safety, and accuracy are so great that in many positions the gun would have answered its purpose long before any serious injury could be done to it, we think, and long before it "racked" itself to pieces. The pivot guns.—There is little to be remarked on the report on these guns. They are well worked out in detail, and as Krupp remarks, a thorough trial would be most interesting.

Altogether the programme of experiments was most interesting, and one of which Krupp may well be proud. The great flaw in it, in our opinion, was that no one from this country was on this occasion invited to witness it. We believe that Herr Krupp looks upon Sir John Adye as a self-willed man with darkened views. We admit that he is not wholly enthusiastic about steel breech-loading guns, but we hope there are men in the country who would speak cordially as to anything that they saw was good, and Herr Krupp might safely have trusted them to report on such a programme as his

* Of course the use of t^2 (t being the thickness) is quite empirical, but it is nearly correct in the case of high velocities and thick armour, though considerably wrong in armour which is thin in proportion to the diameter of the shot.

HAULBOWLINE DOCKYARD EXTENSION WORKS, QUEENSTOWN, IRELAND.

Considerable interest has been taken both by the public and profession in the large extension works at Portsmouth and Chatham, and complete accounts have been published of them, but the works at Haulbowline have not been brought forward in any special manner up to the present time, and we therefore propose to give a description of them here which will be found interesting. The island of Haulbowline in Cork Harbour is half a mile distant from and exactly opposite Queenstown. It contains 28 acres, and is divided into two portions, Ordnance and Admiralty—the former is a military store, and the latter a victualling establishment, naval hospital, stores, water storage tanks, and official residences, &c.

The extension works are being constructed on the site of a large mud bank on the east side of the island, beneath which is the limestone rock of the carboniferous group. This lies at a considerable dip to the north, so that at one part of the works foundations are being carried down through the mud no less than 27ft. to reach the rock, and at the opposite end the rock almost rises to the surface. The works consist of a deep water basin 720ft. long by 560ft. wide, equal to nine acres in extent, and 39ft. to 43ft. deep at high water. Also a dry dock in connection with this basin, and a large area of reclaimed land for workshops and other buildings common to naval yards. The whole is shown on the general plan, Fig. 1.

Along the west side of basin the wall is completed, also the greater part of the south wall—including the dock entrance—and considerable progress is made with the basin entrance from the harbour; it is a duplicate of the dock entrance, but being situated in a locality where the rock has dipped considerably, the masonry has to be carried down from 12ft. to 27ft. below the bottom of the basin—a work of an exceedingly difficult and tedious nature; moreover the rock has a very steep inclination from W. to E., rendering it necessary to form benchings in it to ensure security against any tendency to slide.

The foundations for a portion of the river entrance were made by means of brick cellular caissons devised by Mr. Charles Andrews, Mem. Inst. C.E., who was superintending engineer up to August, 1880, when he retired from that post and was succeeded by Mr. John Orme Andrews, Mem. Inst. C.E., and they are fully described in the Minutes of the Institution, vol. lxiv. These caissons were built upon a timber curb placed on the ground, and the earth was excavated from the interior whilst the walls were being built and the sinking continued until the rock was reached, when the cells were filled with concrete and the permanent masonry commenced thereon. The invert is made of solid concrete resting on the rock, and the invert face is finished in superior concrete, and presents a very good appearance without incurring the great cost of dressed stone.

The wing and north walls of the basin are now in progress, and present a fine example of deep foundation work; the rock occurs at about 27ft. below the bottom of the basin, and the coping of the wall being 39ft. in height, it follows that the total height of this wall is no less than 66ft. It is shown in Figs. 3 and 4. It is designed with solid concrete piers placed at equal distances apart, and of a peculiar dovetail form or plan to prevent the backing from being forced through the spaces between the piers. This would probably happen if the piers were rectangular, as the soil is very treacherous; but it is anticipated that with such an amount of contraction in the width, such a tendency will be checked. In executing this work it has been preferred to adopt sheet piling and open excavation rather than caissons. The sheeting is driven with a batter of 6in., in order to enlarge the base, and when completed the excavations are commenced, and as the removal of the interior progresses the shores and wales are fixed. Finally the rock is reached, and the entire space is filled with concrete, 1 of Portland cement to 8 of sand; the ground between a pair of piers is then trimmed and punned to a curve to form an earth centreing, upon which a massive concrete arch is formed; the wall is continued upon this in concrete with limestone ashlar face.

The excavations of the basin are in a forward state; the general depth is now about 25ft. below coping level, and there remains about 14ft. to 15ft. more to remove. In order to expedite this part of the work the system of skips and steam hoists has been superseded by an inclined plane and winding drum, by means of which a much greater quantity is removed and at a greatly reduced cost; the labour of excavating and filling the wagons is done by convicts.

The dock is of unusual dimensions, and when completed will be the finest and largest in the world. The length was intended to be 410ft., but an increase has been made with a view of accommodating any specially long vessel upon a sudden emergency—such as the American liners which frequent this port—so that the present design gives a total length of 485ft. The breadth of floor is 68ft.; breadth between copings, 115ft.; width of entrance, 94ft.; depth of water over the invert, 32ft. 8in. at high water spring tides, at which level the water in the basin will be maintained. Fig. 2 shows a sectional elevation; Fig. 5 a transverse section; and Fig. 6 an enlarged plan. It will be seen that an arcade of an ornamental and massive character extends along each side. This carries the middle braced altar, and also the iron track upon which a permanent gantry will work. The openings between the piers afford facilities for access to the ship's side, whilst the subway or tunnel behind the piers affords a complete means of communication to any part of the dock clear of all shores and obstruction.

The present state of the dock is well advanced. The entrance is completed ready for the floating iron caisson. The floor is laid for a distance of 340ft., and the sides for an equal length nearly up to level of middle broad altar. The excavation of the rock at the base is in a forward state, and the whole is making rapid progress. The arch stones of the arcade are of granite, but with that exception the whole of the stone used is from limestone quarries in the neighbourhood, being two, seven, and thirty-two miles distant. It is of a bluish tint, very hard, and quite unaffected by weather. The finest tool marks are not altered after an exposure of forty years; but it is of a laminated structure, and requires careful selection. The cost of the dock limestone, dressed and delivered alongside, is 3s. 3d. per cubic foot, and basin stone—coarser in dressing—3s.

The floor of the dock is not of the usual invert form; it was considered that with such a great breadth the radiation of the joints would be too small to be of any use; hence the floor consists of rectangular stones, laid on the solid rock, and perfectly attached to it with Portland cement mortar. It is upon this perfect contact and adhesion to the rock that reliance is placed against any uplifting of the stones by water pressure beneath. The progress of the dock has been much impeded by curious beds of gravel along the west side with springs of sea water. The occurrence of these beds of gravel in the midst of a limestone formation presents a geological paradox; it had been supposed that the limestone had undergone a gradual change, and samples were found in which an apparent conversion had taken place from one material to the other; however, the most probable thing is that large chasms existed in the limestone, which became filled with drifted gravel. It is not known to what depth this gravel extended, but excavations were made to 15ft. below the floor with a view of seeking a bottom free from springs, but no rock could be found. As this depth, if filled with solid concrete, is nearly sufficient to counteract the upward water pressure, it was considered unnecessary to sink deeper.

In connection with the dock there is a low level suction culvert leading to the pumping engine, and a delivery culvert leading to the outfall in the harbour. The plan shows the pumping station and the several culverts. The penstocks can be manipulated in such a manner that water drawn from the dock can be ejected directly into the harbour, and in case of any leakage from the basin water can be pumped in either from the dock or the harbour. Again, if it should happen that the dock has to be emptied at the time of low-water in the harbour, there are means by which the water in dock can be drained through a special culvert to low-water level.

It is not yet decided whether the permanent pumps will be centrifugal or reciprocating; the duty will be to empty the dock in about five hours. The total contents amount to nine millions of gallons, and deducting, say, 6000 tons for displacement of a ship, there would be 7¾ millions of gallons to be pumped, or 35,000 tons. The first half of this quantity, by reason of the small lift, will be pumped out in two hours, and the water will then be sufficiently low to expose the broad altar, when the shoring and other work can be commenced; the remainder of the water will be pumped out in three hours. The dock is provided with a filling culvert at the entrance, in communication with the basin, and there is a similar culvert at the basin entrance in communication with the river or harbour. Space is reserved for a second dock should it be required at any future time.

The works are carried on by a combination of hired and convict labour, the numbers being 380 and 230 respectively; the hired staff consists of masons, 25; carpenters, 26; miners, 48; labourers, 225; boys, 14; sundry trades, 41; the average wages all round are 17s. 11d. per week. The convicts consist of excavators; stone-dressers, 60; stone-breakers, 24; sundry, 146, The works being situated on an island, it was necessary to make special arrangements for conveying such a large body of men to-and-fro from Queenstown and neighbouring villages. To carry on this daily communication the following craft are employed—four launches, 42ft. long, each carrying sixty men; four 25ft. cutters, each twenty-four men; and fifteen others, consisting of pinnaces, whale boats, and gigs. The plant consists of two steam and six hand travellers on gantries, two steam cranes, two geared locomotives, eight portable and one fixed engines, two chain and one centrifugal pumps, one winding drum, one 52in. circular saw, another of smaller size, besides lathes and other tools.

The works were under the charge of Mr. Neville, C.E., from 1871 until his death in 1874, when he was succeeded by Mr. Charles Andrews, C.E., who had previously constructed the Somerset Naval Dock at Malta. This gentleman retired from the service in 1880, and the Director of Works, General Lesley, R.E., C.B., selected Mr. John Orme Andrews, C.E., for many years connected with the Portland Breakwater, as the superintending civil engineer, under whose charge, assisted by Messrs. Pain and Macfarline, the Clerks of Works, and staff, the works are being successfully advanced.

THROUGH THE ALPS BY LOCOMOTIVE.

AN ENGINEER'S TRIP OVER THE ST. GOTHARD.

The station-master had already blown his whistle, and the engine had responded with a shriek, as I hurried past first, second, and third-class carriages, and past a long row of covered goods' wagons, to the head of the train due to start from Lucerne to Milan at 2 p.m on a certain afternoon in August last. By the time I reached the locomotive the station-master had given his final whistle of confirmation, and the wheels were already in motion. Just one moment to catch hold of the side-bars and pull myself up the steps to the foot-plate, just another to wave adieu to the friend to whose good offices I was indebted for the treat before me, and the train steams out of the station, whilst I turn to the somewhat astonished driver and hand him a green card, countersigned by an engineer of the railway, to explain why I, a totally unknown Englishman, claim a right to standing room on his engine as far as it will take me on my journey.

This driver was himself a good specimen of his class, as met with on Alpine railways—less rough, but at the same time less tough and less wiry than his counterpart in England; probably better educated, and possessing a continental politeness of manner, and readiness to give explanations and point out matters of interest, which is certainly agreeable to a chance stranger such as myself. In working his engine, he is prompt, careful, and vigilant, and he evinces more anxiety than would be expected to get away from stations and keep up to his time. My present "guide, philosopher, and friend" had hardly got clear of the station before he lighted a cigar, and in a few minutes his fireman followed his example. This, at least, is not in accordance with English ideas, but I am bound to say his smoking did not seem in the least to interfere with the discharge of his duties. Of the quality of the tobacco—so-called—I will not venture to speak.

Before describing the incidents of the journey, it will be proper to say a few words as to the route I am taking. For a general description of the St. Gothard Railway, as first projected and as actually constructed, I may refer to an article which appeared in The Engineer of June 2nd. The name of the St. Gothard system is given to the whole of the line connecting Lucerne with Milan, but it is broken up for convenience into several divisions. Two of these—one at each end—are not yet completed. That at the Swiss end is the first portion of the line, which is intended to run from Lucerne along the northern shore of the Lake to Küssnacht, and across a neck of land to Immensee on the Lake of Zug. In place of this the traveller is now taken out of Lucerne as if bound for Olten or Basle, but immediately diverges on to a line which leads him to the north end of the Lake of Zug, and then turning to the southwards along the western bank brings him to Immensee. The distance by this line is not materially greater than that by the proposed new route, and though the latter would seem to offer no special difficulties of construction, and is laid down so as to avoid

spoiling the town of Lucerne, there seems very little reason why the expense of its construction should be incurred. of the

From Immensee the line continues to the southern end Lake of Zug, and then rounding the Lowerzersee, reaches the shores of the Lake of Lucerne at Brunnen. From thence forward it has no choice but to follow first the shore of the lake and then the valley of the Reuss up to the great tunnel, and after traversing this to keep the valley of the Ticino down to Bellinzona. Here there is again a divergence. The Ticino falls eventually into the Lago Maggiore, and it is intended that the main line shall follow the course of the river, pass down the east shore of the lake by Pino, and unite itself with the network of Italian railways at Luino. This latter portion, however, is not completed, and the traffic at present takes advantage of a branch line which mounts from Bellinzona along the slopes of the Ticino Valley, passes under Monte Cenere, and then leads past the lakes of Lugano and Como to the terminus at Milan.

Having thus a general idea of the journey before us, we may with satisfaction resign ourselves to the impressions of the moment. The locomotive on which I am standing is a tank engine, six wheels coupled, and of the ordinary Swiss construction. What specially strikes an Englishman in these engines is their lightness of appearance compared with the work they have to do, and at the same time the care with which every pound of weight is utilised, if possible, for adhesion. For railways where economy, not speed, is the first consideration, this is probably the best principle to adopt. The pressures are high, the gauge before me registering from 8½ to 9½ atmospheres. The coal in the bunkers is, alas! that of Saarbrück, well, or rather, ill-known to all travellers in these regions for its dense volumes of dirty and sulphurous smoke. The engine is provided with a Hardy vacuum brake—reserved, however, for emergencies, and apparently little used—and also with a hand brake of peculiar construction. The bringing of the blocks up to and away from the wheels is effected by throwing a weighted lever into one or the other position. An ordinary screw brake-gear moves with this lever, and when the blocks have thus been brought up to the wheels, they are tightened upon them by turning the screw as usual. This enables the brakes to be put on or off with very great rapidity. The device does not seem widely adopted, however, as this was the only engine on which I saw it.

Meanwhile the train, after following for about a mile the line towards Olten, which I had traversed in the opposite direction on the preceding day, bends to the right, and crosses the green and foaming Reuss by a bowstring girder bridge of five spans, each span being set at an angle to the preceding, so that the whole bridge is on a sharp curve. Passing through a short tunnel, I find that we have left the valley of the Reuss, and are running along the bank of a narrow and picturesque lake—the Rothsee—through a country of rich orchards, meadows, and cornfields, with noble pine forests hanging on the slopes of the hills above, and slate quarries visible amongst them here and there. Long may it be before their produce succeeds in displacing the picturesque brownish-red tiles, which form the covering of the houses around, and in giving to a Swiss village, when seen from above, the hideous uniformity of Wales.

Passing two small stations, Ebikon and Gisikon—names which have a curiously Latin flavour about them—we reach the junction of Rothkreuz. Here we again look down upon the Reuss, but at some little distance below us; the little dale of the Rothsee running nearly parallel to, and here opening out into, the main valley. Here a branch, rising up to us from the main line northwards, brings on to the St. Gothard system all the goods traffic from Switzerland and Germany, and probably it would be difficult to find a spot where wagons belonging to so many different nationalities are gathered together. During a few minutes' halt, as the engine ran past the sidings to the water tank, I noticed trucks bearing the various symbols of Austria, Italy, Saxony, Alsace, the Empire of Germany, Baden, and Switzerland, and doubtless others might have been found by a more extensive search. This at least speaks well for the traffic on the new route; and this impression is confirmed a little later, for as we are waiting some miles further on at the station of Schwyz, the "schnellzug," or afternoon express from Milan, comes thundering by on its downward road—two eight-coupled engines leading the van, and some twenty carriages, all of them well filled with tourists and travellers, swaying and plunging after them. The driver remarks with pride that the express trains both ways are always of this size; and it may be said in a word that the traffic, since the line was opened, has exceeded all expectation, and, as my readers will be aware, has evoked much hostile clamour and many covert attacks from those interested in the competing line through France. Of these the most amusing specimen is perhaps a letter to the *Times*, printed in large type and dated from Milan, the internal evidence of which proved conclusively, not only that the writer had no knowledge of the subject, but that he had not travelled along the real St. Gothard route, from Calais to Switzerland, at all.

But I have here, so to speak, run ahead of my engine. I must return to the station at Rothkreuz, whence starting about 2.45, I almost immediately obtained my first look over the beautiful lake of Zug. We are, however, at too high an elevation to descend at once upon its shores; but turning sharply to the right in a cutting through old glacier detritus, or "moraine," we hold our course southwards, exactly as if we meant to tunnel through the mass of the Rigi, which towers directly in front, with its huge hotel watching us over the edge of the "kulm." Bending, however, slightly to the left, we reach the station of Immensee, marking the spot where a mere neck of land divides the lake of Zug from that of the Four Cantons, and where the direct line to Lucerne, if ever completed, will branch off from our present route. From hence the line winds at some height above the lake, along the steep and lofty sides of the Rigi, among chesnut trees and birches, interspersed with huge boulders of conglomerate that have fallen from the cliffs near its summit. Soon we find ourselves at the station of Arth, overlooking the house roofs of the town so named, which clusters at the southern end of the lake of Zug. Close by is another tiny station, the terminus of a somewhat remarkable railway, to which no parallel is to be found in the United Kingdom. From this station a single carriage, propelled from behind by a rack-locomotive, will shortly be climbing a railway, which, like a flexible ladder, winds round and up the formidable slopes of the Rigi, till it leads at last to the very summit. There are two such lines up the Rigi, and five or six more in different parts of Switzerland. But we have no time now to pursue this curious branch of railway engineering. The train has left the Arth station, and for a mile and a-half or so makes its way amongst a chaotic jumble of huge stones and blocks of conglomerate, wedged in sand and shingle, and spread in a vast sheet of ruin over the whole bottom of the valley. The surface is a confused mass of hillocks, here and there enclosing a pool of water, and supporting nothing except a few dry heaths and stunted pines. This is none other than the remains of the famous "bergfall" or landslip of the Rossberg, which took place in September, 1806; and above us on the left towers the mass of the Rossberg itself, showing the enormous and still unhealed scar—looking as if a great ledge of the mountain had been blasted away by some giant race of quarrymen—whence, on that disastrous day, the mountain side slid with thunder and havoc into the valley. In the original trace of the line, provision was made for a tunnel through this mass of *débris;* but more cautious, and probably wiser, counsels prevailed, and the line is now carried mainly in cuttings, the slopes being cut back at about 1 to 1, at which they seem perfectly secure. It is curious, indeed, to notice the great quantity of fine sand and gravel which is everywhere mixed with the stones, and often encloses them completely. The rock itself, a compact conglomerate, no doubt lies on a bed of sandy clay, the lubrication of which—so to speak—by the infiltration of water brought about the catastrophe; but this sand would naturally be found rather at the bottom than near the surface of the *débris*, and one seems drawn to the conclusion that a large proportion of the conglomerate itself must have been reduced to its original constituents of sand and pebbles by the grinding and shattering of the descent. Leaving, however, all theories behind us, we wind round the shores of the Lowerzersee—a pretty sheet of water, which the Rossberg fall robbed of much of its original area—leave to our left the ancient town of Schwytz, nestling under the savage limestone peaks of the Mythen, and turning to the westward along a broad and fertile valley, reach at 3.50 the village of Brunnen on the lake of the Four Cantons, just at the angle where the magnificent bay of Uri unites with the main reach, which stretches past Gersau and Vitznau towards Lucerne.

(*To be continued.*)

THE EARTHQUAKES AT PANAMA.

In view of the construction of the Panama Canal, the frequency of earthquakes along its route is a subject not without interest. The *Panama Star and Herald* of September 14th gives details of several earthquake shocks which had visited the isthmus during the preceding week, doing much damage, but, fortunately, only causing two deaths. At 3.20 a.m. on Thursday, the 7th, the inhabitants were aroused from their beds by one of the longest and most severe earthquake shocks ever experienced in the city. It was preceded by a hollow, rumbling noise. The motion was wavelike, and proceeded almost directly from north to south. The first and most severe shock must have lasted at least thirty seconds. The shock had hardly terminated when the streets were filled with people, many of whom sought the outskirts of the town in order to avoid danger from the fall of edifices. A second and milder shock occurred about half an hour after the first. The Municipal Building and Assembly Rooms, under which the Cascada is situate, were much damaged. The whole of the massive balcony fell bodily into the square, dragging with it the roof and all adjacent timber. The cathedral also suffered severely. Almost the whole of the ornate pediment, composed of heavy blocks of masonry, fell through the roof or on to the steps leading to the principal entrance. Every arch in the nave was cracked and split, and large stones and pieces of cement fell from them. The side aisles were seriously damaged, and an expenditure of at least 50,000 dols. will be required to restore the building. Innumerable private houses were damaged. The walls of the Canal Office were cracked in several places, and an expenditure of several thousand dollars must be incurred to render the building as safe as it was before the shock. Outside the city a number of houses suffered. The tower of Malambo Church fell, and a piece several yards square of the roof of Santa Ana Church tumbled in. General Aizpuru's house in the Calle Real suffered severely, as did also that of Don Manuel Hurtado, in front of the Government House, and many others, including the Grand Hotel. The Pacific Mail steamship Clyde, arrived from San Francisco, reported that the earthquake was severely felt on board. Passengers declared that it appeared as if the vessel were lifted bodily from the sea and allowed to fall back. The effects of the earthquake along the railroad were most marked. The stone abutments of several of the bridges were cracked and split, and the earthworks sank in half a-dozen places. All along the railroad track the earthquake was severely felt. At Emperador, Gatun, Matachin, and all the canal stations, much alarm was created. In several places where the direct action of the shock appears to have made itself most strongly felt, the rails were curved as if they had been intentionally bent. The severe shock on the morning of the 7th was followed during the day by several others of less intensity, and at 11.30 p.m. a sharp shock alarmed the whole city and drove the people from their houses to the squares. Hundreds of ladies preferred to pass the night on mattresses, couches, and chairs in the public *plazas* to running the risk of being crushed to death in the houses. Another slighter shock occurred at about three in the morning; but, fortunately neither it nor its predecessor added further ruin to that already incurred in the city. All the shocks were felt on the islands in the bay, and some houses suffered at Taboga. La Chorrera was very unfortunate. The church and the cemetery are a mass of ruins, and a number of houses fell. A bakery took fire, and it and the adjoining house were totally destroyed. Between Gavilan and Punta Mala a crevasse opened ten metres in width. On the morning of the 7th, at about 3.15, the residents of Colon were aroused by the earthqnake shock which had caused so much alarm and damage to the whole isthmus. The duration of the shock was fully sixty seconds, and was so severe that the whole populace rushed into the streets as rapidly as their feet could carry them; the greatest alarm prevailed. About half an hour afterwards another shock was felt, but much lighter than the first. Several buildings were more or less damaged, including the French Consulate, the house of Mr. F. R. Cowan, the Panama railroad freight house and wharves, the International Hotel, &c. One small house was wrecked completely, and one unfortunate occupant, a native, was killed, two others having each a leg broken in their haste to escape. A deep fissure was opened in the earth from the south end of the freight house for a distance of about 400ft. along the walk leading in the direction of the ice-houses. Many buildings were moved slightly from their foundations, but on the whole remarkably little damage was done. On board the vessels in the harbour the shock was also felt very severely. About 1 p.m. another much slighter shock was felt, and during the succeeding night two more slight disturbances were reported. It may be of meteorological interest to observe that the sea at the time remained calm, the atmosphere quite clear, and the stars and waning moon remarkably brilliant. Soon after, say, about four o'clock, a slight fog wafted from inland; no rain fell. All day an ominous calm prevailed without rain, with fluctuating barometer and excessive heat. Another slight shock occurred at Panama on the morning of the 9th, a little before five o'clock, but fortunately no damage was done. A number of families passed the night on board the vessels in the bay, and many in the public squares, and on Saturday a great many occupied the light cane houses on the outskirts of the city and at the Savannah. The same shock was lightly felt in Colon and along the railroad track. All day on Saturday no shock was felt, and the night passed quietly. At midday on Saturday there was a marked change in the atmosphere, and, with a refreshing shower which fell, the murky, sultry, air of the previous days entirely disappeared. The earthquake destroyed the little church at Cruces and damaged a few houses. The rumours of a volcanic eruption at Chagres are entirely without foundation. The earthquake was felt there, did some little damage, and opened a few cracks in the ground. The earthquake of the 7th was felt at the Pearl Islands, in the bay. At San Miguel one of the walls of the church fell in, and the inhabitants took the saints out and carried them in procession in the hope of preventing the repetition of the convulsion. They were panic stricken. At Donoso, Govea, and Rio Indio a number of shocks were felt, and the people were much frightened. At Miguel la Borda, thirty-five miles from Colon in the direction of Bocas del Toro, the tide rose to an unusual height and flooded some of the houses, which are built on the beach almost on a level with the sea. The earth sunk in about a dozen places. The Governor of the district writes officially that several boiling springs suddenly appeared, some of which threw hot water to a considerable height. The bronze statue of Christopher Columbus at Colon was shaken free from the stone pedestal in which it stands, and moved about 4in. from its former location. The steamer Mediator, arrived at Colon, reports that a slight shock of earthquake was felt in Carthagena on the morning of the 7th. No damage was done. Letters from there, dated the 9th, scarcely mention the occurrence, thus proving the little importance attached to it. Letters have been received from the towns of La Villa, Chitré, Macaracas, and Natà, all in the State, announcing that several shocks have been felt, but that the material of which the houses are built—bamboos and adobes—resisted the movements, and they suffered no damage. At La Villa the bells in the church rang several times. Two or three slight tremblings were experienced in Panama during the night of the 12th, but they caused no alarm, and many people were returning to their houses.

The Largest Electro-plating Establishment in the World.—Prof. Silliman, of Yale College, pronounces the electro-plating establishment lately acquired by the Postal Telegraph Company, at Ansonia, Conn., the largest in the world; yet its capacity is soon to be trebled. The works are employed in copper-plating the steel wire used in the company's system of telegraphy, and now deposit two tons of pure copper a day. The steel core of the wire gives the required tensile strength, and the copper covering extraordinary conducting power, reducing the electrical resistance to such a degree, the company claims, that San Francisco may be brought, telegraphically, nearer New York than Chicago is now. When the plant is completed, three 300-horse power engines will drive dynamo machines to supply current for electro-plating thirty miles of wire a day, the wire carrying 500 lb. of copper to the mile. In the process of coating the wire is drawn slowly over spiral coils through vats containing copper in solution, until the proper thickness of deposit is obtained. The first line of the Postal Telegraph Company will run from New York to Chicago by way of Binghamton, Elmira, Corry, Pa., and Cleveland, Ohio; but there will be no way stations, the company preferring to do what is called "trunk line" service. The lines will be constructed with forty poles to the mile, and are to be completed by December. A line is promised to Boston by the same date.

Presentation to Mr. A. M'Donnell, C.E.—On Saturday evening a very interesting gathering took place at the Inchicore Reading-rooms of the Great Southern and Western Railway, for the purpose of making a presentation and address to Mr. A. M'Donnell, on the occasion of his resignation of the office of locomotive superintendent in connection with this railway. Mr. M'Donnell has filled this position since the commencement of the year 1864, and in 1877 the carriage and wagon departments were placed under his charge. He has now resigned for the purpose of undertaking the more important office of superintendent of the same departments of the North-Eastern Railway. During his period of office on the Great Southern and Western Railway he spared no exertion in forwarding the interests of the company and *employés* alike, and as a consequence he bears with him to his new position the best wishes of all. Under his fostering care the process of home manufacture in the works of the company has made steady progress, and, thanks to his unremitting energy, all the rolling stock necessary for the different lines is now produced in the works at Inchicore. It is but natural that the kindness and care so evinced by him to the men under his charge should have evoked a feeling of respect and friendship on their part. That this was so is fully evidenced by the testimonials of which they were the donors. The presentation took place in the dining-room of the Institute; but previous to the ceremony, Mr. M'Donnell was entertained at dinner. The room had been very tastefully decorated for the occasion. At six o'clock over 360 sat down to dinner. Mr. J. C. Colville, chairman of the Great Southern and Western Railway, presided, and amongst the guests present were Col. G. Thompson, Messrs. Joshua J. Pim, Samuel H. Close, and E. Pike, directors; Drs. Haughton, Carte, Robert McDonnell, and Tweedy; Revs. Thomas Mills, M.A., and F. Skinner; Messrs. S. Symes, F. M. Scott, J.P., J. Fitzsimons, J. M. Burke, C. R. Riley, H. W. Croker, H. A. Watt, J. R. McCready, J. M. Ward, and many others. The presentation was made on behalf of the subscribers, accompanied by an address, which, after congratulating Mr. M'Donnell upon his new and more lucrative appointment, gave expression to their feelings of regret at his removal, and their appreciation of his constant efforts to promote their welfare irrespective of creed or party; and having referred to the success which attended his efforts in the promotion of Irish manufacture in their works, concluded with a prayer for Mr. and Mrs. M'Donnell's future welfare. The service of plate consists of three massive cups or bowls, the centre piece having the following inscription: "Presented to A. McDonnell, Esq., by the *employés* of the Locomotive and Carriage Departments, Great Southern and Western Railway, Ireland, October, 1882." In addition to this service, a richly chased silver salver had been prepared and engraved by Messrs. Waterhouse and Co.; and, as a fitting present to Mrs. M'Donnell, a pair of fine gold bracelets, of Irish design and manufacture, obtained of Messrs. William Gibson and Co., of Belfast. The address was read and the presentation made by Mr. Patrick M'Donnell, one of the workmen; and in responding, Mr. A. M'Donnell said, the sole secret of the success of the Inchicore Works in the development of industry had been the confidence which had been shown and reciprocated alike by directors, himself, and his *employés*, and he took advantage of his position as an Irishman to point out that the want of confidence which, unfortunately, existed in his country, prevented the contented and prosperous state of things which existed at Inchicore extending throughout the island generally. Of the ability of the Irish nation to compete successfully in the commercial race he never had any doubt. The issue of their country rested in their own hands, and only by simple, honest attention to their own business would brighter days return for Ireland. He had striven to do his best for his directors on the one hand, whilst respecting the welfare, customs, and even the prejudices—as far as they did not interfere with the legitimate relationship of master and servant—of his *employés;* and he knew not of any position which to him could be more honourable, and of which he could feel more proud, than to stand between the chairman of his company and his workmen and hear from them their joint approval of his conduct. He had striven throughout to do his best, not only for those immediately connected with him on the Great Southern and Western Railway, but for his country, in whose welfare no one possessed a deeper interest. The chairman proposed the health of Mr. M'Donnell, and in a few graceful sentences touched upon his long connection with the company, their regret at losing his valuable services, congratulating him upon his new appointment, and expressing the hope that success would continue to attend him in his future career. The toast was drunk with all honours. In proposing the health of his successor, Mr. J. A. H. Aspinall, Mr. M'Donnell referred to the great assistance which he received from that gentleman during the past eight years, at the same time paying a high tribute of praise and respect to Mr. J. C. Park, now locomotive superintendent of the North London Railway at Bow, under whose energetic management the reorganisation and extension of the works here began, and which Mr. Aspinall had ably continued. He most thoroughly endorsed the sentiments of confidence in Mr. Aspinall which the chairman had expressed, and said no appointment would have given him so much pleasure, or, he believed, would have been so advantageous alike to the company and the workmen, as that of the assistant who had served him so well and controlled them so justly in the past.

THE NEW BRIDGE AT PUTNEY.

There are some structures that gradually assume a picturesque aspect just as they cease to be safely useful, and this is the case with the Putney Bridge, except that, perhaps, its period of doubtful safety has been greater than that of its picturesqueness. Fortunately the new bridge by which it is to be replaced, need not exactly occupy its site, and the old structure will serve the traffic during the construction of the new one, and the approaches will be improved. The unsightly aqueduct will disappear, and the water mains will be carried under the footpaths of the fine new granite structure which we have illustrated in our impressions of the 29th ult. and 6th inst. With this impression we give illustrations of the centering and their supports upon which the piers will be built. The contract for the construction of the new bridge and the extensive approach and improvement works connected therewith has been placed in the hands of Mr. John Waddell, of 4, Victoria-street. In description of the several drawings we take the following from the specification relating to the works to be carried out:—

The works described herein have reference to the construction of a granite bridge across the river Thames, with convenient approaches to connect the shore ends of the bridge with some of the existing thoroughfares in the parish of Putney, county of Surrey, on the southern bank of the river, with other thoroughfares in the parish of Fulham, county of Middlesex, on the northern bank of the river Thames; also to the entire removal of an existing wooden bridge, known as Putney Old Bridge, from across the Thames; likewise of a temporary aqueduct and pipes in connection therewith; also to the removal of an existing aqueduct, formerly the property of the Chelsea Waterworks Company; the construction of a draw dock connecting the Windsor-road and the towing-path with the southern foreshore of the river; alterations to St. Mary's Churchyard; building of embankment, parapet, and retaining walls; the laying of new water mains beneath the footways of the new granite bridge and along its approaches to the existing mains; construction of new sewers; besides other minor works in connection with those above enumerated.

Levels.—The levels of the aforementioned approach roads to the new bridge will rise from points of junction with the existing thoroughfares, in the manner more particularly defined upon the contract drawings, to the summit levels of the roadway over the bridge.

Spans, &c.—The granite bridge shall consist of five arches, each with level springings 9in. above Trinity datum. The five arches shall be proportioned thus:—Central arch: Span, 144ft.; versine, 19ft. 3in.; central headway, 20ft. above Trinity datum; radius of voussoir intrados, 144ft. The two arches adjoining the central arch: Spans, 129ft.; versines, 16ft. 3in.; central headways above Trinity datum, 17ft.; intrados radii, 136ft. 6in. The abutment arches: Spans, 112ft.; versines, 13ft.; central headways above Trinity datum, 13ft. 9in.; intrados radii, 127ft. The whole of these arches throughout the length of the bridge shall measure between their exterior faces, in the width of the bridge, a uniform width of 47ft.

Piers.—At their springings the thickness of the two central piers shall be 19ft., and of the two outer piers 18ft. The upper surface of the bridge shall, between the parapets, be divided into a carriage-way 26ft. wide, and two footways each 9ft. wide. The summit level of the bridge roadway midway over the central arch shall, when completed, be 38ft. 6in. above Ordnance datum, from whence uniform gradients of 1 in 45 shall incline north and south to points upon the bridge, midway in the 112ft. spans.

High-street, Putney, and Windsor-street Approaches: Gradients.—The main Putney approach road to the bridge shall have a uniform gradient of 1 in 35 from the point midway in the Surrey arch aforesaid, terminating at a point in High-street, Putney, about 204ft. distant from the river face of the Surrey abutment.

General Construction of High-street, Putney, Approach described.—From the rear of the Surrey abutment extending southwards along High-street, Putney, the remaining portion of the 1 in 35 gradient shall be continued upon seven brick arches in lias lime mortar 18in. thick, having 20ft. spans, 5ft. versines, and the spandrils solidly filled with lias lime concrete under the carriage-way and kerb to the underside of the concrete upon which the paving is to be bedded and under the footway to the level of the crown of the arch. These arches shall be supported upon six brick piers intermediate between the bridge abutment and a small concrete abutment at their southern extremity 8ft. in thickness. The bricks piers shall be splayed on plan of varying thickness, increasing from 2ft. 3in. at the narrowest end, and built at right angles to the direction of the central line of the approach road. These brick piers shall be built up, as shown, upon foundations of Portland cement concrete, brought up from a foundation level 6ft. above Ordnance datum and 1ft. thicker than the piers which they support. Beyond the southern termination of the seven approach arches above mentioned the main roadway is continued southwards at 1 in 40 gradient in solid formation for a further length of about 160ft., terminating, at the existing roadway level + 20·5, at a point about 20ft. southward of Albert-row. On the west side the earth under the approach road shall be supported by a retaining wall of Portland cement concrete, but no retaining wall will be required on the east side of the approach road.

Description of General Construction of Windsor-street Approach.—The western extremity of the four brick arches adjoining the southern abutment of the bridge shall be bounded by a Portland cement concrete wall 8ft. thick, carried up to the same levels respectively as the concrete over the spandrils of the arches in High-street. From this wall shall spring the first of a series of six similarly constructed brick arches, under the whole intended width of the Windsor-street approach, and at right angles to its direction; but in these arches the brick piers shall be parallel and uniformly 3ft. in thickness, and the concrete foundations for the same 4ft. in thickness. The aforesaid approach road in Windsor-street shall be executed throughout with a uniform gradient of 1 in 40, commencing at a level of 20·76, adjoining the eastern extremity of the Terrace, Windsor-street, from whence, for a distance of about 168ft. eastward, it shall be constructed in solid formation, supported on each side by a retaining wall of Portland cement concrete, that on the river side being faced with brickwork in lias lime mortar.

Temporary and Permanent Fencing.—From the top of the river stairs to be built in connection with the bridge a parapet shall be built upon the arched substructure corresponding with the parapet of the bridge, and shall extend as far as the churchyard fence, against which it is to be stopped by a pier. The churchyard fence is described elsewhere in connection with the works to be executed in the churchyard.

Method of Regulating Traffic during Construction.—After the entire construction of the new bridge and its northern approaches, and to prevent any interruption of the traffic across the river, the western and northern halves respectively of the approach arches under High-street and Windsor-street shall be first constructed, traffic being meanwhile continued across the old bridge and along the eastern and southern halves of High-street and Windsor-street respectively. During the construction of the eastern and southern portions of the aforesaid approaches, the traffic shall be continued over the new bridge and its northern approaches and upon the completed western and northern halves of High-street and Windsor-street approaches.

Putney Churchyard Alterations.—The contractor shall very carefully take up the shrubs, gravestones, fences, kerbs, &c., now situate in that part of the churchyard which is situate to the west of a line drawn from north to south across the churchyard at the west end of the nave of the church, or so many of them as he may be required to take up, and shall stack them either in the churchyard or on ground adjacent thereto, in such a manner as he shall be directed, labelling them so that he may be able to replace them in the same positions as they now occupy. After the gravestones have been removed he shall raise the general level of that portion of the churchyard sloping from the finished level of the approach road towards the church in accordance with instructions to be given by the engineer. The filling for this purpose shall consist of such of the excavated material as may be approved by the engineer, but the top surface for a depth of 2ft. shall consist of good vegetable soil, and the whole shall be consolidated in such manner as may be directed by the engineer, and when thoroughly consolidated to his satisfaction, the gravestones, fences, kerbs, &c., shall be carefully and properly replaced in the positions from which they were removed. The three existing footpaths leading from High-street to the west and southern entrances of the church, shall be raised and made to slope towards the church, and shall be paved with new 3in. rubbed York landings, bedded and jointed in cement, and laid on a bed of lias lime concrete 6in. thick. These footways shall be flanked on each side by a York stone kerb 6in. in thickness and 9in. deep, rubbed and rounded on top, bedded and jointed in cement, and bedded on lias lime concrete 6in. in thickness. At the High-street end of the path leading from the west door of the church, the contractor shall form a flight of steps—as shown on plan—flanked with a railing and rounded York stone kerb 6in. in thickness. The steps, which are to be solid, and kerb to be of York stone rubbed on all exposed surfaces, bedded and jointed in cement, and laid upon a bed of lias lime concrete 6in. thick, both pathways to be properly drained and a gulley put and grating formed at the lower end next the church, connected by new drains with those already in existence. The pavement adjacent to the church to be made to slope away from the church towards the gully. After the gravestones are re-laid the graveyard shall be re-planted with the shrubs taken up or by new shrubs to correspond with those taken up, and the surface laid with good turf, which shall be left in good and growing condition.

Fencing.—The contractor shall raise the existing wall on the north side of the churchyard, from High-street to the old toll-house, so as to be at least 3ft. above the level of the raised ground, and shall strengthen the same where requisite with counterforts on the outside, carried down to a level 2ft. below the surface of the present approach road to Putney Bridge. The raised portion of the wall and the counterforts are to correspond in material and form with the existing wall, and the wall is to be finished on top with a wrought iron open ornamental fence 3ft. in height. The graveyard is to be fenced off from High-street by a new stone dwarf wall to correspond in material with the now existing wall, and to be built upon the arches carrying the raised approach road as far as such arching extends, and beyond them to be built upon a foundation of lias lime concrete 12in. thick and 2ft. wide. The wall is to be capped with York stone, cap 9in. thick, rubbed, weathered, and throated, and to be 2ft. 6in. in height from paving to top of cap. This dwarf wall is to be surmounted with a wrought iron ornamental fence 3ft. 6in. in height leaded into cap.

Gates.—Two openings are to be left in the wall at the ends of the pathways leading to the church, and these are to be fitted with gates hung to gate-posts and piers corresponding in every respect with the present ones.

Southern Wall.—On the south side of the churchyard the contractor is to erect from the last-described wall a new wall extending eastward to the east wall of the churchyard, into which it is to be bonded. This wall is to be of brickwork, 14in. thick with plinth, and with piers 18in. thick placed on centres of 18ft., and capped with moulded York stone capping 6in. in thickness; it is to be carried down to 3in. below the intended surface of the ground. Below the surface of the ground the brick wall is to be carried on Portland cement concrete piers and arches 3ft. in thickness; the piers to be 5ft. in length, and placed at 25ft. centres and carried down to a level of 13ft. above Ordnance datum. The arches to be 3ft. in thickness at the crown under the wall, to have a span of 20ft. and a rise of 5ft. The top of the capping of the wall is to be carried up to a level of 30ft. above Ordnance datum. In the event of the contractor, in the course of his excavations in the neighbourhood of the churchyard, having to remove any human remains, he shall take all steps to procure the necessary sanction for so doing, and shall abide by any directions he may receive from the parties having authority in such matters, and shall exercise due care in their removal and re-interment in such place or places as he may be directed. All the works to be executed in connection with this churchyard are to be done to the satisfaction of the vicar and churchwardens of the parish.

Main Northern or Fulham Approach: Width and Gradients.—The main northern approach road shall throughout, between the parapets or fences, have a uniform width of 50ft., divided into a carriage-way 32ft. wide, and two footways, each 9ft. wide. It shall commence at a level of + 15·8 at the junction of Church-row with High-street, Fulham, from which point, for a distance of about 170ft. southwards, it shall be paved level, and beyond, for a further distance of about 348ft., it shall rise with a uniform inclination of 1 in 40, continuing thence to a point midway in the northern 112ft. span of the bridge, at an inclination of 1 in 35.

Retaining Vaults and Fencing.—On the east and west sides of this approach from the abutment to the intended arch spanning—Bishop's-walk—the earth shall be retained by vaults with piers and covering arches of brickwork in lias lime mortar, and with vertical arches at the back formed of Portland cement concrete, mixed in the proportion of six measures of ballast to one of cement. These arches and the brick piers shall be carried on foundations of Portland cement concrete, mixed in the proportions of eight measures of ballast to one of cement, and carried down to the level of Ordnance datum. Upon these vaults shall be erected a parapet of brickwork in lias lime mortar, of white Suffolk bricks, with Portland stone capping, as shown. This parapet to be continued over the bridge over Bishop's-walk to a position marked.

Retaining Walls, Parapets, Vicarage Gardens.—On the west side of the approach, from B to A on plan, the earth shall be retained by walls of Portland cement concrete, faced with white Suffolk bricks, supporting a parapet 6ft. high above the footway of the approach road, also of white Suffolk bricks, capped with Portland stone cap, and carried upon foundations of Portland cement.

Steps.—At a distance of about 40ft. north of B on plan No. 1, a descent by steps shall be formed from the approach road down to the vicarage garden. The steps shall be solid, of York stone; the landings also of 6in. York stone, carried upon brick walls of white Suffolk bricks, built in Portland cement upon foundations in Portland cement concrete. A single footway gate of wrought iron to be hung to gate-posts in the parapet wall, and the steps to be protected by a wrought iron fence, all as shown on drawing No. 16.

Temporary Fence.—Before commencing any works upon or interfering with the vicarage grounds, the contractor shall erect a temporary close-boarded fence, 9ft. in height, to the satisfaction of the engineer, extending from Church-row to the south end of the grounds, and at a distance of not more than 5ft. from the roadside face of the intended parapet, and shall maintain the same in good order until the completion of the approach road.

Precautions.—The contractor shall take care that no damage is done by his agents or workmen to the vicarage garden within the fence or to the large trees between the temporary fence and the retaining wall, and shall take every precaution to protect such trees from injury.

Retaining Wall and Fence on East Side.—On the east of the approach road, from N to near O on plan, the earth shall be retained by a wall of Portland cement concrete carried on Portland cement concrete foundations, as shown upon drawing No. 15.

John's-place Approach: Width and Gradients.—An approach 40ft. wide, divided into a roadway 26ft. wide, and two footways, each 7ft. wide, shall rise from a level of + 15·5 in John's-place, Fulham, with a uniform inclination of 1 in 24, so as to intersect the main roadway approach at a level 22·29ft. above Ordnance datum.

Station Approach: Gradients.—An approach of similar width shall rise from a level of + 15·24 in High-street, Fulham, with a uniform gradient throughout of 1 in 36, so as to intersect with its central lines the main roadway approach at a level of 20·03 above datum, or at a point about 50ft. below the central line of John's-place approach at its junction with the central line of the main approach road.

Retaining Walls.—The earth filling on the John's-place and Station approaches shall be retained by walls of Portland cement concrete, and the approach shall be fenced with a temporary fence to be provided and fixed by the architect of the board as elsewhere described.

Paving of Roadways: Footways.—The whole of the footways shall be paved with 3in. York stone, sound and hard, and of a uniform and close texture, free from sand-holes and other defects, and to dry after rain of a light colour, as nearly as possible uniform throughout. The flags to be of full thickness throughout, thoroughly tooled to a fair clean level and true surface, and the joints tooled square. The stones to be laid in lias mortar on a sufficient bed of fine sand, gravel, or other approved material, with close and neat joints and in uniform courses breaking bond; the courses of new paving to be at least 1ft. 10in., and not more than 2ft. 6in. wide, no two adjacent courses to differ in width more than 3in., and no stone to be of less area than 5ft., except for closers as may be allowed, the joints to be dressed down after laying where necessary to preserve a uniform surface throughout. The paving to be laid with a slope towards the carriage-way as shown, or as may be directed.

Kerb.—The whole of the kerbing for margin to the footway paving shall be of Aberdeen or Guernsey granite laid in cement mortar on a bed of lias lime concrete 9in. in thickness. The stones, except over the bridge, where they are to be 6in. by 12in., placed on edge, to be 8in. deep and 12in. wide on bed, all to be worked fair and fine dressed on two faces. The heading joints to be neatly squared through for their entire depth, and the back joints with York paving to be squared for a depth of at least 3in. No stone to measure less than 3ft. in length. The footway paving to be specially rounded at curves, and the kerb-stones shaped to correspond.

Channels.—The channels, 12in. in width, shall be formed of Guernsey granite stones 12in. wide and 7in. deep, no stone to be less than 2ft. 6in. in length, the stones to be worked fair on their upper surface with joints squared throughout the whole depth or thickness, closely laid, and well grouted with Portland cement, as the work proceeds. The channels to be laid with a fall towards the gullies, as may be directed.

Paved Carriage-ways.—The carriage-ways between the channels extending from the northern end of the Fulham abutment of the bridge, over the bridge, and to the southern end of arches carrying the roadway of High street, Putney, and to the western end of the arches carrying the roadway of Windsor-street, shall be formed of Aberdeen or Guernsey granite cubes or setts 7in. in depth and 4in. wide on bed, carefully dressed and free from protuberances on surface, laid on a bed of lias lime concrete 12in. in depth; the surface of both concrete and granite to be formed to a curve as may be directed. After the concrete has set hard, the cubes or setts are to be bedded on a thin layer of Portland cement concrete, spread over the concrete foundation, laid in regular and straight courses, breaking bond and so close at joints that six courses when finished shall not measure more than 27in., leaving only sufficient space for grouting to pass to the bottom; to be well rammed and back-rammed, as directed by the engineer, to a uniform surface, and well grouted with sharp sand and Portland cement in the proportion of 4 to 1, and coated with fine hoggin.

Broken Granite, &c.—The remainder of the carriage-ways of the several approaches, as also of the draw dock, shall be of broken Guernsey granite 7in. in depth, laid to a uniform surface on a hard core of brick rubbish or suitable material, to be approved by the engineer, 12in. deep, the surface of both granite and hard core being formed longitudinally to the levels and gradients shown on the longitudinal section, and transversely to a curved surface, as shown or as may be directed.

Rolling, &c.—The granite shall be put on in two layers, the lower layer being rolled with approved rollers previous to the upper 3in. being laid. After the upper 3in. is put on, the entire surface of the carriage-way shall be spread with a layer of fine hoggin, and approved rollers shall be passed over every part of the surface as often as may be necessary, perfectly to consolidate the same. The broken granite to be approved of by the engineer, to be of angular form and of fairly uniform size, and to be of such dimensions as just to pass freely through a ring 2½in. in diameter in every direction.

Intersections with Old Works.—Wherever the new works intersect with, or end in the existing streets or places, the old road and footway paving shall, without extra charge, be taken up and relaid to such extent as the engineer may consider necessary, and the best of the old materials taken up in any part of the work are to be used therein.

Area Gratings, &c.—Where the levels of the existing footways are to be altered, the contractor will have, without extra charge, to alter the levels of the area gratings, railings, and kerbs, and the steps and landings giving access to the premises in such manner as may be directed.

Gulleys for Roadway.—No. 15 gulleys, in addition to those on the bridge, to be formed in brickwork in cement, and connected with the sewer by 6in. stoneware pipe and a syphon trap. The gulleys to be fitted with cast iron gratings, to be supplied and fixed by the contractor.

Street Lamps.—The contractor shall provide and erect 45 new substantial cast iron street lamps in such situations on the works as the engineer may direct, either to same design and dimensions as those now in the locality, or to some other as shall be ordered, including copper lantern properly glazed, with copper door and ventilator to same, and ladder iron to each lamp.

Gas Pipes.—The whole of the said street lamps are to be painted in four oils, finished, bronzed, and furnished—in manner to be approved—with gas pipes, burners, and fittings. The gas piping, to be provided and laid by the contractor, is to extend from the burners to the bottom of the street lamps and thence to the main, with which it is to be connected. The contractor will have to supply the necessary bends, unions, nipples, and tee-pieces, and to leave the lamps complete and ready for lighting. The whole of the work to be executed in the best style of finished workmanship.

Sewers, &c.: Old Sewers.—There are sewers in High-street and Windsor-street, Putney, with which the new gullies will have to be connected, and care must be taken in executing the works under this contract not to damage or interfere with them. Where the piers for carrying the arches forming the substructure of the new approach roads come over the sewers, discharging arches must be formed in the piers, and a portion of the piers for a length of 3ft. on each side of the sewer carried down to below the invert of the sewer.

(*To be continued.*)

TENDERS.

CARLTON, NEAR NOTTINGHAM.

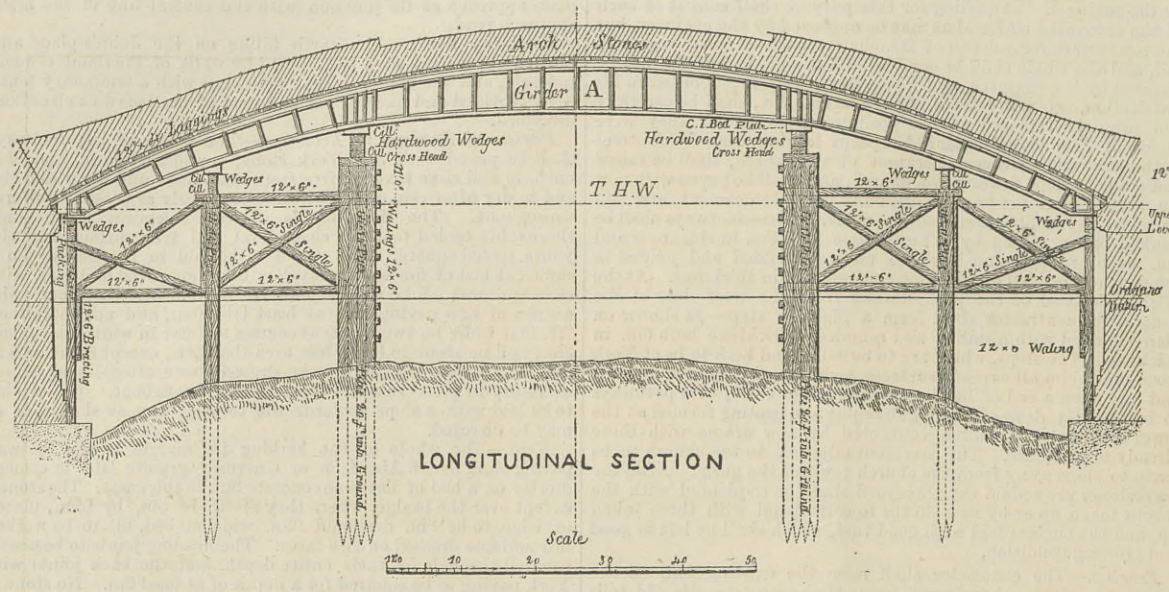
Tenders for new roads at Carlton. Mr. Frederick Jackson, engineer, Nottingham. Quantities by the engineer.

	£	s.	d.
Geo. Morris, Carlton	807	2	6
Thos. Smart, Nottingham	796	10	0
Jas. Knight, Loughborough	714	14	7
Wm. Cordon, Nottingham—accepted	701	7	0

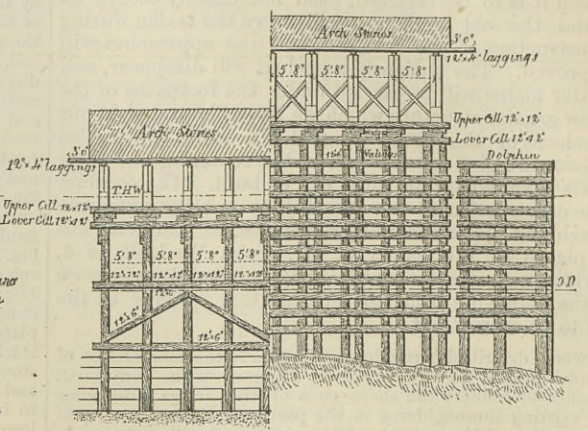
THE NEW BRIDGE OVER THE THAMES AT PUTNEY.

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

(For description see page 294.)

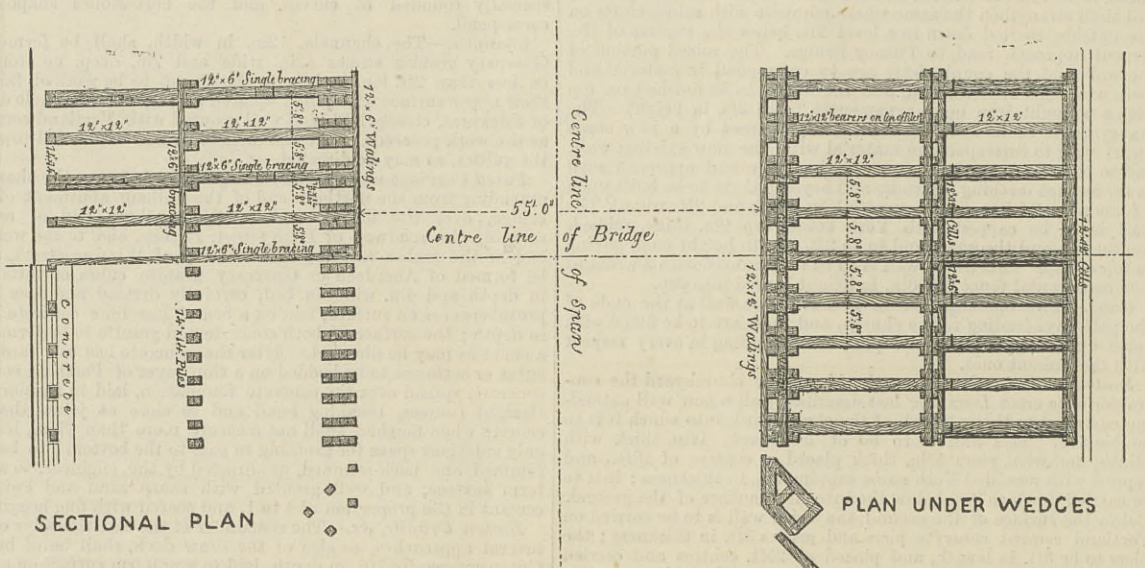


LONGITUDINAL SECTION



SUPPORT AT END OF RIBS

SECTION THRO CENTRE OF ARCH

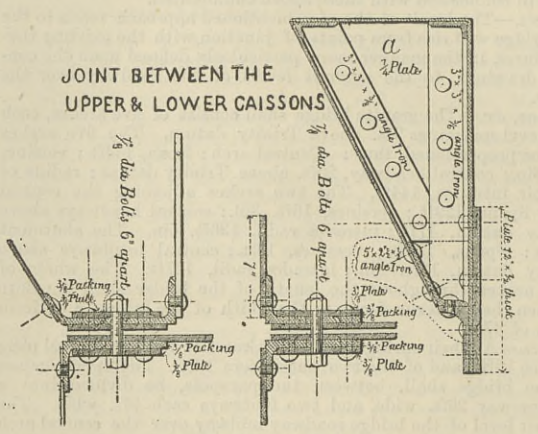


SECTIONAL PLAN

PLAN UNDER WEDGES

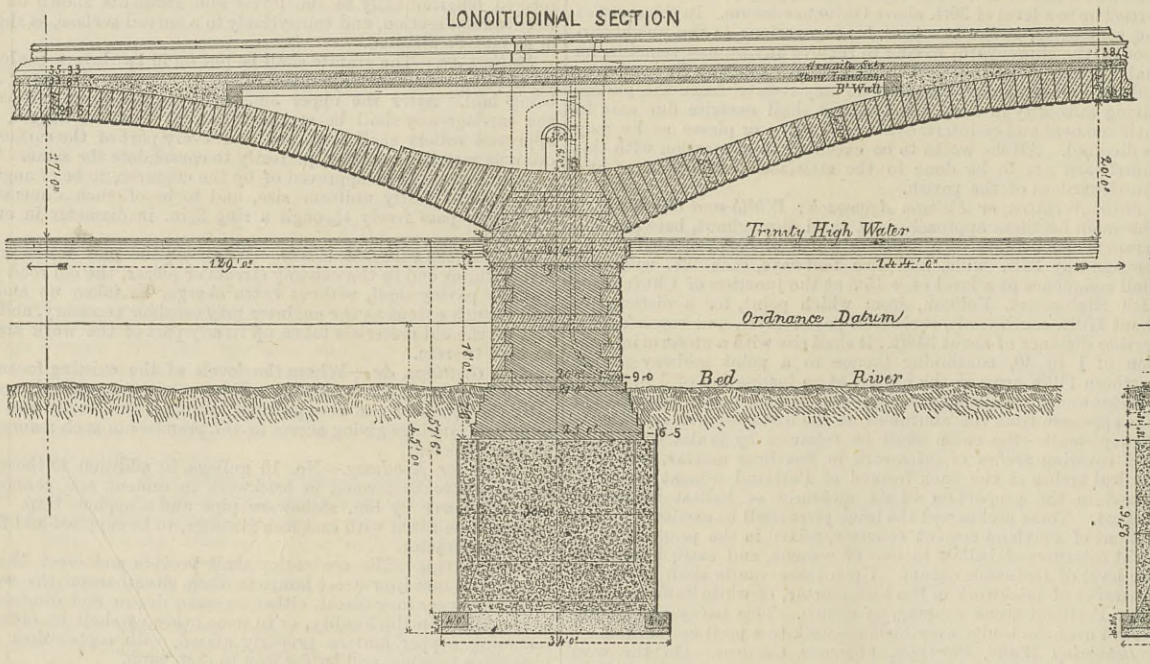
TOE OF LOWER CAISSONS

JOINT BETWEEN THE UPPER & LOWER CAISSONS

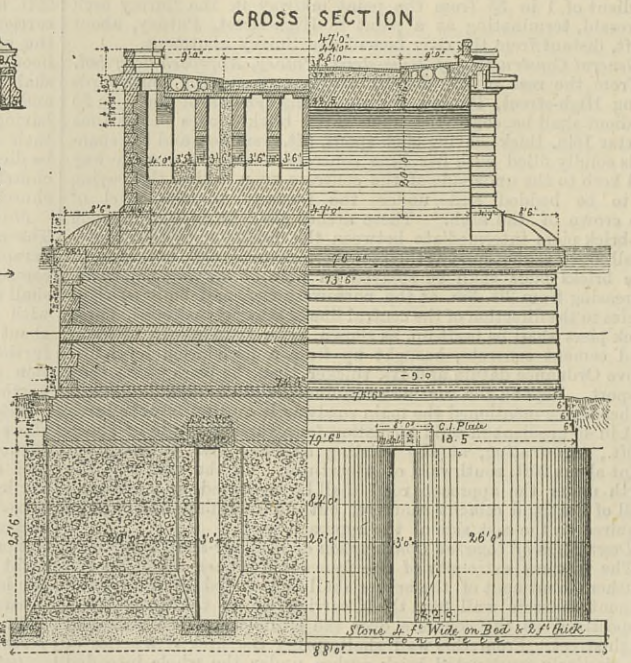


Scale 3 Ins. = 1 foot

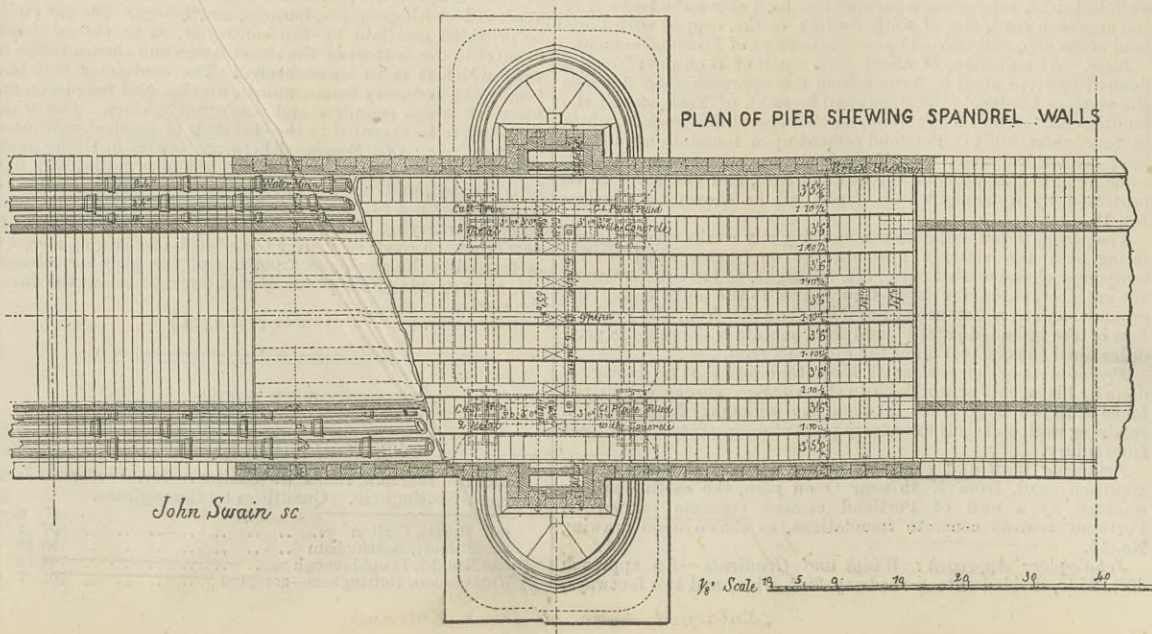
LONGITUDINAL SECTION



CROSS SECTION

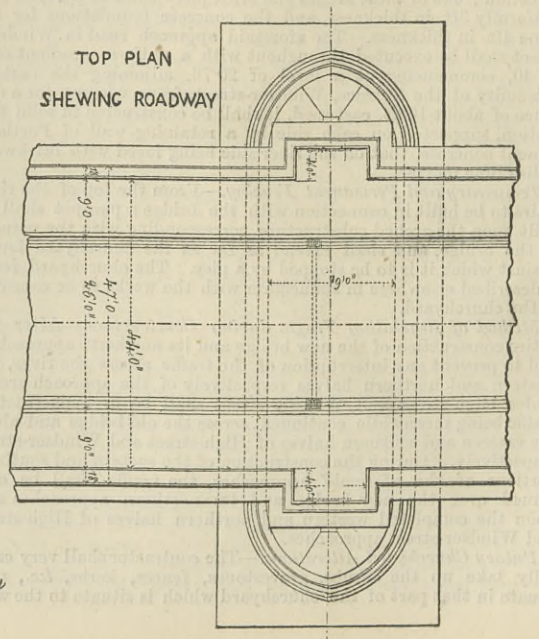


PLAN OF PIER SHEWING SPANDREL WALLS



John Swain sc

TOP PLAN SHEWING ROADWAY

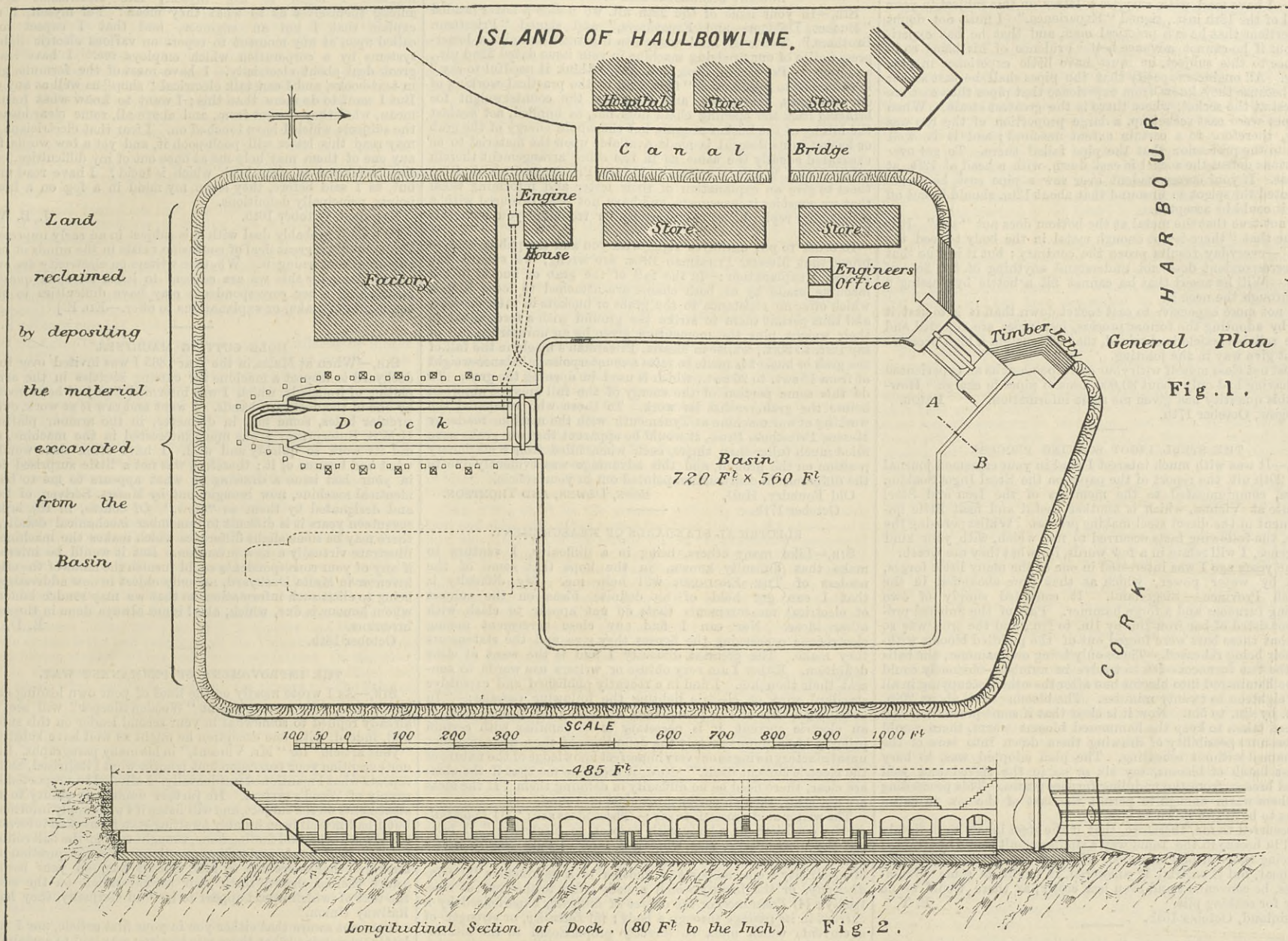


⅛" Scale 0 5 10 20 30 40 50 feet

HAULBOWLINE DOCK EXTENSION WORKS.

MR. J. O. ANDREWS, C.E. ENGINEER.

(*For description see page 289.*)



General Plan

Fig. 1.

Longitudinal Section of Dock. (80 Ft to the Inch) Fig. 2.

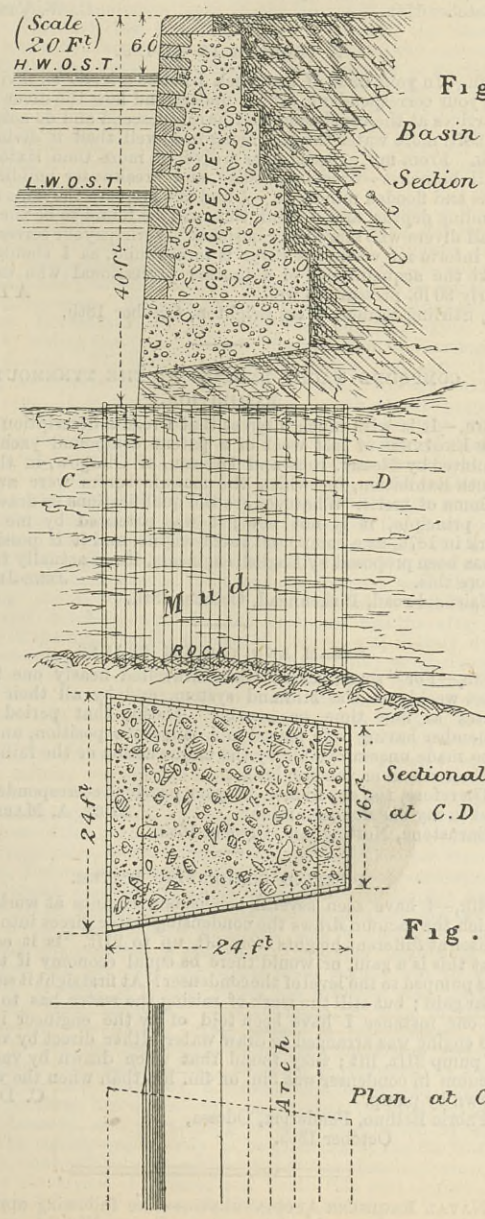
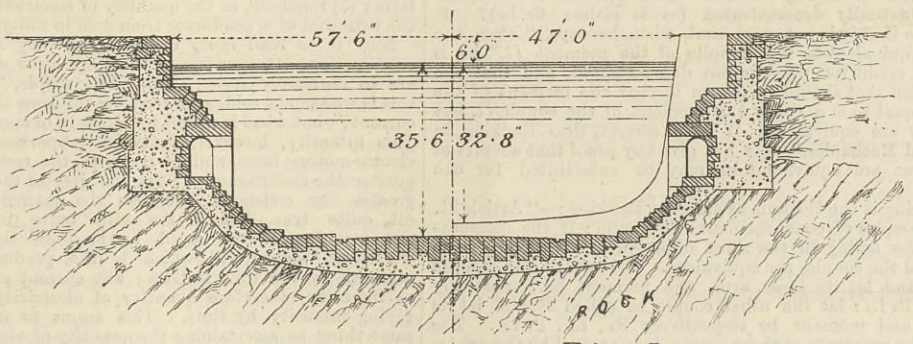


Fig. 3.
Basin Wall
Section at A.B.

Sectional Plan at C.D

Fig. 4.

Plan at Coping



Cross Section of Dock Fig. 5.

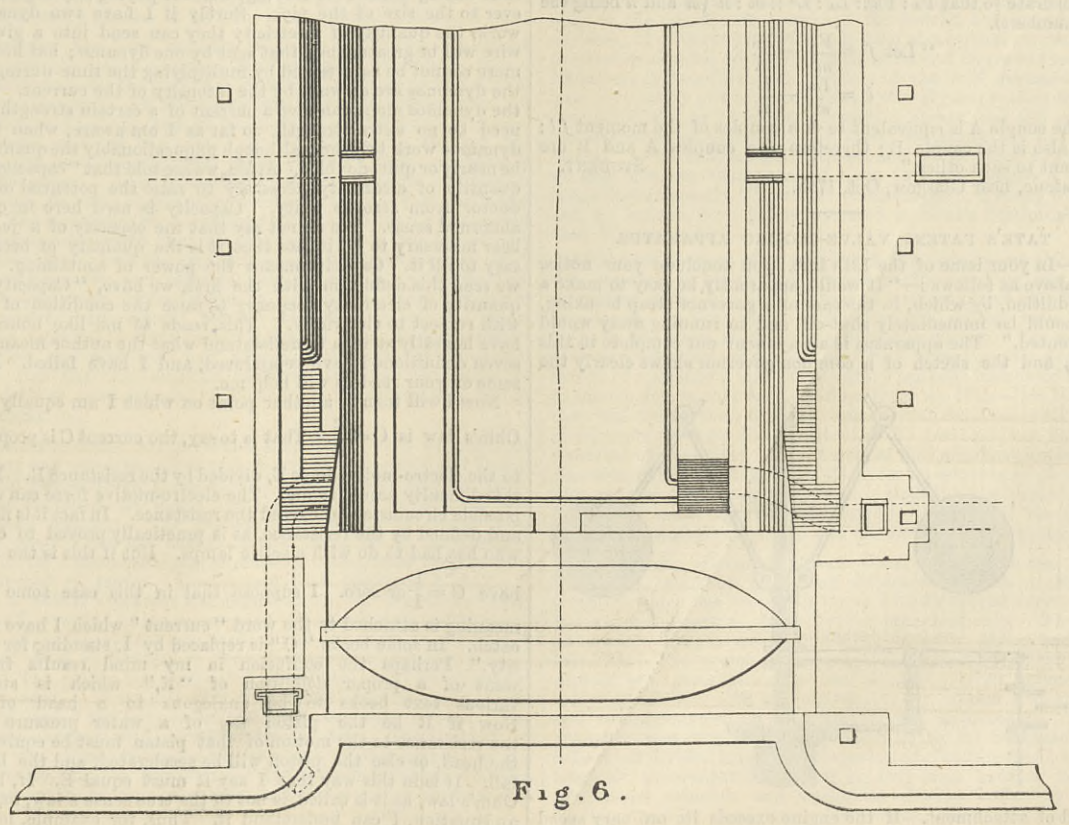


Fig. 6.

Enlarged Plan of Dock Entrance.

John Swain. Sc.

LETTERS TO THE EDITOR.

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

CASTING PIPES.

Sir,—I have read with surprise a letter on this subject in your journal of the 13th inst., signed "Experience." I must not doubt his assertions that he is a practical man, and that he has experience, but if he cannot advance better evidence of his being so in reference to this subject, he must have little experience in pipe casting. All engineers specify that the pipes shall be cast socket down, because they know from experience that pipes thus cast are strongest at the socket, where there is the greatest strain. When the pipes were cast socket up, a large proportion of the top was spongy, therefore to a certain extent unsound; and it is well known to the profession that the pipe failed there. To get over this serious defect the socket is cast down, with a head of 12ft. at the least. If your correspondent ever saw a pipe cast, he would have noted the spigot so unsound that about 12in. should be cut off before it could be accepted.

It is not true that the metal at the bottom does not "set." It is not true that "there is not enough metal in the body to feed the socket"—everyday results prove the contrary; but it is true that your correspondent does not understand anything of the flow of metals. Will he assert that he cannot fill a bottle by passing a fluid through the neck?

It is not more expensive to cast socket down than it is to cast it up, as by adopting the former process, less pipes are rejected and a more reliable article is obtained, that will sustain a high pressure and not give way in the jointing.

I must not class myself with your correspondent as an experienced man, having had only about 80,000 tons of pipes in charge. However, this quantity has given me some information. Prior.

Glasgow, October 17th.

THE STEEL INGOT SOAKING PROCESS.

Sir,—It was with much interest I read in your esteemed journal of the 29th ult. the report of the paper on the Steel Ingot Soaking Process, communicated to the members of the Iron and Steel Institute at Vienna, which is another useful and neat little improvement in the direct steel-making process. Whilst perusing the article, the following facts occurred to me, which, with your kind indulgence, I will relate in a few words, for what they are worth.

Some years ago I was interested in one of the many little forges, driven by water power, which at that time abounded in the Rhenish Province — Siegerland. It consisted simply of two puddling furnaces and a forge hammer. Part of the finished product consisted of bar iron 2in. by 1in. to $\frac{3}{4}$in., and the iron was so good that these bars were forged out of the puddled blooms without their being reheated. There only being one hammer, the balls from the two furnaces—ten to twelve in number—obviously could only be hammered into blooms one after the other, occupying in all about eighteen to twenty minutes. The blooms were about 20in. by 6in. by 4in. to 5in. Now it is clear that if some precaution had not been taken to keep the hammered blooms warm, there would have been no possibility of drawing them down into bars of the sizes named without reheating. The plan adopted was, to bury the last batch of blooms, say six or so, in the sieved and well washed breeze from the puddling furnace grates. This proceeding kept them warm enough to permit the last of the six to seven blooms to be drawn down to size.

It occurred to me, therefore, that if the steel ingots were simply buried in breeze in the same way a similar result would be attained as placing them in pits or ovens. Not that the breeze plan would be so neat, but if on trial it answered, it might, in some circumstances, be convenient and even less costly, as there would be no outlay for soaking pits. F. Y.

Rheinland, October 16th.

A PROBLEM IN DYNAMICS.

Sir,—Is the following theorem from Rankine's "Applied Mechanics" actually demonstrated (as it claims to be)? It appears to me that it is not, and that when he says, "Then the couple A is equivalent to $m\,n$ couples of the moment $f\,l$," he is really taking credit for what is not demonstrated, and that the only conclusion that should be drawn is that the moment of the couple A is equal to $m\,n$ times the moment of the couple $f\,l$, but not that they are equivalent. If I am correct, then Rankine, in his "Applied Mechanics," does not give any proof that couples of equal moment are equivalent or may be substituted for one another.

The following is the theorem as stated in Rankine:—"Article 31. Equivalent couples of equal moment.—Theorem: If the moments of two couples acting in the same direction and with the same axis are equal the couples are equivalent. Let one of the couples be called A and let its force, arm, and moment be respectively F_A, L_A, and $F_A L_A$; let the other couple be called B, and let its force, arm, and moment be respectively F_B, L_B, $F_B L_B$. The equality of the moments of these couples is expressed by the quotation $F_A L_A = F_B L_B$. If the forces and arms of the two couples be commensurate so that $F_A : F_B :: L_A : L^B :: m : n$ (m and n being the whole numbers).

$$\text{"Let } f = \frac{F_A}{m} - \frac{F_B}{n}$$

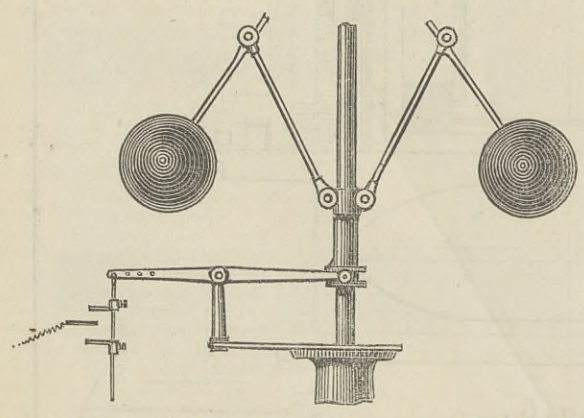
$$l = \frac{L_B}{m} - \frac{L}{n}$$

Then the couple A is equivalent to $m\,n$ couples of the moment $f\,l$; and so also is the couple B; therefore the couples A and B are equivalent to each other." Student.

Johnstone, near Glasgow, Oct. 17th.

TATE'S PATENT VALVE-CLOSING APPARATUS.

Sir,—In your issue of the 13th inst., you conclude your notice of the above as follows:—"It would apparently be easy to make a small addition, by which, in the case of a governor strap breaking, steam could be immediately shut-off, and so running away would be prevented." The apparatus is always sent out complete in this respect, and the sketch of a common governor shows clearly the



method of attachment. If the engine exceeds its ordinary speed the governor balls fly outward, and the finger A presses on the plate B. On the other hand, if the belt or gearing used to drive the governor gives way, the balls at once fall, and the finger C presses on the plate B. In either case the circuit of the electric current is closed, and the stop valve on the engine screwed down. The apparatus is applicable to sluice and other valves for waterworks as well as steam valves, in which case the piston in the small cylinder is actuated by water pressure. Duncan Brothers.

32, Queen Victoria-street, London, Oct. 17th.

BUCKET DREDGERS AND EXCAVATORS.

Sir,—In your issue of the 29th ult. we notice a letter headed "Bucket Dredgers and Excavators," and signed "Priestman Brothers." You were kind enough to illustrate and give a letter-press notice of our dredging machine in your issue dated 22nd ult., and Messrs. Priestman Bros., it seems, "think it needful to say" in reference to your notice "first, that in the practical working of our dredgers, excavators, and elevators, the counterweight for bringing back the opening chain does not, as implied, act against the falling of the bucket or grab, but the whole energy of the grab or bucket in its descent is made available upon the material to be excavated equally the same as in the other arrangement therein referred to." We have written to Messrs. Priestman Bros. desiring them to give an explanation of their letter and informing them that we consider it inaccurate, and have not been favoured with a satisfactory reply, hence the necessity for troubling you with this letter.

In order to put ourselves right with you and the public, and to prove that Messrs. Priestman Bros. are wrong, we submit the following explanation:—In the fall of the grab or bucket in the machine made by us both chains are attached to loose barrels which offer no resistance to the grabs or buckets in their descent, and thus permit them to strike the ground with a force equal to their weight, plus the momentum given by an unretarded fall of say 16ft. to 30ft., whilst in Messrs. Priestman's machine the fall of the grab or bucket is made to raise a counterpoise or balance-weight of from 15 cwt. to 20 cwt., which is used in opening the grab. To do this some portion of the energy of the fall must be absorbed before the grab reaches its work. To those who compared the working of our machine at Tynemouth with the machine made by Messrs. Priestman Bros., it would be apparent that our grabs were filled much fuller than theirs, even when filled from a stationary position on the ground, and this advantage was evidently due to the difference in construction pointed out in your article.

Old Foundry, Hull, Rose, Downs, and Thompson.
October 17th.

ELECTRICAL STANDARDS OF MEASUREMENT.

Sir,—Like many others, being in a difficulty, I venture to make that difficulty known, in the hope that some of the readers of The Engineer will help me. My difficulty is that I can get hold of no definite ideas on the subject of electrical measurements that do not appear to clash with other ideas. Nor can I find any close agreement among electricians concerning the figures they give and the statements they make. The greatest difficulty I find is the want of clear definition. Either I am very obtuse or writers use words to conceal their thoughts. I find in a recently published and expensive standard work on electric lighting the following passage:—"In obtaining a view of the phenomena attending the propagation of an electric current, it is necessary to be familiar with certain primary ideas, unfortunately the definitions of these are somewhat unsatisfactory owing to our very imperfect knowledge of the nature of the electric current itself." Now, it seems to me that if the ideas are clear, there need be no difficulty in defining them. If the ideas are not clear, then obscurity must exist all round.

The writer next proceeds to say:—These ideas are: "(1) *Potential*, or the condition of a body with respect to electricity." I have not the most distant idea what this means; "(2) *Electro-motive Force*, or that mysterious power which tends to produce a transfer of electricity from one point to another of a conductor; (3) *Conductivity*, or the facility which a body offers to the flow of electricity; (4) *Resistance*, or the degree of difficulty experienced by a current in its passage through a body; (5) *Intensity*, or strength of a current, which must be directly proportional to the electro-motive force and inversely to the resistance; (6) *Quantity*, which is plainly the product of the current strength by the time that it lasts; (7) *Capacity*, or the quantity of electricity necessary to raise the potential of a conductor from zero to unity."

Now these read fairly enough, but they will not bear close examination. One or two of them are clear enough, but the rest are to me simply jargon. Take, for example, "intensity." What this is we are not told, save that it is the same thing as "strength of current;" but what is meant by strength of current we are not told. This intensity, however, must be proportional directly to the electro-motive force, and inversely to the resistance—that is, the greater the electro-motive force the greater the intensity, and the greater the resistance the less the intensity. This may be all quite true, but I am still quite in the dark as to the meaning of the word, as used in this passage. Next we have "quantity," which is the product of the current strength by the time it lasts; but current strength is the same as intensity—therefore quantity of electricity is found by multiplying intensity by time. This seems to me to be much the same thing as ascertaining the quantity of steam passing through a pipe by multiplying its pressure in pounds per square inch by the time during which it is flowing, without paying any regard whatever to the size of the pipe. Surely if I have two dynamos at work, the quantity of electricity they can send into a given line wire will be greater than that sent by one dynamo; but how much more cannot be ascertained by multiplying the time during which the dynamos are at work by the intensity of the current. Each of the dynamos alone can give a current of a certain strength. There need be no extra strength, so far as I am aware, when the two dynamos work together, although unquestionably the quantity will be nearly or quite doubled. Again, we are told that "capacity" is the quantity of electricity necessary to raise the potential of a conductor from zero to unity. Capacity is used here in quite an abnormal sense. We do not say that the capacity of a jug is the beer necessary to fill it, nor that it is the quantity of beer necessary to fill it. Capacity means the power of containing. But if we read this definition with the first, we have, "Capacity is the quantity of electricity necessary to raise the condition of a body with respect to electricity." This reads to me like nonsense. I have honestly striven to understand what the author means by the seven definitions I have reproduced, and I have failed. Perhaps some of your readers will help me.

Now I will turn to another point on which I am equally at sea. Ohm's law is $C = \frac{E}{R}$. That is to say, the current C is proportional to the electro-motive force E, divided by the resistance R. But here this difficulty occurs to me. The electro-motive force can under no possible circumstances exceed the resistance. In fact it is measured and defined by the resistance, as is practically proved to everyone who has had to do with electric lamps. But if this is the case, we have $C = \frac{1}{1}$ or zero. I suppose that in this case some definite meaning is attached to the word "current" which I have failed to catch. In some books "C" is replaced by I, standing for "intensity." Perhaps the confusion in my mind results from the want of a proper definition of "E," which is stated in various text books to be analogous to a head of water. Now if R be the piston say of a water pressure engine, the resistance to the motion of that piston must be equivalent to the head, or else the piston will be accelerated, and the head will fall. It is in this way that I say R must equal E. If, however, Ohm's law, as it is called, is not in the true sense a law, but simply an equation, I can understand it. Thus, for example, let, in the case of a given conductor, &c., E = 100 Volts, and R = 10 Ohms. Then C $\frac{100}{10} = 10$; but ten what? The formula cannot be used solely for means of comparison, because if I had 10 Volts = E and 1 Ohm = R, the result would be just the same. On this point I have consulted electricians, but their answers do not agree. One tells me that ten somethings alone is "current;" another that it is "intensity of current;" another that it is "quantity of electricity passing through the wire in a given time;" another that it is "Ampéres," but to all this I can attach no definite meaning, and I begin to ask myself, Are electricians agreed among themselves as to what they mean? For myself, I may explain that I am an engineer, and that I expect to be called upon at any moment to report on various electric lighting systems by a corporation which employs me. I have read a great deal about electricity. I have most of the formulæ given in text-books, and I can talk electrical "shop" as well as any one. But I want to do more than this; I want to know what formulæ mean, what they are got from, and above all, some clear ideas on the subjects which I have touched on. I fear that electricians who may read this letter will pooh-pooh it, and yet a few words from any one of them may help me at once out of my difficulties. Can they refer me to some book which is lucid? I have read many, but, as I said before, they leave my mind in a fog on a host of points, principally definitions.

Evershed, October 16th. J. B. W.

[We shall probably deal with this subject in an early impression. Undoubtedly a great deal of confusion exists in the minds of many engineers concerning it. Whether writers on electricity are or are not to blame for this we are content to leave an open question. Meanwhile, other correspondents may have difficulties to state, comments to make, or explanations to offer.—Ed. E.]

HOLE CUTTING MACHINES.

Sir,—When at Malta in the year 1865 I was invited over to the dockyard to inspect a machine for cutting scuttles in the armour plating of ironclads, which I was informed had just been invented by one of the dockyard hands. I went and saw it at work, cutting circular holes, some 8in. in diameter, in the armour plating of H.M.S. Enterprise. I was much interested in the machine, as it did its work so quickly and well. I have often since wondered what had become of it; therefore was not a little surprised to see in your last issue a drawing of what appears to me to be the identical machine, now brought out by Messrs. Scriven, of Leeds, and designated by them as "new." Of course, in the lapse of seventeen years it is difficult to remember mechanical details, and there may be some slight difference which makes the machine you illustrate virtually a new invention. But it would be interesting if any of your correspondents could furnish the name of the original inventor in Malta Dockyard, my only object in now addressing you being to elicit such information, so that we may render honour to whom honour is due, which, alas! is not always done in the case of inventors. B. D. K.

October 18th.

THE IMPROVEMENT OF PERMANENT WAY.

Sir,—As I wrote mostly on the lines of your own leading article at the time, your correspondent "Wooden Sleeper" will see he is already replied to somewhat in your second leader on this subject; and, indeed, with one exception he might as well have substituted "your article" for "Mr. Vincent," in his many paragraphs. In that one exception your correspondent ignores what I italicised, and only repeats what I mentioned incidentally. I alluded to a reported home supply of Wood's system. He further doubts my ability to make statements on the subject, and will listen if I will supply information; but I had myself been humbly awaiting statements and information for three weeks, and finding none, thought to keep the ball rolling by quoting your article and asking questions. For the question he has answered thanks are due to him, since it has, on your becoming aware thereof, drawn forth your second article on the subject, the text of which would appear to be "in Germany they have a Railway Union."

I am not aware that either you in your first article, nor I in my letter, maintained that there was any iron way laid to sustain home main line traffic—our object being to ask why is there not? Apparently we are answered from Doncaster; so Lord John Russell is proved right as to finality in this case at least. Being absent from home, I did not receive your issue for 6th ult. till this week.

October 17th. C. W. Vincent.

A PROBLEM IN DIVING.

Sir,—In your issue of last week I notice a letter on diving, and like your correspondent, cannot understand how the diver referred to arrives at the conclusion that he can descend and do actual work in 100ft. more water through being in a well than if diving in the open. From my experience as a diver of more than sixteen years in all branches—wrecking, bridge, and breakwater building, or in wells and flooded mines, &c.—I find the pressure the same at corresponding depths, and I think this will be found to be the opinion of all divers who know their business. Perhaps your correspondent can inform me where his diver is to be found, as I should like to make the acquaintance of a brother professional who can stand nearly 80 lb. pressure so well. A Diver.

3, Stirling-terrace, West Brighton, October 18th.

COMPOUND YACHT ENGINES AT THE TYNEMOUTH EXHIBITION.

Sir,—It is with much interest that I read a description given in The Engineer of last week of a patent compound yacht engine exhibited by Messrs. Ross and Duncan, of Glasgow, in the Tynemouth Exhibition, for which the manufacturers were awarded a diploma of merit. Whatever are the qualifications or drawbacks of the principle, it is not new; it was patented by me in Denmark in 1876, as a compound yacht engine, and it is possible that it has been proposed by English engineers, if not actually tried even before this. Jens Jensen.

Fairfield-road, Birkenhead, October 18th.

STEAM AND VACUUM BRAKES.

Sir,—For "seven years" I have travelled nearly one thousand miles weekly on the Midland system, and by all their different routes at one time or another. During that period I never remember having been placed in a dangerous position, and hardly once made uncomfortable by the undue action or the failing to act of their steam or vacuum brakes.

Therefore, the experience of your previous correspondents I am glad to say has not been mine. Robt. A. Marshall.

Barnstone, Nottingham, October 16th.

PUMPING CONDENSING WATER.

Sir,—I have seen several condensing engines at work here in which the vacuum draws the condensing water direct into the condenser at different heights from 6ft. up to 21ft. Is it considered that this is a gain, or would there be equal economy if the water was pumped to the level of the condenser? At first sight it seems to be clear gain; but still the work of raising the water has to be done. In one instance I have been told of by the engineer in charge the engine was arranged to draw water either direct by vacuum or by pump 21ft. lift; they found that when drawn by vacuum the vacuum in condenser was 3in. or 4in. less than when the water was drawn by pump. C. Dunlop.

Fabric Bellino, Fenderick, Odessa,
October 13th.

Naval Engineer Appointments.—The following appointment has beeu made at the Admiralty:—George Wright, engineer, to the Duncan, additional, for the Hydra, vice Richard Irwin.

RAILWAY MATTERS.

In New Brunswick the first sod of the Harvey Branch Railway has been turned.

The London, Chatham, and Dover Railway Company is repairing the roof of Ludgate-hill Station. The repairs are almost complete. There are now only five places on the two platforms where it is necessary to put up an umbrella on a wet day.

The south-westerly branch of the Canada Pacific Railway has now been extended to a point ninety miles west of Regina, the new capital of the North-West, and the first sod of the Emerson and North-Western Railway was turned a fortnight ago.

In the mention made in our last impression of the engines in course of construction by Messrs. Nasmyth, Wilson, and Co., for the San Paulo Railway, the engines were described as four-wheel coupled. This should have been six-wheel coupled.

Messrs. Hawks, Crawshay, and Sons, of Gateshead-on-Tyne, have just contracted for a large iron bridge for the Canadian Pacific Railway Company. The bridge is to cross the river Frazer, and will be 525ft. long over all, with a clear span of 315ft. It will be completed in about a year from the present time.

The Channel tunnel has been discussed by the members of the North of England Institute of Mining and Mechanical Engineers at Newcastle, and arrangements are in progress for a similar discussion to take place at the Cleveland Institute of Engineers at Middlesbrough. It is understood that both these bodies of north-country engineers are anxious that the tunnel should be made, and that so important a national enterprise "should not be allowed to be disposed of according to the ideas of officials who can only see from a military point of view."

The St. Louis Tunnel, 4900 yards long, is ventilated by means of a fan 15ft. in diameter and 9ft. wide and 13ft. in length. It is worked by a Herreshoff engine, capable of developing 190 horse-power at 110 revolutions per minute, and with fifty-six horse-power the tunnel is completely freed of smoke in four and a-half minutes, or in three and a-half minutes when the train is moving away from the fan. It is calculated that the passage of one train represents the extraction of 2,652,650 cubic feet of air, and 272 trains pass through the tunnel per day.

On Tuesday afternoon a train from Guildford to Farnham, on the London and South-Western Railway, ran off the rails near Farnham Station for a couple of hundred yards and finally into a siding. The train consisted of an engine and tender and five carriages, and these were all embedded in the chalk cutting. No one was seriously injured, but many of the passengers were much shaken. It was not until a very late hour that traffic could be resumed, and the line being a single one, and it being market day at Guildford, considerable inconvenience was occasioned.

From the report of the Board of Land and Works on the Victorian Railways during the year 1881, it appears that the North-Eastern system is the best paying of all the Victorian railways, this system having realised 8·5 per cent. on its capital cost. On the other hand, in speaking of the Melbourne and Hobson's Bay lines, the report shows what accidents may cost, for it says: "The balance of profit on working being . . . equal to only 1·39 per cent. on the capital cost," while, "eliminating the cost of the Jolimont accident, . . . the profit on working would be equal to 4·6 per cent. on the cost of the lines."

Plans have been prepared for a proposed new railway to commence at Middlesbrough and pass at the foot of the Hambleton Hills, by way of Easingwold to Leeds. The line, it is contemplated, will pass through some of the richest and most important agricultural districts in England, and supply direct communication between two very large centres of population. A large quantity of ironstone is said to exist in the Hambleton range of hills. The *Leeds Mercury* says if this project be carried out, Easingwold will soon become a rising town, and it would be a greater advantage to the district than any scheme of a more local and limited character.

The absurdly high fares by which the four railway companies owning the 32 miles of railway in the Isle of Wight do their best to make visitors and residents travel by water, or road, or walk, instead of going by rail, are, with the irregularity of the train service, the subject of much complaint in the *Times*. No one who has once had experience of the shamefully high fares charged by these companies, enters a train in the Isle of Wight if it can be helped. The first-class fare from north to south of this island is 4s. 6d., and other fares are equally high. The railway companies are certainly the worst offenders in the matter of unwarranted charges, though tourists will not find anything at reasonable prices in hotels or lodgings. The high prices on the railways and elsewhere are having their effects, as shown by the fact that half the houses in Shanklin, Sandown, Ventnor, and other places are to be sold or to be let, or are hungrily displaying obtrusive "Apartments to let" boards.

East Sussex is an object of considerable competition by several railway promoters, the terminus on the coast being the rapidly growing town of Eastbourne. In addition to the proposed direct line from Eastbourne to Bromley, which route is said to be favoured by the Midland Company, another scheme is on foot to connect it with Charing-cross. The new railway will run by Langney Bridge, Pevensey, Boreham-street, Bodle-street-green, Dallington, and Burwash, joining the present South-Eastern line to Hastings at Ticehurst-road. The length is 18½ miles, and a rich agricultural district, at present entirely unprovided with railways, will be opened up. It is about one-third the length of the proposed Bromley line, and by it Eastbourne would be brought within eighty minutes of Cannon-street. The greater portion of the line, being on level marsh land, will be of very cheap construction, and there will be only one tunnel, at Dallington. The landowners along the projected line are said to be favourable to the project.

The *Times* Geneva correspondent, in writing on the St. Gothard Railway and international traffic, says, "The opening of the St. Gothard Railway has already led to a considerable augmentation of traffic between Germany, Italy, and Switzerland, and bids fair to bring about some important and probably unlooked-for commercial developments. In the first two months after the opening of the new line the exports of German coal to Italy, which had previously been *nil*, amounted to 40,000 tons; of unmanufactured iron and hardware the exports increased from 79 to 107 tons; of machinery, from 12,300 to 14,000 tons; and of copper, from 255 to 693 tons. In the same time—as compared with the previous two months—the exports of spirits rose from 107 to 17,409 tuns; of paper and paper-made articles from 415 to 1446 tons; and 76 German railway wagons, the exportation of which was previously impossible, were sent through the big tunnel for the use of Italian railway companies. Italy, on the other hand, is finding north of the Alps a new outlet for all sorts of fruits and agricultural products, such as vegetables, breadstuffs, and grapes, as well as for wine and fat oxen. Before the opening of the line it was a moot point whether or not German coal would be able to compete with English coal in the markets of Northern Italy. As the Germans are now sending coal into Italy at the rate of 20,000 tons a month, it would seem that this question is receiving a practical answer in the affirmative. In any case the competition cannot fail to affect the price of coal at Genoa, which has hitherto been supplied exclusively from England. The Germans, as they themselves would say, are 'unfolding' great energy in this matter. They propose to establish coal depôts at Locarno and Luino, and other places about the Italian lakes. As Milan is connected by a canal system with Lake Maggiore, a considerable saving—as much, it is said, as three lire a ton—will be effected by discharging the coal at Locarno, and forwarding it to its destination by water. Of all the consequences likely to be produced by the St. Gothard Railway, none will be more portentous, or less pleasing to travellers than the conversion of Locarno and Luino into coal markets, and the sight of fleets of colliers on Maggiore and Lugano."

NOTES AND MEMORANDA.

The "Wreck Register" just issued gives the number of vessels lost on or near the coasts of the United Kingdom in the year 1880-1 as 705, or nearly 2·1 per day.

According to Ryland's "Iron Trade Circular" the alteration in the kind of pig iron being produced during the year ending 30th September has been—hematite, increase 4; cold blast, decrease 3; ordinary, decrease 3.

For bleaching straw it is soaked in a solution of soda, and moved about in a bath containing two ounces permanganate of potassa to one gallon of water. When the straw has acquired a light brown colour, it is washed first in water and then in a solution of bisulphite of soda.

To the uninitiated it may be asked why sole leather need be dyed, but the following is given as the dye which Mr. C. Larrabec employs for that purpose:—750 grms. Paris yellow, 150 grms. chrome yellow, 1250 grms. pipe clay, 1000 grms. quercitron, 1000 grms. alum, 750 grms. sulphuric acid, and 4 litres tragacanth solution. These are boiled together with 16 litres water, and the mixture, when cold, suitably applied.

Rods of iron, steel, and cobalt, lengthen when magnetised by an electric current, but as they remain the same in volume they must be reduced in section at the same time. The lengthening is very minute. In iron it is from 0·00000384 to 0·000005 of its length, or taking the latter figure, about the same as its co-efficient of expansion by heat at temperatures somewhat above the boiling point. The extension of cobalt is about half the above, or 0·00000232. Nickel, though much like cobalt and iron in magnetic properties, shortens when magnetised.

The following figures from Ryland's "Iron Trade Circular" give the number of blast furnaces at work at different parts of the past four years in Great Britain:—November 13th, 1879, furnaces in blast, 457; March 31st, 1880, furnaces in blast, 597; June 30th, 1880, furnaces in blast, 559; September 30th, 1880, furnaces in blast, 555; December 31st, 1880, furnaces in blast, 590; March 31st, 1881, furnaces in blast, 575; June 30th, 1881, furnaces in blast, 542; September 30th, 1881, furnaces in blast, 548; December 31st, 1881, furnaces in blast, 552; March 31st, 1882, furnaces in blast, 572; June 30th, 1882, furnaces in blast, 570; September 30th, 1882, furnaces in blast, 568.

One of the chief, or the greatest difficulty met with in plating iron and steel with other metals has been that, in the absence of a flux, the oxidation of the metals during the preliminary process of heating prevented a perfect weld. But it is stated that by the use of a metallic chloride vaporisable at a red heat, such as chloride of zinc or muriate of ammonia, a perfect union may be obtained, and this is better assured if a coat of tin-foil be placed between them as a welding medium. A flat bar of iron or steel treated in this manner and envelopod in the plating metal is brought to a red heat and drawn to any required dimension between cold rolls, and is said to be in use in Prussia.

The *Nautical Gazette* says that during the year 1881 the vessels lost at sea averaged about one every four hours. A large proportion of these losses occurred from carelessness, and mostly in fogs and other darkness. There were 400 ocean steamer collisions in 1879 and 1880 in the North Atlantic Ocean alone. Each of these might have been avoided if the master of one colliding vessel had been informed in proper time of the course pursued by the approaching one. These losses gave an average of over one steamer a day in which human life was sacrificed and valuable property destroyed. The *Gazette* believes that if a system of fog signals had been in use, such as the Barker code, nearly all of these disasters would have been prevented or avoided.

The following is the number of blast furnaces at work in different parts of Great Britain at the present time:—Cumberland, 42; Derbyshire, 41; Durham, 26; Gloucestershire, 2; Hampshire, 0; Leicestershire, 2; Lincolnshire, 15; Lancashire, 34; Northamptonshire, 15; Nottinghamshire, 2; Northumberland, 4; North Staffordshire, 27; South Staffordshire, 48; Somersetshire, 1; Shropshire, 9; Wiltshire, 3; Yorkshire, West Riding, 29; Yorkshire, North Riding, 90; North Wales, 6; South Wales, 65; Scotland, 107; total, 568. The total number of furnaces built September 30th, 1882, 940; total number of furnaces in blast September 30th, 1882, 568; increase in the number of furnaces built since June 30th, 1882, 4; decrease in the number of furnaces in blast since June 30th, 1882, 2; furnaces blown out since June 30th, 1882, 19.

F. Folie, in the *Bulletin de l'Academie de Belg*, proposes an astronomical criterion for settling the question whether any portion of the interior of the globe is fluid. He finds that Laplace and Poisson have entirely neglected in their integrations certain terms which have a period of a day or of a fraction of a day. These terms would lead to a diurnal nutation, which could be approximately calculated if there is any considerable portion of melted matter about the centre of the earth. Supposing that hypothesis to be true, the determination of the right ascension of stars which are situated as near as possible to the poles should give different values at different hours of the day, especially at epochs when the longitude of the sun and moon is 90 deg. Folie invites the attention of astronomers to this subject, especially of those who have a good altazimuth, which will enable them to follow the movement of a star and to make precise determination of its position at every quarter of an hour in its diurnal revolution.

An inquiry has been recently made by a German industrial society into the use of goggles—*Brillen*—and protective masks—*Schutzschirmen*—on the part of workmen in ironworks and machine works of Germany. Of 120 works that furnished information, 83 had introduced goggles, and 37 had not; 34 had introduced protective masks, and 86 had not. Of the 37 which did not use goggles, five had formerly used them, but gave them up because of disadvantages. As to these disadvantages of goggles and protective masks, 40 works on the other hand reported that they had found none. The remaining 80, including those that otherwise approved the devices, complained that all goggles more or less hinder the circulation of air, heat the eyes, and cause much perspiration; they soon become moist, and through easy adhesion of soot and dust prevent sure vision by the workmen, and often ultimately injure the eyesight. In several works the efficiency of the workmen was reported to have been diminished since the introduction of goggles, and accidents had happened through the uncertain vision. But the final question as to whether the disadvantages preponderated was answered by 52 works in the affirmative, and 51 in the negative.

A correspondent writes:—The Electrical Power and Storage Company has fitted its offices at 4, Great Winchester-street Buildings, Old Broad-street, London, with incandescent electric lights, and has mounted its lamps for office use in an elegant yet substantial manner. The primary local source of energy is a 1-horse power Otto gas engine in the basement of the building, which drives a Siemens' dynamo machine constructed for use with that amount of power. The current thus produced is made to charge a Sellon-Volckmar's storage battery, of twenty-five cells. Each cell is about a foot square, and 5in. thick, and contains two compound leaden plates—one positive and one negative—with thin sheets of wood so disposed as to prevent contact between the two plates. The plates are perforated with holes about ¼in. diameter and ¼in. apart. These holes are plugged with a paste made of red oxide of lead. No felt, as in the Faure batteries, is used. The cells are charged with diluted sulphuric acid. The ammeter of Ayrton and Perry indicates the strength of the current in the engine-room, and an incandescent lamp there furnishes a clue to the manner in which the others in the series, but upstairs, are acting. We are informed that when fully charged—we do not know how much time is spent in charging—the battery will supply thirty lights for ten hours. Swan's incandescent lamps are employed.

MISCELLANEA.

Mr. Lloyd Wise announces the removal of his offices to 46, Lincoln's-inn-fields, W.C.

Prospecting for coal in Colchester county, Nova Scotia, which has been going on for some time, has resulted satisfactorily; a seam 12ft. in thickness of excellent coal having been discovered, and further important finds are expected.

Messrs. Wm. Crichton and Co., of Aktiebolag, Abo, have been awarded the highest prize—the golden eagle—at the Moscow Exhibition just closed, for their 3-horse power steel steam launch, 6-horse power steam launch engine and boiler, and steam pumps.

Certain members of the Wednesbury, Darlaston, and Tipton Local Boards have this week met in conference and resolved to ask the three Boards to authorise the engagement of an engineer to draw up a report and prepare plans, with a view to the drainage of the three districts in one scheme.

It is proposed to erect an iron bridge over the Thames at Teddington, subject to the approval of the authorities. The members of the Teddington Local Board, together with the great majority of the ratepayers, are said to be in favour of the project, and a special meeting of the Board is about to be held to consider the matter.

At the recent open competition for the appointment of county surveyor, Ireland, which was lately advertised in our columns, Mr. Chris. Mulvany, M.A., B.E. (late of the Engineers' Department, Metropolitan Board of Works) succeeded in obtaining the first place, and has been appointed to the county Roscommon. The post is an important one, including among other duties the supervision of about 1000 miles of roads.

The *American Manufacturer* is informed that a joint stock company has been formed in Council Bluffs for the purpose of manufacturing iron sporting shot, and are nearly ready to put it upon the market. The company claims that thorough tests which have been made have proven the shot to be fully equal, and in some respects superior to lead shot, and it can be sold at a much lower price. No tower is required, as the shot is made by this process with less than 3ft. drop. With a view to extraction, it might be well to make bullets of iron.

An experiment in the transmission of power by means of air under pressure is now being made in the Voltaire Boulevard, Paris. The distance from the central station is about 600 metres, and though the pipes are only 0·06in. in diameter, under 2½in., it is held that the loss of pressure due to friction will be only 3 per cent. Cast iron pipes are to be used for the mains, wrought pipes for the branches, and lead for the service pipes into houses and other buildings. A small oscillating cylinder motor, invented by M. Tatin, is to be employed in connection with the system. Its velocity of rotation is fixed, and it will thus be made to act as the meter by which the charge for power will be made.

The electric light is making steady progress in Ireland. Messrs. Harland and Wolff, the well-known shipbuilders of Belfast, have adopted the Crompton arc light and Burgin machine. Mr. A. R. Walker, of Newry, has had his new flour mills and offices lighted up with Swan's incandescent lights, the current being supplied by Crompton's shunt Burgin dynamo. The light has been so much appreciated that it is to be extended to his other mills. Mr. J. H. Greenhill, of Belfast, who represents these combined systems in Ireland, supplied and erected the above installations, and he has been entrusted by Messrs. Guinness and Co., Dublin, with the erection of the electric light in their new premises.

The Ministers of Public Works of France and of War have determined to ask for the necessary vote to carry on the general trigonometrical survey of France. It is admitted that the work completed by M. Bourdaloue in the years 1857-64 is of very valuable assistance in determining the routes of the proposed new roads, railways, and canals, and for strategic requirements, but those surveys need completion. It is proposed that in the first place the operations shall consist in triangulation and levelling with a base having a development of 40,000 kilos.; and, secondly, levelling to cover 800,000 kilos. of ways and communication by road, rail, and water, and having a base of 27 kilos. The total estimated cost of all the proposed surveys and maps is £700,000, but it is not expected that it will be voted.

The Manchester Corporation is just completing an important bridge improvement in one of the main thoroughfares by the reconstruction of the Ancoats Bridge, from the designs of Mr. Allison, the city surveyor. The alteration will give a roadway 60ft. wide, and cut off a previous awkward crooked bend. Some difficulty has been experienced in carrying out the work by the necessity of avoiding an encroachment upon the towing path of the canal over which the bridge passes, or an interference with the lock gates closely adjoining, and another special feature has been the method adopted for carrying the water main with the bridge. This was previously carried on a parapet outside the bridge, but the adoption of a special casting of oblong section for the water main has enabled it to be carried out of sight underneath the bridge between the two main girders.

It is made known that the direct gas smokeless furnace known as the Casson-Bicheroux system, which is in operation at Lord Dudley's Round Oak Ironworks, is gradually finding its way into some of the principal ironworks of the district and elsewhere. In one case, at a recent trial of the system at a certain ironworks, the proprietors decided on altering their mills and forges to the Casson-Bicheroux system forthwith, the last of the mill furnaces having been very lately put to a successful test. By this system the waste heat is utilised, as usual, for generating steam, and the producers can be connected without in the least disturbing the old furnace plates. As an instance of the producing capacity of this system, we may mention that three of these furnaces produced in three single turns recently 87 tons of merchant bars, a result which has not, we believe, been before attained in South Staffordshire and East Worcestershire.

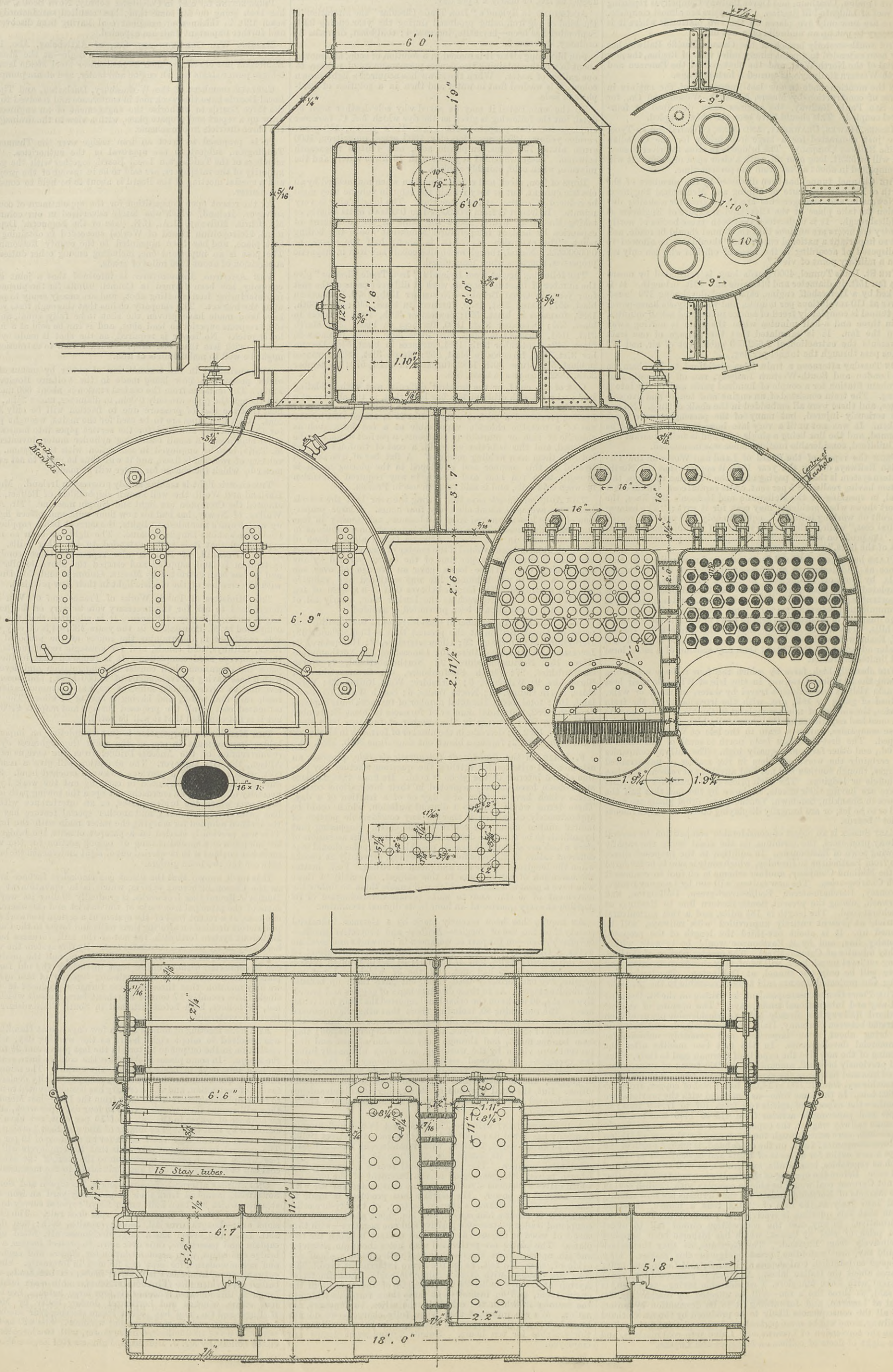
At a mass meeting of miners held a few days ago at Hamilton it was resolved to adopt eight hours as the working day, with a restriction in the output to 2½ tons in the fast places and 3½ tons in the stoops. In some places in Ayrshire the colliers have resolved to hold idle days in order to reduce the output. The miners of Fife and Clackmannan have also by a large majority declared in favour of restriction, and the secretary has been instructed to notify to the employers that fourteen days from the 16th—last Monday—they will reduce their working time to four days per week, should an advance of wages to the extent of 15 per cent. not have been conceded by that time. The miners of Mid and East Lothian have also determined to urge their claim for an advance of 15 per cent. The general impression at present is that the employers will in a few weeks make a partial concession to the men, if the prices of coal can be slightly improved and maintained in the meantime.

On Saturday afternoon Messrs. Robert Thompson and Sons, of Southwick, launched from their shipbuilding yard an iron screw steamer, which has been built under Lloyd's special survey to class 100 A1, and Board of Trade for the spar deck rule. The dimensions are:—Length over all, 345ft.; breadth, 40ft.; and depth, 29ft. 7in. The vessel has a large deckhouse aft, fitted up for captain and passengers, cape over stern to protect houses, a long bridge amidships, with accommodation for officers and engineers, and accommodation for crew and firemen in forecastle. She has cutwater stem, iron chart and wheel house, six bulkheads, water ballast aft divided into two compartments, and in main hold and forepeak, three-masted schooner rig, four large hatches, five boats, four steam winches and horizontal donkey boiler by Messrs. R. Roger and Co., and has patent steam steering gear amidships, screw gear aft, and Harfield's patent windlass. She will be fitted with engines of 1600-indicated horse power, with two large double-ended boilers, by Mr. J. Dickinson, Palmer's Hill Engine Works.

BOILERS AND SUPERHEATER OF THE S.S. LEERDAM.

THE NETHERLAND STEAMBOAT CO., FYENOORD, ENGINEERS.

(*For description see page* 214.)



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TO CORRESPONDENTS.

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P. M. (Lyons).—*You appear to have got the only numbers of* The Engineer *in print containing any information likely to be of use to you concerning suspension bridges.*

T. M. W. (Pontypool).—*If the specification is published you can find the price and number by referring to half-yearly Indexes of* The Engineer, *which no doubt you have.*

Subscriber.—*Mr. Kircaldy's book is a standard work, and may be obtained through most booksellers. If you have any difficulty in getting it, write to Mr. Kircaldy, Testing Works,* 99, *Southwark-street, E.C.*

J. B.—*You can reverse your engine by making your excentric loose on the shaft, and fitting the shaft with a stop which will drive the excentric for going ahead or astern, but you will then have to turn the engine round by hand after steam is shut off. This will be little trouble with a little engine. Take care that the stop is put on to give correct lead. The size of the boiler cannot be reduced by increasing the pressure. For suppose that it made* 100 *cubic feet of steam in a minute at* 50 *lb. pressure, then it would make only* 50 *cubic feet at* 100 *lb. in the same time, and in practice you would get only the same power out of each. If you worked a large engine expansively the case would be different, because the high-pressure steam could be made to go further, so to speak, than the low-pressure.*

WHO INVENTED THE STUFFING-BOX?

(*To the Editor of The Engineer.*)

Sir,—Can any of your readers say who invented the ordinary hemp-packed stuffing-box? Was it James Watt? Inquisitive Sam.
London, October 11th.

EVAPORATING WATER OR BRINE.

(*To the Editor of The Engineer.*)

Sir,—Will any correspondent kindly answer me the following questions through the correspondence column of your paper? (1) In evaporating a given quantity of water or brine from open shallow pans—first method, making the liquid boil and keeping it boiling until evaporated; second method, keeping the liquid at a temperature below boiling and evaporating slowly—would the first or second method be the most economical as regards fuel, and what would be approximate difference, if any? (2) In manufacturing fine salt, what would be the approximate consumption of coal per ton of fine salt produced from brine of 25 per cent.? J. P.
Salford, October 14th.

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

THE ENGINEER.

OCTOBER 20, 1882.

THE CHANNEL TUNNEL.

A large Blue-book concerning the Channel Tunnel has just been issued. It contains little or nothing instructive to engineers, but a good deal of matter which possesses even a national interest. The contents of the book are very varied. They principally consist of correspondence between a host of individuals, Government officials, railway companies, heads of departments, and others; the evidence given by witnesses before a Parliamentary Committee; the report of the Military Committee appointed to consider the nature of the risks in which the tunnel might involve us and the means to be adopted to avoid them; and memoranda from various eminent military authorities on the entire subject. One of the most prominent points about the whole affair is the remarkable diversity of opinion expressed. It seems to have been quite impossible to get more than two or three individuals to agree on any one of the host of questions that may be raised about the tunnel. Thus, for example, while we find Sir Garnet Wolseley condemning the scheme and telling the world that the construction of the tunnel would be fatal to England's greatness, we learn that Sir John Adye does not consider that any risk would be incurred. "Nothing, indeed," writes Sir John, "is more obvious than the facility with which the tunnel can be denied to an enemy by means which no vigilance on his part would prevent or remove." Sir Andrew Clarke almost ridicules the idea that a tunnel would be a source of danger. Assuming that the tunnel was captured by the French, "a force which could only issue from the end of a caterpillar-like structure in driblets would find itself soon disseminated." Seeing that Sir Andrew does not attach much value to railways in war, it may, perhaps, be said that his views are just a little peculiar. Again, the report of the Channel Tunnel Defence Committee contains a statement to the effect that the end of the tunnel should come to the surface out of the range of the guns of ships of war, and the committee give their reasons for saying this. (1) It would be removed from possibility of naval surprise or attack; (2) there would be no necessity to concentrate any portion of our navy near the mouth of the tunnel for its protection—the Channel fleet would consequently not be weakened, and would be free to move to any point where it might be required; (3) in the event of a war with any country or countries other than France, the possession of a secure line of communication for the conveyance of supplies would be of great importance. Such a line would render the nation not wholly dependent for food supplies on the mercantile navy. If the entrance to the tunnel were within the range of effective fire from the sea, this secure line of communication could not be obtained. From all this Colonel Sir John Stokes, a member of the Committee, dissents, holding that the tunnel mouth ought to be brought under the fire of the fleet, so that even if by a temporary command of the Channel, an enemy gained possession of Dover and the tunnel, our fleet, on regaining the command of the sea, could make it impossible for the enemy to enjoy the undisturbed line of communication, which is the real danger. There is nothing remarkable in this diversity of opinion, which arises from the fact that everything connected with the tunnel is at present matter for conjecture, nothing whatever being certainly known. The result is of course that no one can say without fear of contradiction that another is absolutely wrong.

Those who desire to learn the somewhat complex history of the tunnel, and the nature of the various negotiations that have been carried on between the various companies, individuals, and Governments concerned, we must refer to the Blue-book. Its pages will hardly be found either instructive or amusing. The most important part of the whole volume is no doubt the report of the Military Committee, to which we have just referred. If that report is to carry due weight, then it is mere waste of time to speculate about the future of the Channel tunnel, for its construction can never be sanctioned by any English Government. In the first place, the necessary fortifications required to defend the work would probably cost about three millions, and an enormous garrison would have to be maintained within them. The Committee find that neither the Fanhole tunnel of Sir John Hawkshaw, nor the South-Eastern Railway tunnel of Sir Edward Watkin, comply with the necessary defence conditions, and they cannot recommend that either one tunnel or the other should be sanctioned. The Committee state in much detail the means that should be provided for the defence of the English end of the tunnel, but they sum up in the following words:—In conclusion, your Committee have now only to record their answer to the question:—How far will these proposals, "beyond any reasonable doubt," secure "the use of the tunnel in every imaginable contingency" being "denied to an enemy?" In their opinion the application of the principles and measures adopted by them should, with that amount of intelligence, fidelity, and vigilance which the State has a right to expect from its servants, effect this; but it must always be borne in mind that, in dealing with physical agencies, an amount of uncertainty exists which can never be wholly eliminated, and that it is equally impossible to eliminate human fallibility. It is only by the multiplication of means, which can be placed under the control of independent authorities acting from different localities, that this element of uncertainty can be to the greatest extent minimised, and these considerations your Committee have steadily kept in view in the recommendations which they have made. But they cannot disregard the possibility that a long period of peace and uninterrupted tranquillity might engender carelessness in maintaining in good working condition the arrangements applied to the partial or complete destruction of the tunnel, and might lead to fortifications being left so inefficiently armed or insufficiently manned as not to be secure against surprise. They therefore desire to record their opinion that it would be presumptuous to place absolute reliance upon even the most comprehensive and complete arrangements which can be devised, with a view of rendering the tunnel "absolutely useless to an enemy" "in every imaginable contingency."

After every allowance has been made for exaggerated ideas concerning the risks to which a Channel tunnel would expose England, the broad fact remains that in the opinion of the most competent judges at home and abroad, enormous preparations must be made to prevent the tunnel from being used by an enemy. No matter how much the statements of Sir Garnet Wolseley and others may be minimised, it is still clear that Great Britain would be exposed to a new and serious danger the moment the tunnel was completed. We are the last to urge that this danger should not be incurred provided an adequate return was obtained; but this is a point on which there is no evidence forthcoming. In plain English, the construction of the Channel tunnel has been proposed purely as a speculation, a something out of which money is to be made, not necessarily by the ultimate owners of the tunnel, but by those who may construct it. To such speculators the question of national risk is one of no importance whatever, and, to tell the truth, they do not pretend that it is. Mr. Forbes, of the London, Chatham, and Dover Railway, in his evidence was extremely frank; after recounting the progress of the negotiations between the railway companies, the Rothschilds, and others, said, "the sort of steps with which we approached this question are these: "Is it worth doing at a great price? For the railway companies to incur the risk, very doubtful indeed; because any traffic estimates that I have ever been able to produce fall far short of the interest of 5 per cent. upon £10,000,000 of money. Then we thought it possible that, looking at the matter as one of international importance, there were several interests which were really beyond the railways, to which eventually we might appeal for support. The railways would come in primarily as having a certain amount of interest, but that amount of interest can be pretty well measured. Beyond that there would be the Chambers of Commerce and large mercantile corporations, who might be inclined, on the consideration of indirect advantages, to go into it. And behind them again, of course, there is the great milch cow—the State, or rather the two States of France and England, because the effects of intercommunication between the two countries are not limited entirely to the people who merely carry passengers and goods." Nothing can be more straightforward than this. As a speculation pure and simple it is very doubtful indeed if the tunnel will pay. This is admitted by one of the most eminent authorities on railway administration. He cannot see his way to anything like 5 per cent. per annum on £10,000,000, but then there is the great milch cow, or rather the two milch cows, the French and English nations. We are thus told without a blush that the tunnel is either so little wanted, or so likely to prove incompetent to the conduct of a large traffic, that 5 per cent., or anything like 5 per cent., cannot be earned with it, and yet it is to be made in order that the French and English nations may be milked. To gentlemen who speculate in this way national interests in the best sense can be of but secondary importance. Nor is it to be supposed that the promoters of the scheme have any interest in the comfort of passengers or the good which the tunnel might do to importers or exporters. They have had but one consideration in view, namely, to make money. On this point we may again quote Mr. Forbes with advantage. "When I tell you," he said to the Committee, "that the mere cost of unloading goods at Dover or Folkstone, shipping them there and unshipping them at Calais or Boulogne, and reloading them, amounts to something like 5s. a ton in hard cash, irrespective of the damage to the goods and the delay in transmission, you will see how very important intercommunication is." The tunnel completed, "a truck will be loaded at Bradford or Leeds, or any other of the great centres in England, and it will go direct to any of the great centres abroad. When once loaded, whether it travels 200 miles or 2000 miles does not matter. We should have all that intermediate delay and all that enormous outlay in transshipment saved by means of the tunnel. It is to that we are looking to repay us for the interest we should take in this project, and the money we should find for it." Mr. Forbes, it will be seen, forgot to state that the goods on which 5s. a ton are thus expended are of such value that the charge bears but a small proportion to the cost, and that the quantity so conveyed is really insignificant, all heavy goods and merchandise coming and going by steamer direct. In other words, if the national importance of a tunnel in a commercial sense is to be estimated on the figures given by Mr. Forbes, it will be very small indeed; but 5s. a ton would pay the railway companies a very nice little sum each year. But it must not be supposed that the exporter from France or from England would reap any benefit. That would be to suppose that the goods could be carried for nothing through the tunnel. We have at page 56 of the Blue Book a copy of the proposed tariffs. The length of the tunnel may be taken at about 35 kiloms. If we take goods such as flour, corn, wine, timber, and such like, we find that the charge would be 70 centimes per ton per kilom., or 24·5f., or in round numbers, £1 sterling per ton. If this be contrasted with the cost of ordinary steamship freights to Calais from London or the northern ports, it will be seen that the charge is so enormous as to be simply prohibitive. The only goods which would be likely to pay for transport are those put in the first of four classes, and including brandy, oil, dye woods, eggs, sugar, coffee, and such like, the charge for which would be 80 centimes per kilom., or 28f. per ton for the trip. Bearing these things in mind, it is easy to see that the 5s. per ton for transport saved would be of small benefit to the trading community.

Under the circumstances it appears that there is but one course open. The report of the Parliamentary Committee cannot be disregarded, and the Government should at the first suitable moment forbid the construction of the tunnel. No good case has been made out by the promoters of the scheme; those most in favour of it cannot show that they have any higher object in view than making money. To this we have no sort of objection, it is a perfectly legitimate enterprise; but the Government, representing the nation at large, may reasonably object to permit any company to make money out of a project which would entail a serious risk on the country at large. Sir Edward Watkin and his collaborateurs are very much in the position of firework makers who proposed to build a manufactory in the heart of London, and trusted to the Metropolitan Board of Works to aid them with funds. Under the circumstances the speculation might prove very remunerative to the firework makers. Parliament will hardly be brought to see that the aggrandisement of Sir Edward Watkin and his co-speculators, important as it may be, is sufficiently important to compensate for the permanent national risk which, according to the best authorities it is possible to consult, would undoubtedly be incurred were a Channel tunnel to be made.

THE COLLAPSE OF BOILER FLUES.

All Cornish and Lancashire boilers are liable to have their flues collapsed. The liability is so great that stationary boilers, at all events, suffer more frequently from this failure than from any other. Notwithstanding this, more mistakes are made about collapsed flues than about any other failure which can happen to a boiler. It is almost impossible, indeed, to get correct notions on

the subject into the head of the average steam user; the majority of boilermakers are equally dense; and the number of those who can be got to understand that every case of collapse is attended by special conditions worth investigating, is, we fear, very few. The popular idea is that when a flue "comes down" the boiler has been short of water. This is a sound deduction in many cases; but boiler flues have collapsed and furnace crowns have come down, and do come down, while there is plenty of water in the boiler and the furnaces have not been unduly pressed. We are not dealing just now with those collapses of flues which end in the total destruction of the boiler concerned and the killing and maiming of men, women, and children. We refer now to that greater or less flattening of the crowns of flues and furnaces with which the engineers of boiler insurance companies are only too familiar, and about which the world at large hears nothing at all. The sums paid in compensation for failures of this kind by most of the insurance companies are enormous. They are so great, indeed, that they absorb by far the larger portion of the receipts of the companies. With due care the annual outlay for compensation in cases of actual explosion may be kept comparatively small, but this is never the fact as regards collapses; indeed, these result from causes over which the insurance companies have little or no control. It may be useful to explain here for the benefit of the steam user the nature of the evil influences at work.

The first and most important of these is, of course, shortness of water. The crown of the flue is allowed to become dry; then it gets nearly red hot, and yields under the pressure of the steam. If the metal be good no rending or tearing takes place and there is no explosion. If it be brittle from old age, or because of what it has suffered at the hands of boiler repairers, there will be an explosion. There are two prominent causes which lead up to shortness of water. The first is Beer; the second is to be found in defects in the feed apparatus. Over the first the steam user has no control worth mentioning; for the latter he is wholly responsible. We do not hesitate to say that if an examination could be made of all the boiler-feeding apparatus in the kingdom, it would be found that more than 60 per cent. of it was out of order. We do not speak, of course, of locomotives or marine engines. The boilers of most stationary engines are fed by an engine pump, and one or more donkeys, or else some form of injector. As a rule, either the pump or the donkey is out of order, usually both. We do not mean to say that neither will force water into the boilers; on the contrary, both will do it, but more or less badly, with leaking and thumping, and cobbling up on Saturday nights, and coaxing and petting, and slackening a gland here, and tightening a nut there, and so on. Enginemen go to bed and "leave word with the subordinate who takes night duty that if the feed pumps won't work he is to be called." When someone who has a talent for managing feed pumps is away no water can be got into the boilers. When he comes the glasses can be run up at speed. Scores of our readers will be able to amplify this sketch, and will admit that we have overstated nothing. May we venture to hint that boiler insurance companies' engineers would do well in *all cases* to satisfy themselves, not only that the boilers on their books are in good condition, but that the feeding apparatus is really efficient. Only too often the word of the stoker or engineer is taken on this point, no adequate examination being made of check valves, blow-off cocks, feed pumps, injectors, or donkey pumps. This is not quite as it should be.

We have already stated that it would be a mistake to suppose that flues always collapse only because the boiler is allowed to become short of water. Nothing can be further from the truth. Flues may collapse either because of congenital defects, or because something takes place to overheat them. One of the commonest defects in a flue is want of accuracy of shape. Instead of being quite round it has a flat place in it. This is a weak place, and in process of time the weakness is sure to manifest itself in a very vexatious way. The boiler may have worked for four or five years, during which time it was kept clean; at last it happens that from some cause, such as a second boiler being laid off for repairs, the boiler with a flat place in the flue is worked harder than usual, and it goes longer without being cleaned. Then the flat place extends in dimensions, next it ceases to be flat, a "pocket" of greater or less dimensions being formed in the furnace, and then repairs of no small importance have to be made. If there had not been a flat place in the flue to begin with none of the other things would have happened; that is to say, there would not have been a pocket made, nor would the furnace have needed a new crown. In welded flues it is expressly necessary to look out for flat places, and the weld ought always to be put below the level of the fire-bars. A flue truly cylindrical of a given diameter is in theory twice as strong as a shell of the same diameter and thickness. Hence came the old and well-known rule—make the flue of a Cornish boiler half the diameter and half the thickness of the shell. Thus a boiler 6ft. in diameter and $\frac{1}{2}$in. thick, would have a flue $\frac{1}{4}$in. thick and 3ft. in diameter. Such a flue ought to require twice as great a pressure to collapse it as would suffice to burst the shell, and this supposed extra strength was introduced to compensate for want of accurate roundness of the flue. But in practice it was found that the rule was all wrong. It was not even certain that it was theoretically right; and so $\frac{3}{8}$in. flues go with 6ft. and 7ft. shells of $\frac{1}{2}$in. or $\frac{7}{16}$in. plates, and strengthening hoops are put on the flues, or Galloway tubes put into them, which things are needed as far as strength is concerned exclusively, because the flues are not round to begin with. It is not to be supposed that they ever will be made round, unless they are rolled in lengths without a weld, which may yet be done on a large scale. When they are rivetted there is sure to be a flat strip, because three rolls cannot bend the edges of a plate. Dangerous collapses may be almost entirely prevented by the use of strengthening rings; but these rings will not prevent the formation of pockets, nor the coming down of furnace crowns. These things are independent of strengthening rings.

Another and fruitful cause of collapse is the overheating of the plates while there is plenty of water in the boiler. This result is brought about by the presence in the boiler of something which will drive away the water from the plates. As an example, we may say that a few months since a species of epidemic broke out in certain steamers trading from the Tyne. They had scarcely got to sea when the furnace crowns came down. Engineer after engineer was discharged; but this made no difference. At last matters became so serious that the circumstances were investigated by Mr. Parker, chief engineer to Lloyd's, and he discovered on the furnace crowns a thin slimy coating. Further investigations proved that this, when scraped off and painted over the bottom of an iron bucket, was so perfect a non-conductor, that the bucket, being half full of water, its bottom could be made red-hot over a smith's fire, and the water would not boil. The formation of this tarry deposit was traced to the use of a special mineral oil in the cylinders. The use of this oil was given up, and no more furnaces were collapsed. Nor is it to be supposed that land boilers are safe from similar influences. On the contrary, it is well known that soft water containing organic matter—such water, for example, as is supplied from rivers and canals in country districts—while incapable of forming incrustation, will throw down a light brown floury deposit in small quantity. If this can settle on a plate over a fire, that plate will become red-hot, and the flue may either collapse or "pocket." Why these two forms of deposit should act as they do is a matter concerning which no certainty exists, while various theories have been formed with which it is not necessary to concern ourselves. Our purpose will have been served if we can induce steam users to believe that by the exercise of vigilance and forethought they can do much to prevent the occurrence of very troublesome and dangerous accidents. A flue cannot collapse even partially without placing a good many people in peril of their lives. Shortness of water, we repeat, is not essential to the bringing down of a furnace crown; but there is no reason to doubt that it is a principal cause of such accidents. It can be best avoided by employing in the boiler-house none but sober men, and by taking care that the boiler feeding apparatus, whatever it may be, is invariably in a high state of efficiency. As regards the coming down of flues from deposit, this is best avoided either by selecting a suitable water where there is an alternative, or by so heating the water beforehand that the deposit may be thrown down in the heater and not in the boiler. It is impossible to lay down any rule which will meet every case. We may in conclusion add a word of warning about boiler incrustation nostrums, of which there are dozens in the market. Some of these are good, some of them bad, a great many neither bad nor good, but useless. A moderate fee paid to a competent chemist for testing the feed water, will, as a rule, be well laid out. If a water is acid, alkalies may be used with advantage to neutralise the acid. If charged with lime, glutinous matters may be employed with benefit to keep the lime in suspension. A boiler composition which is good in one district may be worse than useless in another It does not follow that the maker of the composition will admit this or even know it. But composition or no composition, nothing will compensate for neglect in blowing off and cleaning out a boiler as frequently as possible. Dirt and collapse are very prone to go together.

THE PREVENTION OF FIRES.

An agitation is being set on foot in the metropolis for the purpose of bringing about the establishment of "fire inquests" both in London and the country. A meeting has been held on this subject, and a memorial is to be presented to the Government, to be followed by the holding of another meeting. The number of fires occurring in London, concerning which the cause is reported by Captain Shaw as "unknown," is considered an alarming and disgraceful symptom; and it is argued that if an official inquiry were held in the case of every outbreak, incendiarism would be checked, and the number of these unknown fires would be reduced. Certainly the statistics of fires tell an awkward story. For the last two years the fires in London, of which the cause has not been determined, have occurred at the rate of one in every nineteen hours. These mysterious fires have amounted in the last two years to more than 900, or about one-fourth the total number of fires for that period. That one-fourth the fires in the metropolis should go undetected as to their cause is assuredly a most unsatisfactory state of things. The cases of incendiarism discovered during these two years have only been ten, whereas we have no assurance but what the true number is very much higher. The metropolitan fires of uncertain origin have shown a tendency to creep up of late years. In 1872 the number was 268, in 1874 they were nearly 300, in 1879 they were quite 400, and in 1880 they verged on 500. Last year they dropped a trifle, being 462. Between 1872 and 1880, fires increased in general a trifle more than a fifth, while the unknown class were nearly doubled. Consolation may be derived from the fact that matters were much worse in 1865 and 1866 than they are now. In the latter of these years the unknown element presented itself in the case of 589 fires, while in 1865 the number exceeded 600. The ratio of the "unknown" was very high. In 1866 it was as much as 44 per cent of the total; yet in that year only four cases of incendiarism were detected.

The Select Committee of the House of Commons which in 1867 investigated the question as to the origin of fires and the best means of preventing them, collected a large amount of evidence, and made some important recommendations. Mr. Peter M'Lagan was the Chairman of the Committee, and the inquiry comprehended the whole of the United Kingdom. The evidence showed that the same unsatisfactory feature which prevailed in London was to be found elsewhere. Mr. F. G. Smith, secretary of the Scottish Union Insurance Company, expressed his conviction that matters had become much worse of late years. Speaking of the experience of his own office, he said:—"Forty years ago it was seldom a case occurred but what we could ascertain the cause of the fire, but now it is a most difficult thing to do so." Notwithstanding the suspicions entertained by his directors, the company had never prosecuted anybody for arson. It is well known that fire offices have an unwillingness to prosecute, because of the unpopularity to which they may be subjected, and partly because of the difficulty of bringing positive proof. The practice of fire insurance thus offers a two-fold inducement to the perpetration of fraudulent fire-raising; first, because of the pecuniary gain which may be acquired; and secondly, because the fire office, however suspicious, is not likely to take active steps to detect the crime. With the evidence which they received on this subject, it is no great wonder that the Committee of 1867 recommended that an inquiry should take place into "every fire." In a large number of cases this inquiry would be very brief and simple. The process, as proposed, was divided into three stages. The first, or initiatory stage, was to be entrusted to the police or the Fire Brigade, and if these parties discovered anything of a suspicious nature they were to report it to an authority who would enter on the second stage of the investigation. This authority, the Committee thought, should be the coroner, who would inquire into the origin of a fire as he would into the cause of a death. If strong grounds of suspicion were then discovered, so as to implicate any particular person or persons, the third stage would consist of a prosecution before the ordinary criminal courts. The Committee recommended that the remuneration of the coroner for conducting these inquiries should be partly by fees and partly by salary out of the rates. They did not think that the insurance companies should be called upon to pay any part of the expense, as it is not the duty of any private commercial company to prosecute for a public crime. Besides, the fire might take place on property not insured. In regard to Scotland and Ireland there was some modification as to the method, so as to suit the existing institutions.

Apart from the question of fraudulent fires, it is obvious that a very useful check on culpable carelessness might be exercised by means of a system, such as the Committee of 1867 recommended. But the ruling idea which gave rise to the proposal was that fires are made matters of profit to unscrupulous persons, who profess to have goods on the premises at the time of the fire which were either not there at all, or which, if there, were of much less value than represented. Where a fire is the work of a malicious incendiary, or where it is intended to conceal the perpetration of a robbery, the sufferer has little or no interest in concealing the fact. But an insurance company, on the other hand, gain nothing directly by proving that a fire is occasioned by an outside incendiary or a thief. If they can prove that the party making a claim against them really caused the fire himself by a felonious act, they at once escape all payment under the policy. But, as we have remarked, they have no great love for this sort of enterprise, unless they can prove that they are prosecuting a gang of professional fire-raisers. Practically the whole matter appears to rest with the police. The result is that, out of the large number of fires which are undetermined as to their cause, there is an apprehension that aconsiderable proportion are intentionally produced. Perhaps the comparative apathy which exists on this subject is due to the fact that honest people know they are not going to set their own premises on fire, unless it be by sheer accident, and they trust that nobody will be so evil-disposed as to make them the victims of incendiarism. The perfection of the Fire Brigade, in the case of the metropolis, encourages the idea that if some rogue sets a shop or warehouse on fire, the flames will be confined to the structure where they began, so that no very wide-sweeping conflagration need be apprehended. No doubt these considerations prevail to some extent, and the answer to the entire question seems to be, that it is nobody's particular business to see how it is that a fire breaks out. It is the business of the Brigade to see that the fire does not spread, and this being accomplished, Captain Shaw may report the cause of the fire as "unknown" if he likes. The property is "insured," and nobody grieves. The company are rich, and are able to pay; the ostensible sufferer is poor, and is glad of the money.

This is an easy way of doing things; but it cannot be called a right way. It may be that fraudulent fires are not so numerous as we fear. But there are statements made which, if correct, seem to show that there is something wrong. Mr. Serjeant Payne, the coroner for the City of London, gave evidence before the Committee of 1867, that there was "unquestionably" a reduction in the number of fires in the City and in Southwark, as the result of the fire inquests which he held between the years 1845 to 1850. Mr. Braidwood told him, "If you had originated these inquiries a few years ago, a great many people who are now in this country would be abroad." Sir John Humphreys stated that the reduction in the number of fires was as much as one-fourth. But although the entire cost to the Corporation was only a little over £50 a year, objection was taken to the legality of the outlay, and the inquests were given up. There is similar evidence on record from the provinces as to the salutary effect of fire inquests. But the Court of Queen's Bench decided in 1860 that coroners have no authority to hold these inquiries. Hence, an Act of Parliament is required to confer the necessary power. The experience of Sir John Humphreys, as given before the Select Committee was very similar to that of Mr. Serjeant Payne. Sir John stated that for one year prior to the adverse decision of the Court of Queen's Bench, he conducted fire inquests in his district with highly satisfactory results. About that time it was the custom, as we may term it, for a fire to take place in Tottenham every Saturday night. The circumstance attracted the attention of the overseers and churchwardens, and "they determined to do something." What they would do now we cannot tell; but at that date they were able to ask Sir John Humphreys to hold a fire inquest. Action was taken, and the fires ceased, though it happened that nobody was prosecuted. In the next seven years there were scarcely half-a-dozen fires in the entire parish. In 1848 the directors of the West of England Fire Office

were so satisfied of the public good arising from the holding of inquests upon fires, that they united with other insurance companies in sending a requisition to the town clerk of Manchester, asking the Corporation to authorise their coroner to hold such inquiries. It may also be taken as a fact possessing some significance, that of 589 fires occurring in the metropolis during the year 1866, whose causes could not be satisfactorily accounted for, as many as 480, or nearly five-sixths, happened on insured property.

The recommendation of the Select Committee of 1867 with regard to fire inquests has been entirely disregarded. It is a singular fact that the Select Committee of 1877, appointed to inquire into matters connected with metropolitan fires, made no recommendation with regard to inquests. We might acknowledge that the fires of unknown origin were mainly due to innocent causes, were it not for the startling results which have followed the exercise of the coroner's functions in this direction. The facts seem to prove the case so completely, that it is difficult to understand how a nation of "practical" people can allow the matter to rest where it is. As against incendiarism, the certainty of an official inquiry is found to be a great protection. Statistics have been given in our columns, showing how the metropolitan fires have risen from time to time during the last half century in a ratio more rapid than the increase of the population. Much may be said as to the increased risk of fire, owing to the inflammable materials which modern science has produced. Spontaneous combustion may answer for something, and the increasing quantity of merchandise stored in a given area may augment the general risk. How far the pecuniary aid afforded by fire insurance tends to make people careless is another thing. But fire is a serious evil, especially in the heart of a great city, and it cannot be safe for men to play with it. No reasonable guarantee against its attacks ought to be omitted, and while science is brought to bear for the purpose of extinguishing fires, it would be no less wise to take such steps as may limit their occurrence.

SHIPBUILDING IN THE NORTH.

It is stated on reliable authority that there are now about 150 vessels in course of construction in the North of England—at the ports of the Tyne, Wear, West Hartlepool, and the Tees, with the subsidiary and smaller ports of Blyth on the North and Whitby on the South. No particulars are obtainable as to the approximate number or tonnage of the vessels built in the present year, but there are grounds for the belief that with two months more of moderately fine weather the tonnage—if not the number—of the vessels built on the north-east coast will be the largest that has yet been built in any one year at these ports; and it is remarkable that there are in several instances preparations for extending the facilities of production, for new shipbuilding yards are spoken of as probable on the Tyne and at West Hartlepool. Concurrently with this there is a very marked reduction in the rate of freights, that to Cronstadt, having been registered as low as 3s. 6d. per ton for coals from the Tyne, which is the smallest rate that has ever been recorded. It is evident, then, that the vessels that are being built cannot be built with an expectation that the present rate of freights will continue, or that there must be an expectation that there will be a speedy increase in the cost of vessels. And, indeed, the latter seems probable, for the action of the miners seems materially driving up the price of coals, and with that movement upwards the price of metals must naturally increase. Whether there will be an increase that will be sustained enough to justify the expectations of those who are investing in iron vessels now, cannot be decided; but it is probable that if the rate of freights does not show a speedy upward movement there will be a material check to the increase of the tonnage of new steamers. In the North of England the greater part of the vessels built are cargo-carrying steamers; and it is that class that soonest finds the benefit of any increase in the general trade of the world. Such an increase seems now to have set in, and it may give some slight stimulus to the trade, but the ultimate test of the shipbuilding trade's prospects must in an ordinary way be that of the freight market. There is, with the approach of winter, some slight show of revival from the extreme dulness that we have hinted at, especially in the Indian trades; but it is slight, and generally it may be said that, looked at from the standpoint of the freight rates, the shipbuilding prospects are not so bright as they were.

THE NEW HULL AND CHESTERFIELD RAILWAY.

Great interest is just now being taken by those interested in the minerals and ironstone trade of North Lincolnshire in the proposed new Hull and Chesterfield line, as well as by Derbyshire coalowners. The new line would undoubtedly provide a grand outlet for the minerals of the two districts named. At the present time very few of the Derbyshire coalowners send any coal to Hull, owing to the tonnage rates being 8d. per ton more than they are to Grimsby. The Staveley and other collieries, although on the list issued from Hull, have for some time sent very little, if any, coal to the port. In the event of the line being constructed, the Derbyshire coalowners would undoubtedly enter the market as competitors for coal, &c., for smelting purposes in North Lincolnshire, which is now largely supplied from South Yorkshire. The proposed new line is intended to cross the Humber, near Hessle, by a tunnel, and traverse about ten miles of the rich ironstone districts of North Lincolnshire by Frodingham to Gainsborough, and thence to Retford, Worksop, Shireoaks, to Chesterfield. It will thus be seen that, viewed in connection with the iron and coal interests, the undertaking is a highly important one. At the present time the North Lincolnshire district—one of the most modern of our iron-producing localities—is for the most part dependent on the Manchester, Sheffield, and Lincolnshire Railway Company for its railway connection to the north, whilst its connection with the South and West Riding is secured by a branch of the Trent and Ancholme line. Its importance may be gathered from the fact that in 1867 only 86,587 tons of ironstone were carried, but ten years later this had increased to 293,437 tons. In 1880 it had become still further increased, for the Manchester, Sheffield, and Lincolnshire Company had no less than 358,244 tons placed on its lines for distribution to various parts of the country. In 1881 the latest official return showed that 240,624 tons were forwarded from Frodingham, 8557 tons from Bolton-le-Moor, and 78,080 tons from Lincolnshire, making a total of 257,261 tons sent by rail, and 694,245 tons used at the ironworks in the district. In addition to the tonnage of ironstone a large traffic is derived from the carriage of pig iron and coke for smelting purposes. In 1870 only 31,690 tons of iron were made, but in 1880 this had increased to 207,704 tons, whilst in the latter year no less than 481,807 tons of coal and coke were used at the furnaces, all of which had to be sent by rail from South Yorkshire and the North of England.

IRONWORKERS AND THEIR WAGES.

Our correspondents from Cleveland and from Staffordshire alike speak of a healthy disposition shown by the ironworkers to avoid a conflict with their employers. This is hardly the spirit which was recently displayed in each of those districts; and together the organisations there represent all the ironworkers this side of Monmouth and south of the Tweed. While in Staffordshire there was an actual disregard of the rules of the Wages Board, and a consequent suspension by the employers of the customary examination of the books to test the prices obtained quarter by quarter, there was in Cleveland an open rupture, and a decided though informal expression of dislike to the Wages Board in that district, and a threat to wholly throw over arbitration. Determining to be befooled no longer, the ironmasters of the North formed themselves into an organisation to take care of themselves, and the steelmasters have followed suit. Reminded of this by their own secretary, and warned of their impotence if these organisations should put forth their strength, the northern ironworkers have now pronounced in favour of the continuance of the arbitration principle, and have declared their allegiance to the Board, and the operatives' section of the Staffordshire Board have of their own accord appealed to the present Mayor of Birmingham to become the president of their Board, through which they are now preferring a claim to a rise in their wages.

LITERATURE.

Coal: Spontaneous Combustion and Explosions Occurring in Coal Cargoes. By Thomas Rowan. London: E. and F. N. Spon. 1882.

In this book Mr. Rowan examines the existing evidence on the spontaneous combustion of different kinds of coal, and seeks to prove that sulphur in combination with iron in the form of iron pyrites, though not the only cause of this combustion is almost always the original cause. He combats the hypothesis that carbonaceous oxidation resulting from the absorption and condensation of atmospheric oxygen by the carbon pores of coal is the more fruitful cause. The proof of this has been based to a great extent on some writings of Dr. Percy, and on the investigations of Herr Richters, which show that the absorption of oxygen by coal commences soon after coal is exposed to the air, and that it progresses with proportionate rapidity and is accelerated by heat. Richter's experiment showed that those coals which will absorb the greater quantity of moisture will absorb oxygen the more rapidly, and that this power of absorption is not dependent on structure merely, as some dense coals will absorb much more than some of the softer kinds. He has also shown that some coal containing a large quantity of iron pyrites is not so liable to spontaneous combustion as some that have a small quantity. The advocates of the carbonaceous oxidation theory of spontaneous combustion thus only show that some coals are liable to it, but Mr. Rowan quotes the report of the Royal Commissioners appointed in 1875 to inquire into the cause of spontaneous combustion of coal in ships, to show that all the various kinds of coal which have been exported are liable to it, which would not be the case on the carbonaceous oxidation theory. He also quotes statistics of combustion of cargoes of coal which show that the larger the cargoes the larger the percentages of spontaneous combustion, which he also argues would not be the case on the carbonaceous oxidation theory, because this would cause the heating of comparatively small bulks of coal as well as large bulks, while on the other hand the larger the quantity of coal the greater the possible contents of pyrites in a position to be acted upon by moisture so as to originate combustion.

Having to his satisfaction proved that iron pyrites are the chief cause of spontaneous combustion, Mr. Rowan enters into a consideration of the requirements for its prevention, or the prevention of the explosions due to the generation and exhalation of marsh gas. He shows that the surface ventilation as recommended by the Royal Commission has not been attended by a reduction of the cases of explosion arising from spontaneous combustion, but that there has actually been an increase, and he proposes that coal, classed as "intrinsically dangerous," should before shipment be subjected to the action of air heated to, say, 150 deg. Fah., for from twenty-four hours to several days, and that the holds of coal-carrying vessels should be fitted with a series of "abstractors" and "supplies," by means of which air may be supplied at proper times to all parts of the mass of coal in a hold, and by which the gaseous exhalations may be removed, not only from the surface, but from all parts of the mass, so as to prevent the lodgment of the gases in different spots, helped as this may be by the existence in some parts of greater quantities than in others of small and dusty coal. Mr. Rowan gives in several appendices a large quantity of statistics bearing on his subject, and which strongly supports the view he takes. The abstractors which he proposes to employ are simple in construction, and are made on the principle of the ejector. It is useless to attempt ventilation and abstraction of impure air or gases by means of one or more ventilating funnels, for these take air or gases from but a small area round their inlets. He therefore places these abstractors sufficiently close together for their areas of action to meet. Mr. Rowan's subject is one of national importance, and the Doterel explosion lends considerable support to those advocating, as Mr. Rowan does, a perfect arrangement of forced ventilation.

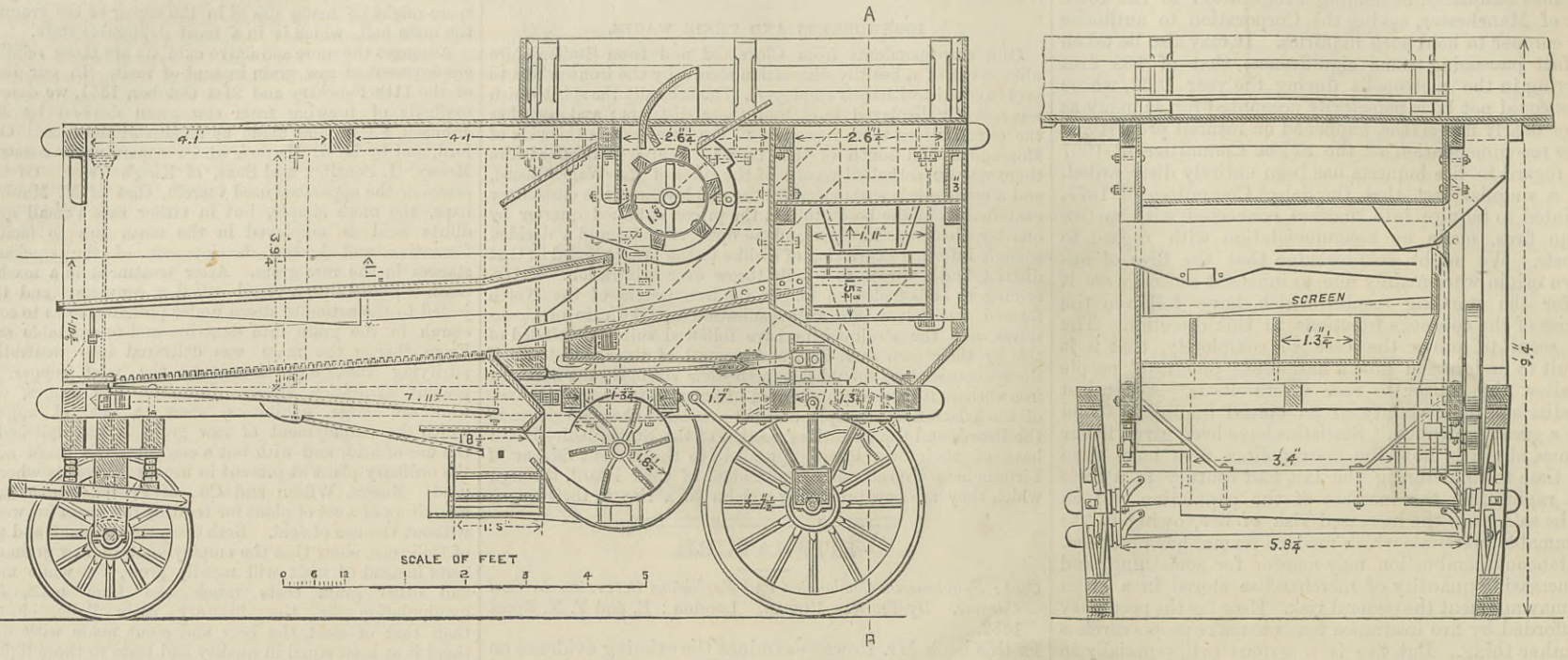
THE BREWING EXHIBITION.

The fourth annual exhibition of machinery, apparatus, and other plant used by brewers, distillers, and others, opened in the Agricultural Hall, Islington, on Monday, and closes to-morrow. By far the larger quantity of articles exhibited consists of fittings and fixtures, aërated water machinery, and hotel and public house requirements, but there is a large display of brewers' machinery and plant, and there is a smaller quantity of irrelevant exhibits than in the previous exhibitions. The frequent recurrence of trade and special exhibitions seems to be a good thing for the Agricultural Hall proprietors, for they find it necessary to extend it by covering in the arcade entrance in Upper-street, Islington, with a double storied structure, but those who frequently have to visit this hall will wish that there had not been this room for extension, in the hope that the money that is to spare might be made use of in the repair of the ground floor of the main hall, which is in a most deplorable state.

Amongst the more attractive exhibits are those relating to the employment of raw grain instead of malt. In our impressions of the 11th February and 21st October, 1881, we described the methods of brewing from raw grain devised by Mr. S. H. Johnson, F.C.S., and made by Messrs. Johnson and Co., Stratford, and by M. A. Manbré, whose apparatus is constructed by Messrs. H. Pontifex and Sons, of King's Cross. Of these processes or the apparatus used therein, that of M. Manbré is perhaps, the more simple, but in either case a small quantity of dilute acid is employed in the mash tun to facilitate the formation and hasten development of the saccharine substances in the raw grain. After treatment in a mash tun, the mash is passed into a vessel called a converter, and there subjected to the action of steam under pressure, so as to convert the starch in the grain into dextrine and fermentable saccharine. From thence the mass was delivered into neutralising and purifying vats, and thence to the wort copper. In the present exhibition Messrs. Lewellyn and James, of Bristol, who are large exhibitors, show a set of apparatus by which the employment of raw grain is accomplished without the use of acid, and with but a comparatively small addition to the ordinary plant at present in use in breweries where malt is used. Messrs. Wilson and Co., of Frome, Somerset, are also exhibitors of a set of plant for treating raw grain for wort making without the use of acid. Both these sets of plant, and the results of their use, show that the employment of raw grain of various sorts instead of malt will rapidly grow, for while maize, rice, and other grain costs much less than malt, and their manipulation in the brewery costs little or no more than that of malt, the beer and stout made with worts from them is at least equal in quality and taste to those liquors made in the ordinary way. Another advantage which attends the new development of the raw grain process is that the ordinary experience of the brewer guides him in its use, and he can see and modify the progress of the mash in the different stages of its conversion. By the arrangement adopted by Messrs. Llewellyn and James a mash occupies about half an hour to three-quarters of an hour longer than the mash of malt, but it at the same time possesses the advantage that no extra tuns or vats are required. We shall, however, further describe it in another impression with the aid of illustrations. In Messrs. Wilson and Co.'s process two tuns or vats are employed, one being at such an elevation that the mash will run from it into the other. In the first mashing tun is placed a revolving rouser, consisting of a vertical hollow spindle to which is attached a number of horizontal pipes with closed ends. Steam is passed into the vertical spindle, and thereby into the horizontal pipes, and the mash is thus raised and maintained at any temperature found necessary, according to the character of the grain employed. The grain is always kibbled or reduced to a coarse meal, and in this state is put into the first mash tun, and its starch is afterwards converted into a saccharine extract by the diastatic power of a small proportion, about 5 per cent., of malt. The temperature of this first mash is gradually raised and usually kept at from 180 to 200 deg. Fah. This is easily done as the steam in the pipes forming the revolving rouser is under the control of the brewer. When the mash is thus treated and converted it passes through a full-way cock at the bottom of the tun into a Steel's mashing machine at the top of the lower or second mash tun, where it meets and mixes with the other liquor in the usual way, and at the same time receives the addition of the proportion of malt whatever the brewer may determine that shall be. The system is now so simple that it will be found to possess many advantages, amongst which is the facility it affords for the utilisation of imperfectly malted barleys. To some other parts of the Exhibition we shall refer in another impression.

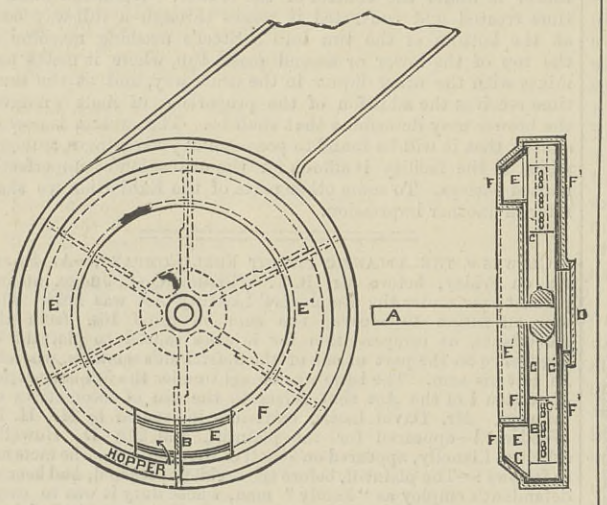
Clowes *v.* the Atlantic Patent Fuel Company.—At Swansea on Friday, before Mr. B. T. Williams, Q.C., Judge, an important case under the Employers' Liability Act was held. This was an action to recover the sum of £163 16s. from the defendants, as compensation for injuries caused to plaintiff by negligence on the part of one of the defendant's servants, whereby he lost his arm. The issue was brought under the 5th sub-section of section 1 of the Act that refers to the use of locomotives on railways. Mr. David Lewis, barrister—instructed by Mr. H. D. Woodwood—appeared for the plaintiff, and Mr. D. Howells, solicitor, Llanelly, appeared on behalf of the company. The facts are as follows:—The plaintiff, before the accident occurred, had been in defendant's employ as "handy" man, whose duty it was to carry out whatever he was instructed to do by the foreman. At 9 o'clock on the morning of the 16th of May last, he was ordered to go on the engine and act under the orders of the driver Rogers in fetching trucks from the Prince of Wales Dock. When they got on the low level line they found it necessary to reverse the engine to move ten trucks further up towards the Pottery Bridge. They were so near the crossing that they were prevented from bringing up above the crossing two trucks that were down the other side of the crossing towards the New Cut Bridge. In applying the engine to move these ten trucks it was found that she was not heavy enough, for the wheels would not bite the rails, and they turned round without moving the engine. Rogers moved the engine a yard back, and brought her to a standstill; then ordered the plaintiff to get down and sand the rails in front of the wheels, so that the engine might have a start, and gain momentum force on the ten trucks. The engine had only one sand-box in the front, and the plaintiff went round to the sand-box, filled his two hands with sand, and proceeded to sand the rails in front of the wheels. Whilst there he was sanding with his right arm between two buffers, when without any signal by way of whistle or by the usual cry of "All right," the engine was suddenly started, and hence the injury was caused which was now complained of. The plaintiff proved the above facts, as opened by Mr. Lewis, and further said it was the practice on such occasions for the engine-driver to wait until the handy man had called out "All right," and also whistled, neither of which was done by Rogers on the occasion in question. Mr. Howell, on the part of the defendant, contended that the plaintiff might have sanded the rails by throwing sand from one side of the rails, and that plaintiff had necessarily put himself in danger by sanding the rails while he was between the buffers in the way he did. In the course of further remarks the learned advocate said that Nelson won all his battles after he had lost his arm. (A laugh.) Mr. Lewis, amidst some laughter, said that Mr. Howells might make a good general in case of war breaking out, for history told them that hitherto lawyers had shone in war rather on land than on sea. His Honour gave judgment for plaintiff for £140 and costs of counsel, solicitors, and witnesses on the higher scale. It may be mentioned that Rogers was discharged by the company a week after the accident, and as he was not produced in court, it was alleged by the company that he was at the Cape of Good Hope. The plaintiff had been five weeks in the infirmary, and had had his right arm amputated above the shoulder. When he came out, £5, which was afterwards increased to £10, was offered to him by the Employers' Liability Assurance Corporation, with whom the defendants were insured, and subsequently the present proceedings were taken.

MANTLE'S THRASHING MACHINES.



By the accompanying engravings we illustrate a double-blast finishing thrashing machine, designed by Mr. A. W. Mantle, of Eckernfoerde, Germany, and patented in this country and elsewhere. From these sections it will be seen that the arrangement of the machine differs very much from the usual English practice. The shakers are differently arranged and are adjustable at the outer ends on joints at the inner end, so as to give a different inclination to them for different materials. For instance, it must be raised when thrashing barley or oats or short straw grain, or the straw passes off too quickly, while for the long straw of wheat, rye, &c., it must be lowered to help the straw off. No rotary dressing screen is employed, but a screen having a number of sieves of different meshes is used instead, and is attached to and driven by, and may be said to be an extension of the second dressing shoe.

The two riddles are so mounted as to balance each other, and run so lightly that on a 54in. machine only a 2in. strap is employed; a fly-wheel is placed on the crank shaft. In the whole machine there are only twelve bearings or frictional parts. Three small straps are used, and two fans; the second blast fan is not very clearly shown in the engraving, as its length is that of the machine frame width, and its lines are coincident. A blast elevator is employed, in which provision is made to prevent the breaking of the corn by bruising against the fan case sides.



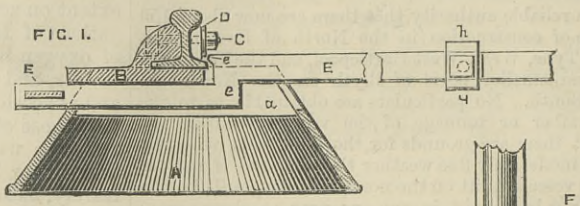
Mr. Mantle has had machines made in this way at work for several months with much success in Germany, and much importance is attached to the simplifications he has made, the value of which will be understood by agricultural engineers without further explanation.

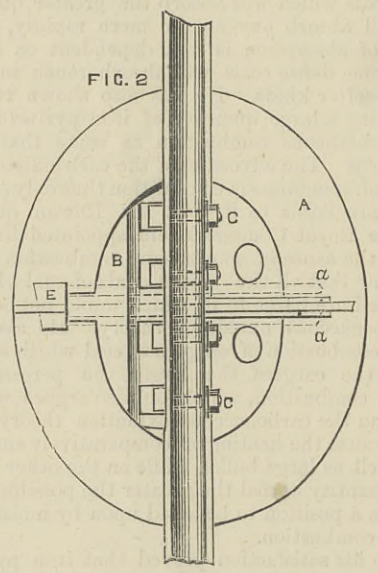
It will be seen that the machine is fitted with a fan blast elevator, and this is more fully illustrated in the accompanying detail engravings. In these A is the shaft, B the elevator blades, C slots for adjusting these, *d* the perforated plates on outside, E the hopper into which the corn is delivered, *f* and f^1 the casing plates of elevator, *g* and g^1 sheet iron plates to prevent the corn coming in contact with elevator sides; E^1 is a box cast on inside plate in which the hopper runs. The blades are made and fixed in a casing, but are parallel-edged instead of pointed. By this means Mr. Mantle says the corn is prevented from severe contact with the sides of the elevator, which is the place where it gets broken up. Of these fans Mr. Mantle has made one for trial, which he drove at 1800 revolutions per minute without, he informs us, breaking up any corn whatever.

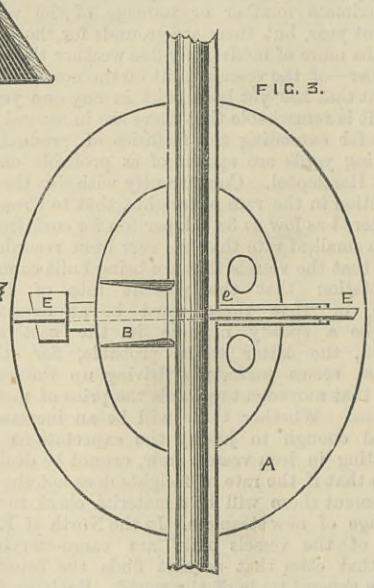
RAINBOW'S SLEEPERS.

The accompanying engravings show a system of iron permanent way, patented by Mr. W. Rainbow, of 10, Essex-street, Strand. Fig. 1 is a transverse section through one of the pot-sleepers. Fig. 2 is a plan of the same. Fig. 3 is a plan of a modification. A is an ordinary cast iron pot sleeper, and B is a jaw or half chair cast upon the top table of the sleeper, and of a form to correspond to the profile of the rail, as shown. This jaw B answers both the purpose of a chair and of a fish-plate for fish jointing the ends of the rails. It is of the same length as an ordinary fish-plate, and is cast with recesses on the back of it and holes through it for the heads and shanks of the fish-bolts C, which pass through the same, through the web of the rails, and through an ordinary fish-plate D, on the opposite side, and are secured by nuts as usual. The holes in both B and D are slightly oblong to allow for expansion and contraction of the rails, and the square heads of the bolts fit loosely in the recesses for the same purpose, but yet so as to prevent the bolts turning when tightened up.

In Fig. 3 B is an intermediate chair. It is shorter and has no bolts through it, but is otherwise similar to Figs. 1 and 2. E is a cross-tie to maintain the gauge of the line. This cross-tie is of peculiar construction, and serves not only the purpose of a cross-tie, but also that of a clip, which, in combination with the jaw B at the opposite side of the rail, serves to hold the rail securely down upon the pot sleeper. For this purpose it is



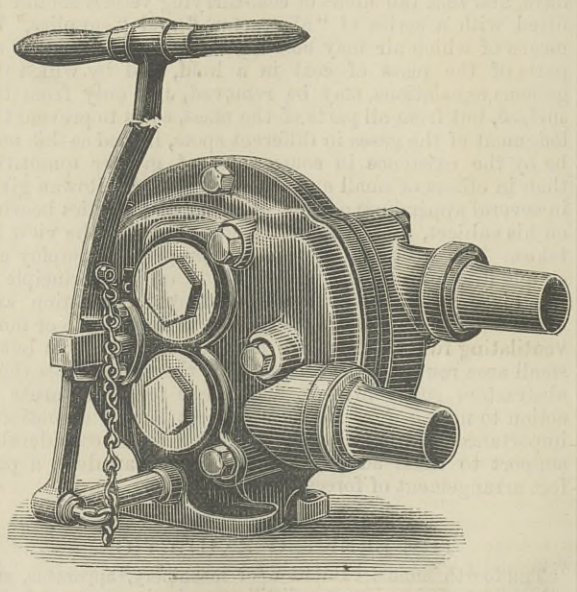


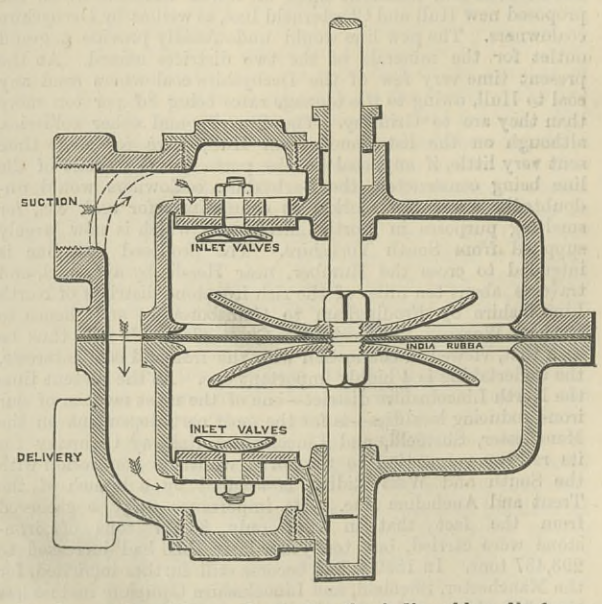


cranked at *e*, and provided at *e'* with a lug or projection which rises above and fits upon the foot of the rail, as shown, and holds the same firmly down upon the sleeper. This cranked part of the cross-tie passes through a transverse slot made partly in the top table and partly in the sides of the pot sleeper A, and its straight extremity passes close under the top table of the sleeper, and is secured at the opposite side by a key E. The sleeper A is strengthened at this part by two transverse parallel ribs *a* on the under side, between which the cross-tie passes. The cross-tie is thus immovably attached to the sleeper on the one side by the key E and on the other by the lug or clip *e*, so as to maintain the gauge of the line accurate, and at the same time, in combination with jaw B, clamp the rail securely to the sleeper. The latter purpose is served more particularly at the intermediate chairs, Fig. 3, where the rail is not otherwise secured.

To enable the one rail to be removed without loosening the other from its chair, the cross-tie E is in two parts, united at the middle of the track by a joint H, consisting of a wrought iron clip *h*, embracing the overlapping ends of the two parts of the cross-tie, so as to make a rigid joint with a bolt *i* passing through the whole, and secured by a nut, as shown.

FOSBERY'S DIAPHRAGM PUMP.

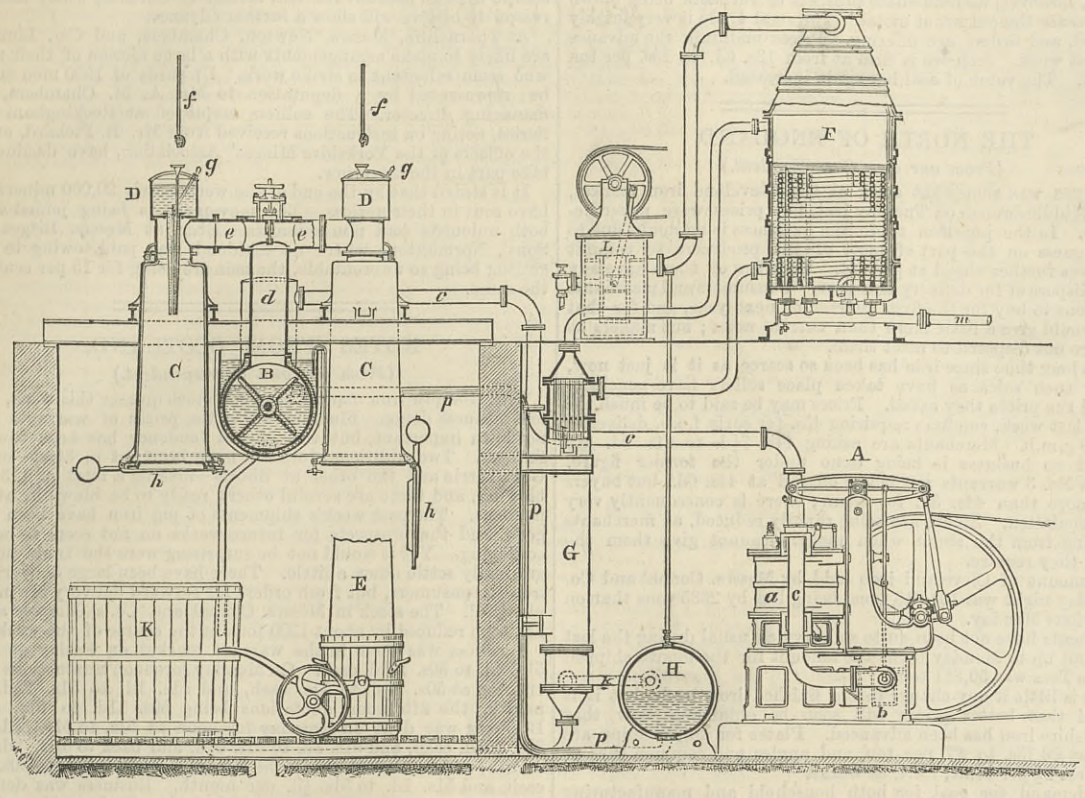




This pump, exhibited at Tynemouth, is suitable for short lifts, and is more particularly intended for ships, boats, fishing smacks, &c. It is simple in construction, and little liable to derangement. The pump is double-acting, with separate suction and delivery valves on each side. In the centre of pump is a sheet of soft flexible india-rubber, dividing it into two parts. On each side of this rubber are iron shields secured to a rod guided at both ends; one end of the rod is attached to a handle in the usual way. The suction and discharge of water is caused by alternately raising or depressing the india-rubber diaphragm. The general arrangement can be understood from the engraving.

King's College Engineering Society.—At an ordinary meeting of this Society held on the 12th current, the president, Mr. N. Douglass, S.I.C.E., delivered the opening address. A discussion was also announced for the 26th October, "Gas *v.* Electricity for Lighting Purposes." There was a large attendance of students of the Applied Science Department.

THE WINDHAUSEN REFRIGERATOR.



On Friday, the 13th inst., a number of gentlemen, among whom were Professor Frankland, F.R.S., Surgeon-General Mackinnon, C.B.D., Dr. John Hopkinson, F.R.S., Mr. Geo. Baird, and Dr. Vieth, F.C.S., assembled by invitation to witness the working of a new patent vacuum pump, refrigerator, and ice machine, now erected on the premises of the Aylesbury Dairy Company, Limited, at Bayswater. This apparatus, which is the invention of Mr. Franz Windhausen, of Berlin, an engineer whose name is well known in connection with refrigerating appliances, is the first of the kind put to work in this country, and as it is claimed that by its means ice can be commercially manufactured of a better and more durable quality than that produced by the freezing machines at present in use, and at from one-third to one-half the cost, a short description of the process and plant will probably be interesting to many of our readers.

It has long been known that extreme cold can be produced by the rapid evaporation of water in a comparatively perfect vacuum, the heat required for vaporisation being abstracted from the remaining water, which consequently becomes reduced in temperature, and if the process be sufficiently prolonged, actually converted into ice. Machines to carry out this principle have been constructed by Leslie, Carrè, and others, but in all these cases the air pump served only for the rarefaction of the air in the refrigerating compartment, and not for the removal and condensation of the vapour, which had to be entirely absorbed by sulphuric acid, requiring renewal after each operation. Owing to this defect continuity of action could not be obtained, while the removal and replacement of the acid was not only an expensive operation, but was open to obvious objections from the danger and difficulty of dealing with such a highly corrosive material as oil of vitriol. For these reasons the introduction of vacuum machines has never been general, and in point of fact they were little known or used, except for producing very small quantities of ice for household purposes and for laboratory experiments, in both of which cases the air pump was worked by hand.

In Windhausen's machine is introduced a combined air and vapour pump, which serves for maintaining the extreme vacuum of about four millimetres absolute pressure in the refrigerator, and at the same time to remove and condense the steam, while the renewal of the sulphuric acid is avoided by a cooling and concentrating arrangement, by which the absorbed water is abstracted and the acid rendered available for use over and over again.

Our illustration above gives a general view of a complete vacuum ice machine, arranged as it actually is in practice. The pump A shown in the present instance as driven by an independent engine, maintains an almost perfect vacuum in the freezing cylinders C C, with which it is connected by the suction pipe *c*, through the absorber B containing concentrated sulphuric acid continually agitated by revolving arms. Pure water is delivered by pipes *f f* into cisterns D D, from which it is gradually admitted to the cylinders C C by pipes with adjustable valves, projecting somewhat into the interior, and water-jacketted to prevent obstruction from the formation of ice. The vacuum within the freezing cylinders at once causes rapid evaporation, and the vapour, together with a certain amount of air given up by the water, is drawn towards the pumps through connecting pipes *e e* and *d* over the surface of the sulphuric acid in B, which absorbs the greater part of the vapour.

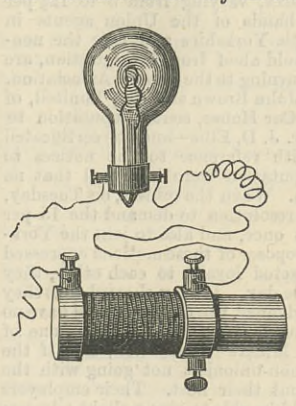
Each pound of vapour formed in the cylinders, requiring a supply of some 1100 thermal units, has no other source of heat to draw from but the water itself, and as about 200 units are given off in the formation of one pound of ice, it will be seen that by properly arranging the supply nearly six pounds of water might be converted into ice for every pound evaporated. Actually about five pounds of ice are obtained, the balance of the heat being drawn from the iron casings by conduction from the outside. When the process is sufficiently advanced, that is when the freezing cylinders are filled, which takes place in about an hour—more or less depending on their size—the doors *h* at the bottom are swung open and the blocks of ice permitted to fall by their own weight into receptacles of any convenient description. The freezing vessels are placed in two rows, one on each side of the absorber with which they communicate by separate pipes with shut-off valves, so that if desired each cylinder can be worked and discharged independently of the other.

The absorber B, containing the sulphuric acid, is a horizontal cylinder within which a shaft provided with arms rotates. These arms stir the acid and mix the surface portion, which is diluted from absorbed moisture with the more concentrated portion at the bottom, and being made spoon-shaped, carry up acid with them, so promoting absorption. A cold water jacket surrounds the cylinder and cools the acid, which would otherwise become heated. From the absorber the dilute acid is conveyed by a pipe to the bottom of the heat exchanger G, and, ascending through tubes, is heated by hot concentrated acid outside, travelling in the contrary direction on its passage to the reservoir H. From the exchanger the dilute acid, now somewhat raised in temperature, enters the concentrator F by a pipe at the top, and is further heated by a steam coil in order to evaporate off the water, the vapour being removed by the small supplementary pump L. The hot concentrated acid then passes from the bottom of the concentrator round the outside of the tubes in heat exchanger, where it is cooled, into H; from which the pipe *p* conveys it for re-use in the absorber.

In a report by Dr. John Hopkinson, F.R.S., who has personally inspected one of the vacuum machines erected in Berlin in 1880, and in use since that date, it is stated that no undue depreciation or corrosion was apparent in any part of the apparatus, and that after most careful examination no trace of acid could be found either in the condensed vapour from the large air pump or in that from the small concentrator pump. With regard to cost, the report states that the writer found from experiment that 1 ton of coal would produce 12½ tons of ice, the average net horse-power to work a machine making 12 tons in twenty-four hours not exceeding three, and that he is of opinion that after allowing interest on capital, depreciation at 10 per cent., and estimating other expenses on a liberal scale, solid block ice can be produced by the vacuum process for from 3s. 4d. to 5s. per ton, depending upon the magnitude of the plant and whether it was continuously worked up to its full power or otherwise. Even in this country the manufacture of ice and the refrigeration of water and other liquids have become such necessities that it is quite certain the advantage of a cheaper method of producing cold than those now in use will be readily appreciated; while in hot climates, where, from the difficulties resulting from the high pressures required in ice machines in which cold is produced by the evaporation of ammonia or other volatile liquids, the use of cooling apparatus has hitherto been attended with considerable difficulties and expense, the new vacuum plant should be worked as effectually and economically as in this country. The ice produced is not transparent, but opaque, this appearance being caused by vacuoles due to its formation in a vacuum, and which so soon as the doors of the freezing cylinders are opened become filled with air. On this account it is claimed that the ice is more durable than if transparent. The experimental trial last Friday was a complete success in every respect, and we shall look forward with interest to the further development of the invention and its actual application to commercial purposes.

RHEOSTAT FOR ELECTRIC LAMPS.

A small rheostat, consisting of a spiral coil connected in an electric circuit and fitted with an adjusting device, by which a greater or less number of the wires of the coil may be brought into contact so as to vary the resistance, is thus described in the *Scientific American*. In the annexed engraving A is a coil formed of fine wire, preferably German silver. A support is provided, consisting of a short rod of non-conducting material having a fixed and a loose collar; upon this rod the fine wire is wound in a loose spiral, and it has its ends connected to the fixed and loose collars. The loose collar is fitted with a set screw for securing it in any position in the length of the rod. By moving the loose collar out on the rod the coil is stretched and opened, or by a reverse movement the coil is closed, so that there is contact between the coils. The circuit wires connect to the ends of the coil at the fixed and sliding collars. The resistance offered by the coil depends upon the length of the coiled portion opened by adjustment of the slide. The closed portion is short circuited, and allows the current to pass freely. This regulator may be used for electric currents generally, and is specially adapted for electric lamps. It is the invention of Mr. Patrick H. Fox, of New York city.



The Channel Tunnel.—It is stated that, despite the adverse report of the Military Committee, the two rival Bills to authorise the construction of a Channel tunnel will probably be again brought forward next session, together with plans modified in order to meet, as far as possible, the structural requirements of the War-office Committee.

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

(*From our own Correspondent.*)

Now that the miners have obtained a rise of 10 per cent. in their wages, and the blast furnacemen a rise of 5 per cent., the iron-workers who were the operatives' section of the Wages Board have instructed their secretary to give the requisite notice calling that Board together, "to reconsider the rate of wages fixed by the Board in February last." The giving of this notice constituted an element of strength in the otherwise not conspicuously strong markets yesterday in Wolverhampton, and to-day—Thursday—in Birmingham. In addition to Messrs. P. Williams and Sons, who have notified their resolve to make no advance in their quotations, a second firm was named on Wolverhampton Exchange as having taken a similar course; but as I have not yet received from the firm cited authoritative information upon the point, I decline the responsibility of naming them, though I have little doubt that the course alleged has been taken. Yet the firms who had quoted the 10s. rise on finished iron were strong in their demands for full rates.

The Earl of Dudley's new prices are: Bars (flats, rounds, and squares), common quality, £8 12s. 6d.; single best, £10; double best, £11 10s.; and treble best, £13 10s. Rivet and T-iron—the latter not exceeding eight united inches—single best, £11; double best, £12 10s.; and treble best, £14 10s. T-iron, ordinary, £9 12s. 6d. Angles, not exceeding 8in., common, £9 2s. 6d.; single best, £10 10s.; double best, £12; and treble best, £14. Strips and hoops, from 14 to 19 w.g., ordinary quality, £9 2s. 6d.; single best, £10 10s.; double best, £12; and treble best, £14. Strips and hoops, ⅞in.—not thinner than 20 w.g.—common, £10s. 2s. 6d.; single best, £11 10s.; double best, £13; and treble best, £15; ditto ¾in., ordinary, £11 2s. 6d.; single best, £12 10s.; double best, £14; and treble best, £16.

The new list of Messrs. William Barrows and Sons is as here:—Common bars, £8; best, £9 10s.; and double best, £10 10s.; chain bars, £9 10s. to £10 10s.; double best charcoal bars, £16; plating bars, £8 10s. to £10; scrap bars, £9 10s. to £10 10s.; angles, £10 to £11; T and rivet iron, £10; double best swarf rivet iron, £11; boiler plates, £9 10s., £10 10s., £11 10s., and £12 10s., according to quality; extra treble best plates, £15 10s.; and best charcoal ditto, £19 15s.; sheets to 20 w.g., £9 10s.; 21 to 24 w.g., £11; and 25 to 27 w.g., £12 10s.; best charcoal sheets, £10 5s. extra; hoops of four widths of from 14 to 18 w.g., £8 10s.; best hoops, 30s. extra; best matched slit rods, £10; second best, £9 5s.; double best charcoal ditto, £17; and ditto rolled, £18 10s.

Messrs. Noah Hingley and Sons, who warrant their iron equal to any other Staffordshire brand, state that their advanced prices are:—"Netherton" crown best bars and crown best horseshoe bars, £8 at works; best rivet iron, £8 10s.; double best plating iron, £9 10s.; "Netherton" crown double best bars, £9; and treble best, £10. These prices apply to rounds and squares ½in. to 3in., not exceeding 27ft. long, and to flat bars 1in. to 6in. wide, not exceeding 25ft. Angles and tees up to 8in., and not exceeding 25ft. are:—Angles, 10s. per ton extra; and tees, 20s. per ton extra.

Messrs. E. T. Wright and Son's new prices for their "Monmoor" iron are:—Boiler plates, £9 10s.; sheets, £9; bars, £7 15s.; and hoops, £8 5s. The "Wright" qualities of this firm are 10s. per ton less, as usual.

Messrs. William Millington and Co., of the Summer Hill Iron-works, Tipton, inform me that they have determined not to issue any new lists, but that they will supply quotations on receiving specifications from buyers.

The fresh quotations of the Pelsall Coal and Iron Co., Limited, are:—Bars, £6 12s. 6d. to £7 2s. 6d.; hoops and strips, £7 to £7 10s.; horseshoe bars, £7 2s. 6d.; sheets, singles, tank plates, and tack sheets, all £8 10s.; large strip, £8; gas strip, £6 12s. 6d., £6 17s. 6d., and £7 12s. 6d., according to width; nail strip, three widths, £6 12s. 6d.; angles, £6 17s. 6d. to £7 7s. 6d.; Tees, £8 to £8 10s.; sash iron, £8 10s.; steel hoops and strips, 1in. by 18 w.g. and upwards, and "Eureka" hoops and strips, £8 12s. 6d.; "Eureka" sheets, to 20 w.g., £11; charcoal sheets, to 20 w.g., £15 10s.; charcoal rods, £13 12s. 6d.; and steel rails, as "per section sheet," £8.

Messrs. E. P. and W. Baldwin (best), thin sheet makers, advise me that their present rates stand at:—"Severn" singles at works, £12; Baldwin Wilden B., £13; ditto B.B., £14; ditto B.B.B., £15; ditto charcoal, £17s. 10s.; ditto best charcoal, £20 10s.; ditto extra best charcoal, £22 10s.

Merchants pointedly declined, both in Wolverhampton and Birmingham, to give makers' quotations, and though the latter mostly maintained a resolute front, yet a few consented to book orders for small lots at only a little advance upon previous rates, when the commodities required did not come under the denomination of market bars or plates.

The galvanisers were less anxious to buy than for six weeks past; for there has been no week in that time in which the orders received have been less satisfactory. This had its effect upon galvanised sheets, which are subject to severe competition, notwithstanding the rise of 10s. declared last week.

Prices of stamping sheets, both in iron and steel, were likewise irregular, though most of the firms are well engaged. Competition came chiefly from the houses who are not largely occupied upon export, and do mainly a home business. The foregoing quotations of such commodities were difficult to realise.

The plates also were variable. While in one case 18s. 6d. to 19s. was asked for coke sorts, and 20s. to 21s. for charcoals, in another the quotations were 21s. for coke, and 23s. for charcoal; and in a third charcoals were priced up to 25s. per box.

Hard spelter the galvanisers quoted at £15, f.o.b., London and Liverpool.

Pigs did not sell either to-day or yesterday in lots calling for record; but recent aggregate sales have been heavy. Ulverstone hematites have been sold forward to the end of the year. The present quotation is 67s. 6d. Barrow forge pigs were named at 72s. 6d., and Tredegar 70s. Native all-mine pigs were 65s. to 70s. Derbyshire were quoted 52s. 6d.; Millfield's "part-mine" were 52s. 6d., and the "mine" brand of the same firm 57s. 6d.—both a rise of 5s. per ton.

Coal is less active at the moment, but when orders will be accepted at within the last rise there is a disposition to buy forward, for even at the rise the rates are generally below the average in a series of years, and mineowners' profits very trifling.

The ironworkers are not only seeking an advance in their wages all round, but also a special rise in the remuneration given at some forges for working "best" and "best best" iron. They desire to get their terms through the interposition of the Wages Board, though they virtually abandoned it when lately against the terms of the agreement they enforced a rise. Before, however, they could make any progress they had to get a president, for Mr. R. Chamberlain, the late mayor of Birmingham, had declined to continue in the office. They fixed upon the present mayor, Alderman Avery, and they resolved to send a deputation to invite him to take Mr. Chamberlain's place. The ironmasters have no wish to impose any obstacle in the way of an amicable settlement of the men's wages demand, and hoping that they may perhaps hereafter show less disloyalty to the Board's decision, have consented to join in a request to Alderman Avery to accept the office of president.

This (Thursday) afternoon a deputation representing the Masters' and the Operatives' Section of the Wages Board waited upon Alderman Avery at the Council House, Birmingham, to ask his acceptance of the presidency of the Board. The deputation was favourably received, and Mr. Avery said he would send them his reply at the beginning of next week. The Board is to be summoned together for the 30th inst. to consider the mens' notice for an advance.

A rise of 10s. per ton in cut nails of all descriptions has been declared by Mr. John J. Parkes, of the Eagle Works, Smethwick, which makes his price 9s. 3d. per cwt. Most of the firms in this district are, however, selling at 9s. per cwt.

Ironwork for railway carriages is in request. The subsisting activity is likely to be augmented from India. This week manufacturers are sending up tenders to supply the Indian Railway Company with iron underframes, and body and underframe ironwork and fittings for third-class carriages, together with wheels and axles, spring bearings, and the like.

At a meeting of the Stourbridge Firebrick and Clay Masters' Association, which has just been held at the Talbot Hotel, Stourbridge, prices were advanced as follows:—Firebricks, 5s. per thousand; fireclay, 1s. per ton; retorts, 6d. per foot.

The gun-lock filers of Darlaston have this week secured an advance in wages of 1½d. per lock, which brings the present rate of payment up to 9d. per lock. The concession was preceded by a strike of a few days' duration.

The Wolverhampton Chamber of Commerce on Friday last received from the Foreign-office copies of the new Spanish tariff, and circulars as to the present position of the commercial negotiations between this country and Spain. It was stated that the Spanish Government had placed England in a most unfair position in relation to import duties, and that the Foreign-office, ably supported by Mr. Morrier, the British Ambassador in Spain, had up to the present done everything that appeared possible, consistently with the maintenance of self-respect, to bring about a better understanding.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—As I anticipated in my last week's "Notes," the quarterly meetings have been followed by an advance in the price of iron in this district; but this has in some cases been larger than was expected, and the upward movement is not at present being followed at all readily by buyers. There is naturally an uneasy feeling in the market owing to the disturbed state of the coal trade, but no general apprehension of a protracted strike seems to be entertained, nor is it believed that the result of the miners' agitation will in itself very materially add to the cost of iron, while the production is regarded as sufficiently large to meet any possible requirements.

There was only a quiet market at Manchester on Tuesday, and so far as pig iron was concerned, the advance in prices seemed to check business completely. Most of the large consumers are now tolerably well bought, and although makers as a rule have sufficient orders on their books to relieve them of any anxiety with regard to further sales at present, they have extremely little business offering at the prices they are now asking. Lancashire makers have put up their prices between 4s. and 5s. per ton, and for delivery equal to Manchester are now quoting 50s. for forge, and 50s. 6d. for foundry, less 2½. At these figures they are doing no business, but a fair quantity of iron could have been booked during the week at about 2s. above old rates. For Lincolnshire and Derbyshire irons delivered here the prices quoted range from 50s. to 51s. and 52s. per ton, less 2½, but in these also the top figures cause buyers to hold off.

In the finished iron trade there has been an advance of from 5s. to 7s. 6d. per ton in some cases, but although there is a tolerably large business on foot, and the local forges are all full of work, this does not represent much actually done at the advanced prices. For delivery into the Manchester district £7 per ton for bars is quoted in exceptional cases, but good local makes from the Warrington district can be bought at £6 15s., and Wigan bars at £6 10s. per ton; hoops, in which a good business is being done, are quoted at £7 5s. to £7 10s., and sheets, which are also going away freely for shipment, at £8 12s. 6d. to £8 15s., with good Staffordshire qualities at £9 2s. 6d. per ton.

The engineering trades generally continue well employed, with the exception that machinists are reported to have less work in hand.

Messrs. Wm. Muir and Co., of the Britannia Works, Manchester, have this week completed for Sir Wm. G. Armstrong and Co., of Newcastle, an exceptionally powerful combined boring, facing, drilling, tapping, and studding machine, weighing altogether about 60 tons. This machine, although specially designed for machining at one setting, has the hydraulic jib cranes so constructed that it is adaptable also to general engine work; and briefly described, it consists of a double machine, having an upright carrying headstock at each end. These headstocks, which are driven independently, have a cross traverse of about 10ft., and also a vertical movement of 10ft. Each headstock is fitted with two spindles, one of 4in. and the other of 2⅞in. diameter, both arranged for the several purposes above named. The cross-bed for the right-hand headstock has a self-acting longitudinal movement of about 15ft., and the several motions for bringing the headstocks into the required position for their work are under the control of the workmen from the platform fixed to the headstock. In addition to the several operations for which the machine has been specially designed, an adjustable movable headstock is arranged, so that after work has been bored, faced, drilled, tapped, and studded, it can then be chucked, and part of the machine used as an ordinary lathe, for which there is provided a compound rest on a stand which is adjustable on the base-plate. Amongst other heavy work which the firm have in hand I noticed a very massive lathe in course of construction. This lathe will admit of turning 10ft. diameter clear of the saddle, which has also duplex rests, and is self-acting in all motions.

The quantities for the superstructure for the new Victoria station which is being built by the London and North-Western Railway are now out, and an idea of the extent of roofing may be gathered from the fact that it will require about 100,000ft. of rough cast plate glass and 60,000ft. of zinc.

The project for the ship canal to Manchester is very warmly taken up by the trades councils and trades unions throughout this immediate district. Already resolutions in favour of the scheme have been passed at several meetings, and arrangements are now being made for a large representative meeting to be held in Manchester in furtherance of the proposal.

The miners' agitation for an advance of wages is naturally tending to keep up an extra demand for coal, whilst the restriction of the output, which is being very generally enforced, is causing a scarcity of supplies, slack being the only class of fuel in the market which is at all in excess of requirements. Prices are very firm at full rates, with a slight upward tendency in some of the best qualities. At the pit mouth prices are about as under:—Best coal, 10s.; second, 8s.; common house coals, 6s. 6d. to 7s.; steam and forge coals, 6s. to 6s. 6d.; burgy, 4s. 9d. to 5s. 3d.; and good ordinary slack, 3s. 6d. to 4s.

The demand for shipment has somewhat fallen off, and although there are no large supplies offering at either Garston or Liverpool, the recent advance in prices is with difficulty maintained; delivered at the high-level, Liverpool, or at Garston docks, steam coal averages 7s. 6d. to 8s. per ton.

The wages agitation is being steadily pursued by the men; this week the notices for an advance of 15 per cent. will be renewed, and there seems to be a strong determination to insist upon the advance or stop work. Many of the colliery proprietors are still strongly averse to conceding any advance; but not a few of them would be willing to give way if present prices could be maintained, and it is not improbable that some compromise may be arrived at.

Barrow.—I have nothing new to report this week in connection with the hematite iron trade of this district, except a strike among the hammermen and coggers at the Barrow Steel Works, but there is every probability that the difficulty will be settled. The masters are submitting a proposal of a reduction of 5 per cent. in the rate of wages, and the men are resisting it. The demand for all classes of pig iron is very well maintained. Both Bessemer and forge samples have changed hands in large parcels, and prices show no variation from previous quotations, No. 1 Bessemer being still quoted at 58s. 6d. net per ton at works, and No. 3 forge at 56s. 6d. Stocks are not extensive, as large deliveries have recently been made, and others have to be made during the course of this month. There is, however, no immediate prospect of furnaces being blown in to increase the output of metal. The steel trade is very briskly employed, and orders are offering. Prices maintain the advance noted last week. Iron ore is firm at from 13s. 6d. to 15s. per ton at mines. The value of coal has again increased.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

Business was somewhat slack at the Cleveland iron market, held at Middlesbrough on Tuesday last, but prices were nevertheless firm. In the pig iron trade the quietness is no doubt due to unwillingness on the part of most of the producers to commit themselves further ahead at present. Very few of them have any iron to dispose of for delivery this year. Consumers and merchants are anxious to buy for the first quarter of next year, and for that period would give a little more than current rates; but makers as a rule are not disposed to meet them.

It is a long time since iron has been so scarce as it is just now, and for such sales as have taken place sellers have generally obtained the prices they asked. Prices may be said to be much the same as last week, smelters requiring 45s. for early f.o.b. deliveries of No. 3 g.m.b. Merchants are asking 44s. 7½d. to 44s. 9d. per ton, and no business is being done under the former figure. Connal's No. 3 warrants are being offered at 44s. 6d., but buyers refuse more than 44s. 3d. for them; there is consequently very little speculation. Stocks are being rapidly reduced, as merchants are taking from the stores when makers cannot give them the delivery they require.

The amount of Cleveland iron held by Messrs. Connal and Co. on Monday night was 104,618 tons, being less by 2685 tons than on the previous Monday.

Shipments have not been quite so heavy as usual during the last week; but up to Monday night the amount for the month shipped from the Tees was 50,811 tons.

There is little if any change in the finished iron trade, but it is expected that better prices will soon be obtainable now that Staffordshire iron has been advanced. Plates for shipbuilding are quoted at £6 15s. to £7 per ton, and angles and common bars at £6, all less 2½ per cent., f.o.t. at works.

The demand for coal for both household and manufacturing purposes continues to be good, and prices are firm. Coke is now 12s. 6d. to 13s. 6d. per ton delivered at Middlesbrough.

A meeting of the Board of Arbitration and Conciliation for the North of England Manufactured Iron Trade was held at Darlington on Monday last. The principal business was to receive the report as to the ballot which took place on Saturday last at the works in connection with the Board. Mr. W. Whitwell occupied the chair, and there was a good attendance of employers and operative representatives. It will be remembered that the men were asked to say by their votes whether or not they would abide loyally by the decision of the Board, or of any arbitrator appointed by it in view of the impending wages difficulty. It was reported that at the twenty-one works under the Board the number of subscribers was 10,307, and the result of the ballot was as follows:—Ayes, 5481; noes, 1320. There were 138 spoiled or doubtful papers. The remainder of the men who did not vote were either indifferent, or from some cause or other were unable to take part in the ballot. All parties expressed themselves satisfied with the result, and proceeded to discuss the best means to adopt for settling the wages question. The men ask for an advance of 7½ per cent., and the employers for a reduction of 7½ per cent. on forge and mill wages from October 28th. The masters also suggest that a sliding scale should be established for the future regulation of wages. After some discussion the board passed the following resolution:—"That Mr. Waterhouse's figures be completed in the usual way as soon as possible and sent to Messrs. Winpenny and Trow, and that the sales on the books be taken out independently by Mr. Waterhouse and checked by Mr. Benson at the earliest possible date, when another meeting will be held."

The Rosedale and Ferryhill Ironworks, consisting of eight blast furnaces and other plant, were offered for sale at the Royal Exchange, Middlesbrough, on Tuesday last. The upset price was £20,000. Very few people attended, and there was not a single bid made.

The erecting of machinery at the new Jarrow Forge Works is being pressed forward, and it is expected that a start will be made at the beginning of next month. The firm will be in a position to turn out forgings and various other kinds of work with great dispatch.

A committee of iron manufacturers will meet a committee of ironworkers on Thursday next, to confer on certain modifications which it is desired to make in the constitution of the Board of Arbitration, with a view to increase its stability and bring its operations more in harmony with the fundamental principles of arbitration. Many of the leading employers and operatives are alike dissatisfied with the Board as at present constituted, and are equally anxious for certain reforms.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

The Manchester Conference has uttered no uncertain sound with regard to miners' wages. The 15 per cent., the whole 15 per cent., and nothing but the 15 per cent., is the men's demand; and, in consequence, the whole of the South Yorkshire district is in a turmoil. In the Derbyshire district, the action of coalowners who early in the day conceded advances, varying from 5 to 12½ per cent., greatly strengthened the hands of the Union agents in demanding 15 per cent. in South Yorkshire and now the non-unionists, who were expected to hold aloof from the agitation, are joining with the unionists, and returning to the Miners' Association. The colliers employed by Messrs. John Brown and Co., Limited, of Sheffield, at Aldwarke Main and Car House, sent a deputation to the chairman of the company—Mr. J. D. Ellis—and the certificated manager—Mr. C. E. Rhodes—with reference to the notices to be given by the men. The deputation were informed that no immediate advance could be given. When the miners, on Tuesday, heard the decision, they passed a resolution to demand the 15 per cent., to give in their notices at once, and also to join the Yorkshire Miners' Association. The proposer of these motions expressed the opinion that if the miners acted loyally to each other, they would not have to "play" a single day. If they showed that they were determined to press for an advance, the owners would have no option but to make them a reasonable offer. Mr. J. Frith, one of the secretaries of the Yorkshire Miners' Association, said if the masters were depending on the non-unionists not going with the others they were reckoning without their host. Their employers had held out hopes that they would be able to give a slight advance with the new year, but he believed it would be no use to wait, as when they asked again they would be told that they had asked too late, as they were on the last occasion. Some of the coalowners were quite willing to advance their coal if others would do so, but they would not do it by themselves. Gas companies made large profits, the railway companies made heavy charges, the City of London imposed heavy dues, and while those profits and charges were made and enforced, the poor colliers were working for low wages, and some of the owners had gone through the Bankruptcy Court. He repudiated the sliding scale as a question with which they had been "shuttlecocking" for years. The coalowners had brought the men's wages to the lowest ebb, and the men had as much right to ask for a proportion of the winter's advances on the prices of coal as the masters had to make these advances.

The Sheffield Coal Company, which supplies a large tonnage to London from its Birley Collieries, has posted on the notice-boards at its pits a notice to the effect that the sliding scale account taken for the month of September justifies an advance of 2½ per cent. due to the underground workmen, and the increased wages were immediately commenced to be paid. The company is also to take an account for the month of October, which there is reason to believe will show a further advance.

At Thorncliffe, Messrs. Newton, Chambers, and Co., Limited, are likely to make arrangements with a large section of their men, who seem reluctant to strike work. Upwards of 1600 men are to be represented by a deputation to Mr. A. M. Chambers, the managing director. The colliers employed at Rockingham Collieries, acting on instructions received from Mr. B. Pickard, one of the officers of the Yorkshire Miners' Association, have declined to take part in the interview.

It it stated that by the end of the week nearly 20,000 miners will have sent in their notices. The movement is being joined in by both unionists and non-unionists. Even at Messrs. Briggs and Sons', Normanton, where no dividend was paid, owing to coal getting being so unprofitable, the men are going for 15 per cent. all the same.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

The Glasgow iron market has been much quieter this week, with less business doing. Fluctuations in the prices of warrants have not been important, but the general tendency has been towards flatness. Two additional furnaces have been put in blast—one at Gartsherrie and the other at Shotts—making a total of 113 now blowing, and there are several others ready to be blown in at any moment. The past week's shipments of pig iron have been very good, and the prospects for future weeks do not seem to be discouraging. Yet it would not be surprising were the trade now to gradually settle down a little. There have been large deliveries of iron to consumers, but fresh orders for forward delivery are not so plentiful. The stock in Messrs. Connal and Co.'s Glasgow stores has been reduced by about 1300 tons in the course of the week.

Business was done in the warrant market on Friday at from 51s. 3d. to 50s. 10½d. cash. On Monday forenoon transactions were effected at 50s. 9½d. to 51s. cash, and 51s. 1d. to 51s. 2½d. one month, the afternoon quotations being 50s. 11d. to 51s. cash. Business was done on Tuesday forenoon at 51s. to 51s. 1½d. and 50s. 10½d. cash, and 51s. 3d. to 51s. 4½d. and back to 51s. 2d. one month, and in the afternoon the figures were 50s. 10d. to 50s. 9½d. cash, and 51s. 1d. to 51s. ½d. one month. Business was done on Wednesday at 50s. 8d. to 50s. 10d. cash. To-day—Thursday—transactions were effected at 50s. 9½d. to 50s. 7½d. cash, and 50s. 10½d. one month.

The demand for makers' iron being now not quite so pressing the quotations are somewhat easier as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 65s. 6d.; No. 3. 55s.; Coltness, 69s. and 56s.; Langloan, 68s. and 56s. 6d.; Summerlee, 65s. and 54s. 9d.; Calder, 64s. 6d. and 54s. 3d.; Carnbroe, 59s. and 53s.; Clyde, 55s. and 53s.; Monkland, 52s. 6d. and 50s. 6d.; Quarter and Govan, each 52s. 3d. and 50s. 6d.; Shotts, at Leith, 66s. and 56s. 6d.; Carron, at Grangemouth, 53s. (specially selected, 57s. 6d.) and 52s.; Kinneil, at Bo'ness, 51s. 6d. and 50s.; Glengarnock, at Ardrossan, 58s. 9d. and 52s. 9d.; Eglinton, 53s. 6d. and 51s.; Dalmellington, 54s. and 52s.

The total shipments of Scotch pig iron for the year to date are 511,843 tons, as against 461,561 in the corresponding period of last year; while the stocks in Messrs. Connal and Co.'s stores are 622,398, as compared with 599,900 tons.

As indicated above the founders and makers of malleable iron have been providing themselves with large supplies of the raw material. In most cases they are very busy, and will no doubt do well during the winter. It is worthy of notice, however, that some makers of plates and angles for shipbuilding state that their books are not so well filled with orders as of late. Whether this is owing to the effects of the joiners' strike in the shipbuilding trade keeping back the completion of vessels now in hand, or to a cessation of the demand for new vessels, is not as yet quite apparent; but the probability is that both causes have something to do with the matter.

There is a very brisk demand just now for all kinds of tubes, the makers of which are so full of orders that the execution of some of these is being arranged with English houses.

The coal trade continues active, the shipments being large in all places save at one or two of the Ayrshire ports. In the course of the week 13,026 tons were shipped at the Glasgow Terminus Quay, and 7310 tons at the Queen's Dock. For inland consumption the demand is also very fair. Prices f.o.b. are—Main, 6s. 3d. to 8s.; ell, 6s. 6d. to 8s. 6d.; splint, 6s. 4d. to 8s.; and steam, 7s. to 8s.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

The great activity at the Cardiff Docks is telling favourably upon speculative movements, and new companies are cropping up in a remarkable manner. In addition to those in which Mr. Morel, the leading importer of Bilbao ore, is largely interested, some important mining and shipping companies are about to see the light. It would be well, however, that this sort of thing be not overdone. One or two large shipping ventures at Cardiff in the past were ruinous concerns. The best guide to outsiders is to follow the lead of the well-known principal coal or shipowners. The Milford Haven Shipping Company has been formed, capital £250,000, in £5 shares; also the Diamond Llantwit Coal Company—£10,000, in £100 shares.

These spirited movements are not confined to steamships and collieries; in railways I am glad to note the same activity. The Swansea Bay contract is given out, and I hear additional powers will be sought for next session. The Taff Vale has given a concession to coalowners by reducing rates on pitwood, and to the general public by reducing parcels rates. They are also going in for extra station accommodation, one being fixed for Merthyr Vale, which has long been advocated in this column, another for Penrhiwceiber, and a third for Ynyshire, in the Rhondda Valley.

The iron and coal trades are in a flourishing condition. Steel rails are fetching better prices and Welsh make is being sought after. Dowlais works are full of orders, and extensions are likely.

Tredegar Steel Works are getting quite a name in the locality. This week rails were rolled off in three lengths of 24ft. each direct from the cogging mill, without going through the process of reheating. It is claimed that this is a feat not performed elsewhere in Wales, but I have some recollection of seeing the same thing done at Rhymney, where the whole of the rolls, engine, &c., were made on this plan.

For some time prices have been stiff in all branches of iron and steel; now it may fully be expected, after the action of the Staffordshire makers, that a distinct advance will take place.

In coal most owners are as busy as they can be. Some of the large contracts of the country are again coming this way. The Peninsular and Oriental to wit. This has been divided amongst the following Welsh companies:—Powells Duffryn, Tylor and Co., Harris's Deep Navigation Co., and the National Steam Coal Company. The first named has the largest share. Prices are decidedly on the advance. I am pleased to record that more satisfactory work is being done at Harris's Navigation Colliery, and also at Bedlinog. Negotiations are pending between Messrs. Crawshay and the owners of an important coal field near Pontypridd. I hear that treaties are re-opened. Business generally is good at Swansea. Last week two important anthracite collieries were sold by auction, and the interest taken shows that this class of coal is in favour.

The Bute Dock extension contract is now out, and tenders for this important undertaking are being solicited.

A small advance of wages is to take place at the Ocean Collieries. It will amount to 1¼ per cent.

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.

10th October, 1882.

4809. Secondary Batteries, R. Tatham, Rochdale, and A. Hollings, Salford.
4810. Dynamo-electric Machines, R. E. B. Crompton, London, and G. Kapp, Chelmsford.
4811. Door Stops or Checks, A. J. Boult.—(*G. R. Elliott, Boston, & J. Winslow & T. Clary, Norfolk, U.S.*)
4812. Incubator, T. Christy, London.
4813. Lighting by Gas, W. T. Sugg, London.
4814. Moulders' Nails, &c., W. Motherwell, Glasgow.
4815. Tools and Cutters for Boring Taper Holes, J. G. Perkin and J. Scott, Wakefield.
4816. Voltaic Batteries, E. J. Wimshurst, Anerley.
4817. Producing Clear or Transparent Block Ice in Moulds, T. Dowrie, London.
4818. Refrigerating Rooms, M. J. Power, Waterford.
4819. Dynamo or Magneto-electric Machines, W. R. Lake.—(*J. Wenström, Sweden.*)
4820. Stopping Leaks in Boiler Tubes, &c., A. M. Clark.—(*W. F. Thompson, San Francisco, U.S.*)
4821. Apparatus for Transporting Afloat Barges, &c., C. D. Abel.—(*C. G. Viehoff, Paris.*)
4822. Printing Machines, J. E. Dawson.—(*W. P. Kidder, Boston, U.S.*)

11th October, 1882.

4823. Apparatus for Drying Wool, D. P. Smith.—(*J. Scott, Cape of Good Hope.*)
4824. Incandescent Lamps, E. Muller, London.
4825. Extracting Precious Metals from Silicious and other Substances, J. P. Kagenbusch, London.
4826. Vaporisers, P. Chapelain, Paris.
4827. Treating Steel Ingots, H. J. Kennard, London.
4828. Propelling Tricycles, &c., J. T. B. Bennett, Aston-juxta-Birmingham.
4829. Electrical Switch, G. W. Bayley, Walsall.
4830. Fuses for Projectiles, A. Noble, Newcastle-on-Tyne.
4831. Machine Guns, &c., A. Noble, Newcastle-on-Tyne.
4832. Telephones, J. H. Johnson.—(*L. de Locht-Labye, Paris.*)
4833. Coating Tin and Terne Plates, T. H. Jones, Hackney.
4834. Utilising Distilled Shale, &c., T. L. Paterson and T. I. Scott, Glasgow.
4835. Causing more Perfect Combustion in Furnaces, H. J. Haddan.—(*W. A. Campbell, Montreal, Canada.*)
4836. Stacks or Walls of Furnaces, J. Toussaint, Birmingham.
4837. Construction of Vehicles Propelled by Human Force, C. Truman, Birmingham.
4838. Employing the Muscular Force of Man, B. J. B. Mills.—(*L. Bellefonds, Lyons, France.*)
4839. Sash Balances, A. J. Boult.—(*C. E. Bogle, U.S.*)
4840. Supplying Feed-water to Boilers, W. Teague, jun., Pool, Cornwall.
4841. Balance Valve, W. Teague, jun., Pool, Cornwall.
4842. Locks, &c., F. Garon, Southend.
4843. Looms, J. W. Holmes, Preston.
4844. Rotary Printing Machines, J. Dobson, London.

12th October, 1882.

4845. Galvano-electric Batteries, J. Oliphant, London, and E. B. Burr, Walthamstow.
4846. Explosives for Fire-arms, &c., R. Hannan, Glasgow.
4847. Velocipedes, J. Rettie, London.
4848. Bottles for Liquids, &c., E. Hawkins, London.
4849. Looms, J. Almond, Blackburn.
4850. Apparatus for Ventilating Purposes, W. Teague, Illogan, Cornwall.
4851. Figured Hearth, &c., Rugs, W. Smith, London.
4852. Raising and Lowering Cages in Mines, T. J. and J. Griffiths, Aberavon, Glamorgan.
4853. Compound for Making Tight Joints in Machinery, A. J. Scollick.—(*H. Simons, Cologne, Germany.*)
4854. Transmitting Heat to Fluids, W. L. Wise.—(*B. Röber, Dresden, Saxony.*)
4855. Apparatus for Making Hydrogen Gas, S. Pitt.—(*W. H. Bradley, New York, U.S.*)
4856. Producing a Lint from New Flax Fibres, G. W. von Nawrocki.—(*M. Salomonson, Bielefeld.*)
4857. Producer Gas Furnaces, C. D. Abel.—(*Stettiner Chamotte Fabrik Actien-Gesellschaft, vormals Didier, of Stettin, Germany.*)
4858. Fixing Round, &c., Heels to Boots and Shoes, C. Mole, London.
4859. Bicycles, &c., G. W. von Nawrocki. — (*L. Schmetzer, Rothenberg-on-the-Tauber, Germany.*)
4860. Carriages, W. P. Thompson.—(*G. E. Bartholomew and E. Armant, Montreal, Canada.*)
4861. Omnibuses, &c., S. Andrews, Cardiff.
4862. Under-carriages, S. Andrews, Cardiff.
4863. Reflectors, A. M. Clark.—(*P. Costes, Bourges.*)

13th October, 1882.

4864. Clips, &c., for Machines, D. P. Smith, Glasgow.
4865. Spring Mattresses, D. R. Gardner Glasgow.
4866. Brake, J. D. Hankey, London.
4867. Machinery for Washing Wool, &c., W. H. Greenwood, Bradford, and C. Hoyle, Keighley.
4868. Lounge, A. J. Wilkinson, London.
4869. Electric-lighting, W. Strickland, Woodford.
4870. Facing Points for Tramways, &c., H. Scott, Liverpool.
4871. Range-finding, G. McGuire Bate, Woolwich.
4872. Bridles, &c., J. G. Heinisch, Belgard, Germany.
4873. Ventilated Waterproof Garments, I. Frankenburg, Salford.
4874. Producing Yeast from Grain, &c., A. M. Clark.—(*G. Claudon and C. Vigreux, Paris.*)
4875. Device for Preventing Opening of Doors, E. Guattari, London.
4876. Gun Carriages, J. Vavasseur, London.
4877. Fittings for Use in Stables, &c., J. A. Hanna and T. F. Shillington, London.
4878. Galvanic Batteries, G. C. V. Holmes and S. H. Emmens, London.
4879. Pigment, J. B. Freeman, Tottenham.
4880. Electric Arc Lamps, A. M. Clark.—(*W. S. Parker, New York, U.S.*)

14th October, 1882.

4881. Apparatus for Lubricating Steam Engines, G. Varley and W. Gregory, Over Darwen.
4882. Looms, W. Youngjohns, Kidderminster.
4883. Electric Lamps, P. R. de F. d'Humy, London.
4884. Electrical Distribution, T. J. Handford.—(*T. A. Edison, Menlo Park, U.S.*)
4885. Periodically Extracting Sediments, G. Bacher, Kladno, Austria.
4886. Gas Engines, T. Baldwin, Cheetham.
4887. Producing Dense Steel Castings, C. M. Pielsticker, London.
4888. Compound for Preserving Rope Yarns, &c., J. Evens & H. Lowenfeld.—(*F. de P. Weber, Austria.*)
4889. Apparatus for the Development of Electricity, J. Whitley, Leeds.
4890. Fluid Pumping, &c., Apparatus, B. W. Davis, Lambeth.
4891. Carrying Away the Products of Combustion of Gas, G. E. Webster, Nottingham.
4892. Gauge for Measuring, B. Joseph, Birmingham.
4893. Obtaining, &c., Motive Power, W. Wade, Crewe.
4894. Heating, &c., J. Wadsworth, Manchester.
4895. Horseshoes, E. Hewett.—(*A. Gauer, Hamburg.*)
4896. Ventilating Waterproof Garments, J. Trapowski, Manchester.
4897. Charging Cartridges, W. Smethurst, Wigan, and J. Collins, Bolton.
4898. Tricycles, &c., J. P. Dalby, Leeds.
4899. Machine Guns, T. Nordenfelt, London.
4900. Fire-arms, T. Nordenfelt, London.
4901. High-speed Engines, P. W. Willans, Thames Ditton, and M. H. Robinson, Hampton Wick.
4902. Compound Welded Steel and Iron Plates, &c., A. L. S. Leighs, London.
4903. Galleries for Holding Globes, &c., C. Ferranti, Liverpool.
4904. Machine for Washing Bottles, W. W. Horner, Dulwich.
4905. Driving Pulleys, &c., G. E. Sherwin, Aston.

16th October, 1882.

4906. Steam Engines, W. Crook.—(*W. and H. Monk, Levis, Canada.*)
4907. Apparatus Applicable to Hosiery Stitching Machines, H. Clarke, Leicester.
4908. Filling, &c., Bottles, A. Macdonell, Newry.
4909. Screw-neck Bottles, &c., F. Foster, London.
4910. Fuel Economisers, S. Elson and V. Eastwood, Castleton.
4911. Electric Lamps, J. Allmann.—(*L. E. Schwerd and L. Scharnweber, Karlsruhe.*)
4912. Perambulators, T. F. Simmons, Croydon.
4913. Constructing Boilers, W. H. Thompson, L. Hardaker, and J. M. Porter, Leeds.
4914. Umbrellas, J. B. Seel, Urmston.
4915. Switches for Electric Lamps, T. W. Cowan, Rotherham.
4916. Looms, &c., J. Bywater, C. Bedford, and T. Kershaw, Birstall.
4917. Weather-proof Explosive Compounds, P. Jensen.—(*J. Schulhof, Vienna.*)
4918. Machine for Disintegrating Fabrics, J. C. Watson, Leeds.
4919. Synchronising Clocks, J. A. Lund, London.
4920. Fastenings for Neckties, P. Ambjorn, Paris.
4921. Voltaic Batteries, J. L. Henderson.—(*A. Blondin, Abbeville.*)
4922. Setting Spokes of Velocipedes, &c., R. Adams, London.
4923. Velocipedes, E. H. Hodgkinson, London.
4924. Fountain Pens, R. Enright, London.
4925. Velocipedes, W. Jeans, London.
4926. Range-finders. F. H. Poore, Portsmouth.
4927. Treating Silk Yarns, A. M. Clark.—(*G. Teissonnière and J. Auroy-Deslongchamps.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

4785. Treating Linseed or Flax-seed, G. G. B. Casero, St. Etienne, France.—*7th October*, 1882.
4788. Machines for Treating Hides, &c., W. R. Lake, London.—A communication from C. Holmes, Boston, U.S.—*7th October*, 1882.
4795. Machinery for Preparing Fibrous Substances for Spinning, H. J. Haddan, London.—A communication from J. F. Gebhart, New Albany, U.S.—*9th October*, 1882.
4804. Propellers for Navigable Vessels, R. Smith, Sherbrooke, Canada.—*9th October*, 1882.
4835. Causing more Perfect Combustion in Furnaces, H. J. Haddan, London.—A communication from W. A. Campbell, Montreal, Canada.—*11th October*, 1882.
4857. Producer Gas Furnaces, C. D. Abel, London.—A communication from the Stettinger Chamotte Fabrik Actien-Gesellschaft vormals Didier, Stettin, Germany.—*12th October*, 1882.

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

4077. Pumps, F. N. Mackay, Liverpool.—*9th October*, 1879.
4094. Door-spring, E. Bull, Halifax, York.—*10th October*, 1879.
4512. Working Valves, &c., of Motive-power Engines, J. H. Kitson, Leeds.—*5th November*, 1879.
4105. Hydraulic Lifts, C. W. Baldwin, London.—*10th October*, 1879.
4124. Kilns, J. and C. J. Foster, Normanton.—*11th October*, 1879.
4199. Drying Bricks, C. Cooper, Birkenhead.—*17th October*, 1879.
4186. Mining Machines, H. H. Doubleday, Washington, U.S.—*13th October*, 1879.
4141. Making Iron, A. M. Clark, London.—*13th October*, 1879.
4244. Boxes for Biscuits, &c., W. Staniforth, Sheffield.—*20th October*, 1879.
4299. Colouring Fibrous Materials, W. R. Lake, London.—*22nd October*, 1879.
4137. Appliance for Enabling Persons to Remain Under Water, &c., H. A. Fleuss, London.—*13th October*, 1879.
4144. Treating Hair, E. L. Hamilton, London.—*14th October*, 1879.
4145. Treating Hair, E. L. Hamilton, London.—*14th October*, 1879.
4322. Driving Metal Tubes &c., into the Earth, A. le Grand & R. Sutcliffe, London.—*23rd October*, 1879.
4180. Heating Carriages, W. R. Lake, London.—*15th October*, 1879.
4253. Making Magnesia, A. J. Boult, London.—*20th October*, 1879.
4184. Stopping Bottles, &c., H. Barrett, Hampton.—*16th October*, 1879.
4185. Spinning, &c., Cotton, J. Tatham, Rochdale.—*16th October*, 1879.
4256. Railway Switches, C. W. E. Marsh, Newport.—*21st October*, 1879.
4501. Gas Engines, J. Robson, North Shields.—*4th November*, 1879.

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

3644. Making Lozenges, W. Crosby, Aston.—*20th October*, 1875.
3535. Making Lime, J. B. Thompson and W. W. Ladelle, Wraysbury.—*12th October*, 1875.
3557. Tubular Structures, H. N. Maynard, Newport.—*13th October*, 1875.
3703. Treating Sewage, C. Rawson and J. Slater, London.—*25th October*, 1875.
3725. Machinery for Polishing Needles, V. Mil-Ward, Redditch.—*27th October*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition, 3rd November, 1882.

2671. Centrifugal Governors for Regulating Steam Engines, &c., W. P. Thompson, London.—A communication from J. Selwig.—*7th June*, 1882.
2685. Feeding Bottles, G. Falconnier, Switzerland.—*8th June*, 1882.
2694. Dynamo, &c., Machines, W. R. Lake, London.—A communication from E. Weston.—*8th June*, 1882.
2697. Propelling Velocipedes, &c., C. H. Brooks, London.—Partly a communication from W. Chew.—*8th June*, 1882.
2698. Axle Bearings, &c., W. J. Brewer, London.—*8th June*, 1882.
2701. Exhausting Apparatus, A. R. Leask, London.—*8th June*, 1882.
2702. Levelling Molehills, &c., T. Morgan, London. Com. from A. Royer.—*8th June*, 1882.
2706. Treating Ores, J. M. Stuart, London, and J. Elliott, Reigate.—*9th June*, 1882.
2718. Boiler Furnaces, &c., T. Ogden, Burnley.—*9th June*, 1882.
2735. Compressed Air Machines, S. Mason, Birmingham.—*10th June*, 1882.
2737. Antifriction Bearings for Vehicle Wheels, W. J. Brewer, London.—*10th June*, 1882.
2739. Adjusting the Rollers of Roller Mills, J. Higginbottom and O. Stuart, Liverpool.—*10th June*, 1882.
2742. Lanterns, W. E. Heavens, London.—*10th June*, 1882.
2743. Finishing Textile Fabrics, E. Edwards, London.—A communication from Messrs. C. and J. Chollet.—*10th June*, 1882.
2753. Gas Motor Engines, C. T. Wordsworth, Leeds, and J. Wolstenholme, Radcliffe.—*12th June*, 1882.
2754. Apparatus to Print, &c., Sugar Medals, H. Faulder, Stockport.—*12th June*, 1882.
2755. Electric Lamps, W. Chadburn, Liverpool.—*12th June*, 1882.
2778. Compressing, &c, Explosive Material into Cylindrical, &c., Forms, E. Hesketh, Dartford.—*13th June*, 1882.
2823. Generating and Storing Electric Energy, C. Westphal, Berlin.—*15th June*, 1882.
2846. Railway Brake, E. Foakes, Cardiff.—*16th June*, 1882.
2897. Railway Brakes, W. R. Lake, London.—A communication from J. Woods.—*19th June*, 1882.
2931. Umbrellas, &c., B. J. B. Mills, London.—A communication from J. A. Dupuy.—*20th June*, 1882.
2934. Suspending Electroliers, &c., A. W. Brewtnall, Warrington.—*20th June*, 1882.
3070. Electric Arc Lamps, E. de Pass, London.—A communication from C. Roosevelt and B. Abdank.—*29th June*, 1882.
3076. Mills for Grinding Corn, W. R. Lake, London.—A communication from W. Hartman.—*29th June*, 1882.
3228. Cartridges, F. Wirth, Germany.—A communicatton from "Pulverfabrik Rottweil-Hamburg."—*7th July*, 1882.
3321. Stacking or Ricking Hay, &c., E. R. Salwey, Ifield Court, near Gravesend.—*12th July*, 1882.
3333. Purifying Metals, A. M. Clark, London.—A communication from C. Edwards.—*13th July*, 1882.
3640. Distilling Tar, &c., W. Maxwell, Gartsherrie.—*1st August*, 1882.
3764. Permanent Way for Railways, J. Dickson, jun., Seaforth.—*8th August*, 1882.
3858. Treating Solutions used for Purifying Copper Ores, &c., D. Watson, Manchester.—*12th August*, 1882.
4167. Instantaneous Boat-discharging Apparatus, C. Mace and J. Brewster, Sunderland.—*1st September*, 1882.
4357. Constructing Stoves, &c., J. H. Stiles, South Norwood.—*13th September*, 1882.
4379. Iron and Steel, J. G. Willans, London.—*14th September*, 1882.
4405. White Lead, A. J. Smith, London.—*15th September*, 1882.
4455. Feed Cups for Lubricants, R. Baird, Glasgow.—*19th September*, 1882.
4481. Decoration of Ceramic Ware, A. Wenger, Hanley.—*20th September*, 1882.
4795. Preparing Fibrous Substances, H. J. Haddan, London.—Com. from J. F. Gebhart.—*9th October*, 1882.
4804. Propellers for Vessels, R. Smith, Sherbrooke,—*9th October*, 1882.

Last day for filing opposition, 7th November, 1882.

2749. Capsules for Covering Necks of Bottles, C. Cheswright, London.—*12th June*, 1882.
2750. Miners' Safety Lamps, W. Morgan, Pontypridd.—*12th June*, 1882.
2756. Voltaic Batteries, C. G. Gumpel, London.—*12th June*, 1882.
2758. Extracting Glycerine from the Residuary Liquors of the Soap Manufacture, A. M. Clark, London.—A communication from E. Brochon and Co.—*12th June*, 1882.
2776. Carbons for Electric Candles, &c., F. H. Varley, London.—*13th June*, 1882.
2779. Haymaking Machines, J. C. Float, Malden.—*13th June*, 1882.
2780. Sensitive Paper, W. T. Morgan and R. L. Kidd, Greenwich.—*13th June*, 1882.
2790. Albums, A. Aron, London.—A communication from A. Aron.—*14th June*, 1882.
2792. Centre-seconds Watches, J. H. Godsell, Coventry.—*14th June*, 1882.
2795. Looms for Weaving, T. Knowles, Blackburn.—*14th June*, 1882.
2797. Abdominal Belt, W. A. Barlow, London.—A communication from W. Teufel.—*14th June*, 1882.
2804. Employing Electricity for Telegraphic, &c., Purposes, W. R. Lake, London.—A communication from F. van Bysselberghe.—*14th June*, 1882.
2808. Fluting Metal Rollers, J. A. A. Buchholz, London.—*14th June*, 1882.
2810. Ratchet Braces, T. W. Cheesebrough, London.—*14th June*, 1882.
2826. Manufacture of Lead in the Form of Thread-like Fibre, F. J. Cheesbrough, Liverpool.—Com. from A. K. Eaton.—*15th June*, 1882.
2859. Sash-weight Attachments, H. C. Tucker, Peterborough.—*17th June*, 1882.
2875. Gas Batteries, R. J. Gülcher, London.—*17th June*, 1882.
2880. Sewing Machines, W. Fairweather, Manchester.—*19th June*, 1882.
2889. Stages of Theatres, C. D. Abel, London.—A communication from R. Gwinner, J. Kautsky, C. Dengg, and F. Roth.—*19th June*, 1882.
2900. Promoting Combustion in Furnaces, A. M. Clark, London.—Com. from T. Brennan, W. G. Munn, W. J. Duncan, W. A. Meriwether, and C. G. Davison.—*19th June*, 1882.
2918. Obtaining Ferrocyanide of Iron, &c., from the Manufacture of Coal Gas, S. Pitt, Sutton.—A communication from H. Bower.—*20th June*, 1882.
2943. Primary, &c, Galvanic Batteries and Cells, H. Aron, Berlin.—*21st June*, 1882.
3001. Corsets and Stays, C. L. Reynolds, Landport.—*24th June*, 1882.
3034. Receiving, &c., Excrementitious and other Foul Solid and Liquid Matters in Houses, F. A. Bonnefin, London.—*27th June*, 1882.
3074. Treating Hops, W. G. Forster, Streatham Common.—*29th June*, 1882.
3089. Breech-loading Fire-arms, H. A. A. Thorn, London.—*30th June*, 1882.
3114. Forming, &c., Articles of Glass, C. H. Stearn, Newcastle-upon-Tyne.—*1st July*, 1882.
3137. Sporting Cartridge Cases, C. D. Abel, London.—A communication from W. Lorenz.—*3rd July*, 1882.
3145. Rack Pulleys for Blind Cords, C. Priestland, Birmingham.—*4th July*, 1882.
3200. Wheel Tires, A. C. Guerrier, London.—*6th July*, 1882.
3237. Tipping Carts, &c., W. Vincent, Arborfield.—*7th July*, 1882.
3248. Cranes, M. J. Brooks, Rawtenstall, and J. H. Spencer, Crawshaw Booth.—*8th July*, 1882.
3256. Rolling Mills, C. A. Snow, Washington.—A communication from C. B. Sill.—*10th July*, 1882.
8294. Regulating the Speed of Marine Engines, A. J. Boult, London.—A communication from R. G. Brown.—*11th July*, 1882.
3296. Preparing Sheet Lead Electrodes of Secondary Batteries, A. M. Clark, London.—A communication from G. Planté.—*11th July*, 1882.
3474. Couplings for Shafts, H. Smith and C. Harrison, London.—*21st July*, 1882.
3523. Gas-burners, D. and W. H. Thompson, and W. J. Booer, Leeds.—*25th July*, 1882.
3526. Direct-acting Rotary Engine and Pump, E. G. Brewer, London.—A communication from S. Earcus.—*25th July*, 1882.
3576. Distributing, &c., Electricity, J. Hopkinson, London.—*27th July*, 1882.
3579. Locomotive Engines, J. B. Fell, Spark Bridge, near Ulverston.—*28th July*, 1882.
3702. Cement, L. Roth, Wetzlar, Prussia.—*3rd August*, 1882.
3809. Chemicals, J. W. Kynaston, Liverpool.—*10th August*, 1882.
3827. Compressing, &c., Air by the Action of the Waves of the Sea, C. W. Harding, King's Lynn.—*10th August*, 1882.
3956. Artificial Stone, &c., J. H. Johnson, London.—A communication from the Certaldo Marble Company, Limited.—*18th August*, 1882.
3973. Churns, W. McCousland, Belfast.—*19th August*, 1882.
3976. Electric Lights, T. J. Handford, London.—A communication from T. A. Edison.—*19th August*, 1882.
4068. Moulding Tobacco, &c., into Packets, H. Clarke, London.—*25th August*, 1882.
4073. Electric Bell and Automatic Alarm P. M. Justice, London.—A communication from V. Vankeerberghen.—*25th August*, 1882.
4090. Heating and Warming. W. Thornburn, Boroughbridge.—*26th August*, 1882.
4175. Securing Heads of Brooms, W. J. Sage, London.—*1st September*, 1882.
4273 Casting Metals, &c., H. Woodward, London.—*8th September*, 1882.
4283. Treating Coal, R. de Soldenhoff, Merthyr Tydvil.—*8th September*, 1882.
4409. Coupling Carriages of Trains, T. A. Brockelbank, London.—*16th September*, 1882.
4431. Secondary Voltaic Batteries, A. Watt, Liverpool.—*18th September*, 1882.
4493. Registering Padlocks, W. R. Lake, London.—A communication from R. G. Usher and C. C. Dickerman.—*20th September*, 1882.
4523. Malted Farinaceous Food, J. Schweitzer, London.—*22nd September*, 1882.
4561. Secondary Batteries, &c., F. C. Hills, London.—*25th September*, 1882.
4599. Secondary and Storage Batteries, W. Clark, London.—A communication from N. de Kabath.—*27th September*, 1882.
4728. Sharpening the Calks on Horseshoes, &c., W. R. Lake, London.—A communication from F. A. Roe.—*4th October*, 1882.
4788. Treating Hides, &c., W. R. Lake, London.—A communication from C. Holmes.—*7th October*, 1882.
4835. Causing more Perfect Combustion in Furnaces, H. J. Haddan, London.—A communication from W. A. Campbell.—*11th October*, 1882.
4857. Producer Gas Furnaces, &c., C. D. Abel, London.—A communication from the Stettiner Chamotte Fabric Actien-Gesellschaft, vormals Didier.—*12th October*, 1882.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the 13th October*, 1882.)

1685. Purifying Air Escaping from Mill-stones, &c., E. Flechter, Liverpool.—*6th April*, 1882.
1804. Traction Engines, H. G. and W. Woodbridge, Chipping Sodbury.—*15th April*, 1882.
1813. Traps for Catching Rats, &c., E. A. Brydges, London.—*17th April*, 1882.
1825. Pistons, G. W. von Nawrocki, Berlin.—*17th April*, 1882.
1826. Refining Metals, &c., W. A. Barlow, London.—*17th April*, 1882.
1832. Regulating Automatic Lubricators, W. A. Barlow, London.—*17th April*, 1882.
1836. Artificial Stone, W. Walker, London.—*18th April*, 1882.
1847. Printing, J. F. Haskins, London.—*18th April*, 1882.
1884. Separating Metals, &c., from their Ores, W. R. Lake, London.—*19th April*, 1882.
1893. Cultivating Land, M. R. Pryor, Weston Manor, Stevening.—*20th April*, 1882.
1894. Spinning Silk, &c., W. R. Lake, London.—*20th April*, 1882.
1940. Electric Batteries, W. R. Lake, London.—*24th April*, 1882.
1950. Coke Ovens, R. de Soldenhoff, Merthyr Tydfil.—*25th April*, 1882.
1965. Head Coverings, C. E. Naish, Birmingham.—*26th April*, 1882.
1972. Railway Carriage Roof Lamps, H. Defries, London.—*26th April*, 1882.
1973. Moulding Seggars, W. E. Gedge, London.—*26th April*, 1882.
1974. Barns and Shelters, I. Henson, Derby.—*26th April*, 1882.
1992. Stoppers for Bottles, I. Burdin, Knottingley.—*27th April*, 1882.
2030. Electrical Switches, R. Brougham, London.—*28th April*, 1882.
2038. Weaving Fancy Fabrics, J. Hamilton, Strathaven.—*29th April*, 1882.
2044. Dynamo-electrical Machines, R. Brougham, London.—*29th April*, 1882.
2048. Vaginal Syringes, E. de Pass, London.—*1st May*, 1882.
2098. Machines for Making Paper Bags, H. J. Haddan, London.—*4th May*, 1882.
2237. Microphones, J. H. Johnson, London.—*11th May*, 1882.
3046. Abstracting Gold and Silver from their Ores, R. Barker, Seacombe.—*28th June*, 1882.
3244. Incandescing Electric Lamps, T. J. Handford, London.—*8th July*, 1882.
3282. Fastening for Lids, &c., J. Ingleby, Manchester.—*11th July*, 1882.
3318. Producing, &c., Electric Energy for Lighting, I. L. Pulvermacher, London.—*12th July*, 1882.
2468. Fasteners for Boots, &c., J. N. Aronson, London.—*21st July*, 1882.
3486. Ventilating Appliances, J. Leather, Liverpool.—*22nd July*, 1882.
3492. Signalising, H. J. Haddan, London.—*22nd July*, 1882.
3572. Clocks, W. R. Lake, London.—*27th July*, 1882.
3586. Toy Savings Banks, W. R. Lake, London.—*28th July*, 1882.
3628. Looms for Weaving Cloth, H. J. Haddan, London.—*31st July*, 1882.
3630. Motor, H. J. Haddan, London.—*31st July*, 1882.
3634. Bobbin Frames for Looms, H. H. Lake, London.—*31st July*, 1882.
3683. Locking Mechanism for Safes, &c., W. R. Lake, London.—*2nd August*, 1882.
3727. Type-writers, A. H. Boulton and C. Dickie, London.—*5th August*, 1882.

(*List of Letters Patent which passed the Great Seal on the 17th October*, 1882.)

1841. Stretchers for Trousers, &c., T. H. Harris, London.—*18th April*, 1882.
1852. Preserving Meat, E. G. Brewer, London.—*18th April*, 1882.
1857. Bricks and Tiles, W. Blyth, Barton-upon-Humber.—*18th April*, 1882.
1858. Oil, &c., Lamps, A. Leefe, London.—*18th April*, 1882.
1872. Operation of the Slide-valves, &c., of Steam Engines, E. Edwards, London.—*19th April*, 1882.
1877. Rolls for Grinding Mills, W. P. Thompson, London.—*19th April*, 1882.
1886. Showing the Illuminating Power of Gas-burners, C. W. Morley, London.—*20th April*, 1882.
1892. Steam Traps, J. Shaw, Lockwood, near Huddersfield.—*20th April*, 1882.
1918. Water-gas, J. C. Mewburn, London.—*22nd April*, 1882.
1924. Cable, Chain, or Rope-traction Rail or Tramroads, W. P. Thomson, London.—*22nd April*, 1882.
1945. Telephone Alarms, W. Morgan-Brown, London.—*25th April*, 1882.
1975. Ventilators, T. E. Bladon, Birmingham.—*26th April*, 1882.
1979. Urinals, J. Beresford, Birmingham.—*26th April*, 1882.
1992. Umbrellas, &c., J. T. and F. S. Liley, London.—*27th April*, 1882.
2080. Testing the Strength of Materials, W. Porter, Manor Park, Lee.—*2nd May*, 1882.
2287. Treating Linen and other Fibre, F. C. Glaser, Berlin.—*16th May*, 1882.

2447. Opening and Closing Window Curtains, R. Henry, Edinburgh.—24*th May*, 1882.
2547. Thrashing Machines, J. H. Johnson, London. —30*th May*, 1882.
2960. Nails, J. W. Summers, Stalybridge.—22*nd June*, 1882.
2981. Purifying Gas, J. Duke, Glastonbury.—23*rd June*, 1882.
3048. Insulating, &c., Telegraph Wires, G. Macaulay-Cruikshank, Glasgow.—28*th June*, 1882.
3416. Chimney Tops or Ventilators, T. J. Baker, Newark.—18*th July*, 1882.
3438. Connecting Switches, J. Pickering, London.— 19*th July*, 1882.
3542. Washing and Rinsing Fabrics, B. Davies, Adlington, and J. Eckersley, Blackrod.—26*th July*, 1882.
3609. Obtaining Carbonate of Strontia from the Residues in the Manufacture of Sugar, D. Sidersky and H. Probst, Germany.—29*th July*, 1882.
3795. Electric Lamps, W. R. Lake, London.—9*th August*, 1882.
3905. Setting and Intensifying the Colours of Dyed, &c., Fabrics, C. Toppan, Salem.—15*th August*, 1882.
3967. Watch Chains, A. M. Clark, London.—18*th August*, 1882.
4039. Impregnating Mineral Substances, &c., with Bituminous Products, W. R. Lake, London.—23*rd August*, 1882.

List of Specifications published during the week ending October 14th, 1882.

2101*, 4d.; 3019*, 4d.; 3101*, 4d.; 539, 10d.; 870, 6d.; 939, 4d.; 1008, 6d.; 1015, 8d.; 1067, 6d.; 1073, 4d.; 1075, 6d.; 1076, 6d.; 1077, 6d.; 1078, 6d.; 1079, 4d.; 1080, 6d.; 1085, 8d.; 1089, 6d.; 1900, 8d.; 1091, 6d.; 1099, 6d.; 1104, 6d.; 1106, 6d.; 1107, 4d.; 1113, 6d.; 1114, 6d.; 1117, 6d.; 1118, 2d.; 1119, 2d.; 1120, 6d.; 1123, 8d.; 1124, 2d.; 1125, 6d.; 1126, 6d.; 1129, 2d.; 1130, 2d.; 1131, 2d.; 1134, 2d.; 1185, 2d.; 1136, 4d.; 1141, 6d.; 1143, 6d.; 1144, 2d.; 1148, 6d.; 1149, 6d.; 1150, 6d.; 1151, 4d.; 1153, 4d.; 1154, 2d.; 1155, 4d.; 1158, 2d.; 1159, 2d.; 1160, 2d.; 1161, 2d.; 1162, 6d.; 1163, 6d.; 1165, 6d.; 1166, 4d.; 1167, 4d.; 1169, 2d.; 1170, 6d.; 1172, 6d.; 1177, 6d.; 1180, 6d.; 1184, 6d.; 1187, 6d.; 1188, 6d.; 1192, 6d.; 1194, 6d.; 1197, 6d.; 1198, 6d.; 1199, 6d.; 1200, 6d.; 1201, 2d.; 1202, 6d.; 1203, 2d.; 1205, 6d.; 1206, 6d.; 1207, 2d.; 1208, 2d.; 1209, 2d.; 1210, 2d.; 1213, 4d.; 1214, 6d.; 1216, 2d.; 1217, 2d.; 1218, 4d.; 1220, 4d.; 1222, 8d.; 1228, 2d.; 1229, 6d.; 1233, 6d.; 1234, 6d.; 1236, 2d.; 1237, 6d.; 1238, 6d.; 1239, 2d.; 1240, 6d.; 1242, 4d.; 1244, 6d.; 1251, 2d.; 1252, 2d.; 1253, 4d.; 1255, 6d.; 1259, 6d.; 1261, 2d.; 1262, 6d.; 1263, 2d.; 1265, 6d.; 1266, 4d.; 1285, 2d.; 1307, 2d.; 1314, 2d.; 1320, 6d.; 1361, 6d.; 1502, 10d.; 1791, 4d.; 3187, 6d.; 3283, 6d.; 3291, 6d.; 3315, 6d.; 3319, 4d.; 3443, 4d.

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

ABSTRACTS OF SPECIFICATIONS.

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

539. Metallic Bedsteads, *J. R. C. Taunton and G. O. Aston, Birmingham.—3rd February*, 1882. 10*d.*

This relates, First, to the mode of making the joints; Secondly, to the mode of casing the corners with brass.

837. Improvements in Apparatus for Collecting and Storing Electric Currents, *J. L. Pulvermacher, Regent-street, London.—21st February*, 1882. —(*Not proceeded with.*) 2*d.*

The inventor corrugates platinum and fills the recesses with platinum sponge or black; plates thus formed are arranged in a vessel which is filled with conducting liquid, and then hermetically closed.

870. Reservoir Self-feeding Pen-holder, *O. Bussler, Clerkenwell.—23rd February*, 1882. 6*d.*

This relates to means for regulating the flow of ink to the nib.

880. Improvements in Electrical Signalling Apparatus, especially intended to Communicate the Outbreak of Fire, *C. Spratt, Peckham.—23rd February*, 1882. 8*d.*

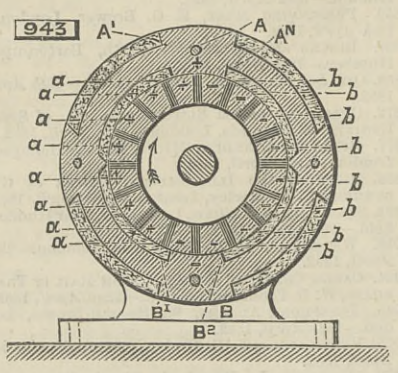
The object of this invention is to connect a central or district fire station with a number of outlying posts. It consists in the combination of apparatus, including a step-by-step receiving instrument at the station and a series of posts arranged in succession upon a circuit, each post containing an automatic circuit closer, which on being started, by drawing out a stop or similar means, automatically closes and opens the circuit the number of times required to indicate on the dial of the receiver the name of the signalling post, together with other apparatus which is described in detail.

941. Improved Arrangements or Appliances for Electrically Controlling and Regulating the Speed of Engines Employed for Driving Dynamo-electric Machines, *J. Richardson, Lincoln.—27th February*, 1882. 6*d.*

This relates to improvements on the inventor's patent No. 288, 22nd June, 1881, taken out for a method of governing engines by means of a solenoid connected with the steam valve. The improvements consist in so arranging the levers connecting the valve and solenoid core as to reduce the diameter of the valve stalk, thereby reducing the friction in the stuffing-boxes; in the substitution of a weight, instead of a second electro-magnet to prevent the engine racing; and in an improved method of winding the solenoid, so that by means of a sliding contact its intensity can be varied.

943. Improved Machinery for Obtaining Continuous or Alternating Currents of Electricity, *H. E. Newton, London.—27th February*, 1882.—(*A communication from A. J. Gravier, Paris.*) 6*d.*

This invention consists in the substitution of what the inventor calls magnetic commutation for the



ordinary commutator brushes and system. The figure is a transverse section of the machine. The induction cylinder or revolving armature is composed of bars of soft iron *a a a*, *b b b*, separated by paper. The stationary field magnet, A, A¹, &c., and B, B¹, &c., is composed of eight cast iron rings, one of these being hardened so as to retain a certain amount of residual magnetism for the initial effect. These rings are insulated from one another. The winding of the wire is divided so as to form forty separate circuits, the extremities of each of which terminate in a grouping table, to allow of the circuits being connected up for tension or quantity. On starting the armature it will be polarised by the residual magnetism of the exterior magnet, and a current induced in the coils of the latter. The currents will flow from the terminals of the coils of the exterior magnet, and may be used as required without employing a commutator.

985. Improvements in Apparatus for Lighting Gas by Electricity, &c., *C. L. Clarke and J. Leigh, Manchester.—1st March*, 1882. 6*d.*

This relates to improvements on the inventor's patents, Nos. 2229, 1880, and 245, 1881, for a gas-lighter, consisting of a holder containing a battery, a push, induction coil, and connections, with terminals, at which a spark is caused to take place on making contact by means of the push. The improvements consist in rendering the apparatus more portable and handy, arrangements whereby the battery cannot be exhausted by continued pressure on the push, and whereby the battery can readily be replaced.

986. Improvements in Dynamo-electric Machines, *W. H. Akester and T. E. Barnes, Glasgow. —1st March*, 1882. 6*d.*

This invention relates more particularly to an improved form of armature, consisting of a series of cast iron wheels, the spokes of which are hollow, and round which coils of insulated wire are wound.

990. Improvements in Apparatus for Checking and Recording the Speed of Trains Passing over Railway Bridges, &c., *G. F. Redfern, Finsbury.—1st March*, 1882.—(*A communication from J. H. M. Waldorp, Nymegen, Holland.*) 8*d.*

This consists in the combination of a series of contact pieces placed at intervals on the bridge, and in electrical connection with a clockwork recording apparatus, provided with a cylinder, on which is marked the time occupied by the train in passing each one of the contact points on the bridge. The speed of the cylinder being known, the distance between the records on it will indicate the time taken by the train to pass from one contact point to another. Further electric connections start the clockwork before the train enters the bridge, and stop it when the train leaves the bridge.

939. Trouser Protector, *L. A. Groth, London.— 27th February*, 1882.—(*A communication from A. F. Milders, Berlin.*) 4*d.*

This consists of a trouser protector formed of pieces of sheet metal, india-rubber, cloth, oil-cloth, caoutchouc, waterproof, and other fabrics, connected and folded together in such manner that while the bottom hem of the trouser leg lays against the longitudinal clip of the protector, the flaps of the said protector pass together on the inner and outer sides of the trouser leg.

1002. An Improved Electric Rotary Hair Brush, *H. Lersner, Kew Gardens, Surrey.—2nd March*, 1882.—(*Not proceeded with.*) 2*d.*

Wires are fixed on a revolving brush and brought up amongst the bristles. The frame on which the bristles are fixed is of vulcanite, the axle on which the brush turns is of wood covered with leather. The friction caused by rotation generates a current which is conveyed by the wires to the hair.

1008. Looms for Weaving, *T. Singleton, Darwen.— 2nd March*, 1882. 6*d.*

This relates, First, to an improved weighing motion for the warp beam without weights; Secondly, to an improved cloth roller lever; Thirdly, to a gripper for holding the weights and ropes; Fourthly, to a shuttle box guard or front; Fifthly, to a spring buffer for the duck-bill bracket; Sixthly, to means of attaching the box end and spring to the sley; Seventhly, to a spectacle or guide; Eighthly, to a spring for box end; Ninthly, to a steadying guide for weft fork hammer.

1015. Reflecting Lights, *W. Brass, jun., St. Luke's. —2nd March*, 1882. 8*d.*

This relates to the arrangement and construction of a series of reflectors of different depths arranged in succession, the back or hindermost of the series being the deepest, the reflectors being mounted so as to be capable of adjustment to different angles.

1029. Improvements in Incandescent Lamps. *F. Wright and M. W. W. Mackie, Gray's-inn-road, London.—3rd March*, 1882. 6*d.*

The inventors fix the two conducting wires (with the carbon fibre attached) on a tube by means of spun glass, they insert this tube into the tubular throat of the glass bulb, and then by heating the throat cause it to collapse on the tube and wires and hermetically enclose them. The end of the inner tube is drawn out to a small bore, and the air extracted thereby from the bulb. The carbons are fixed to the conductors by thickening the ends with syrup and carbonising the sugar contained in it by acid. The carbons are then inserted in tubular pieces of platinum.

1067. Self-acting Block-signalling Apparatus.— *E. Callot, St. Denis, France.—6th March*, 1882. 6*d.*

The object is to produce an apparatus which shall effect the automatic putting on and taking off of the optical discs or signal arms usually employed on railways, in such manner that every train passing over an apparatus of this kind sets behind itself an optical signal placed at the preceding apparatus, which signal shows "danger" or blocks the next following train until the first one has passed over the next apparatus.

1073. Steamships or Vessels Propelled by Self-contained Power, *J. E. Mouland, Roby.* —6*th March*, 1882. 4*d.*

This consists essentially in carrying up the skin of the vessel, so as to cover the same with a cylindrical, oval, elliptical, or other dome or cover.

1075. Musical Piston Instruments, *W. R. Lake, London.*—6*th March*, 1882.—(*A communication from F. Sudre, Paris.*) 6*d.*

This consists, First, in the application of an automatic adjustment, consisting of a lengthening of the slide, which operates only when first and third pistons are used together; Secondly, in dispensing with a column of air when the third piston is used; Thirdly, in a method of manufacture by machinery, which permits of forked pieces or semicircles of all sizes being made with a regular bore or passage.

1076. Smiths' Hearths, *P. Everitt, London.—6th March*, 1882. 6*d.*

This relates to a smiths' hearth having an annular air-heating chamber in communication with an air supply on the one hand, and with a central escape opening or openings on the other, such hearth being provided with a valve or valves for regulating the retention or emission of the heated air, and with a trap or valve for the discharge of the molten slag.

1077. Fire Blowers for Hastening Combustion and Abating Smoke in Fire-grates, &c., *J. J. Lish, London.—6th March*, 1882. 6*d.*

This consists in having a fire-resisting piece or sheet of metal or other suitable material or fabric, capable of being easily bent or adapted by the hand or by the force of the draught to any ordinary form of fireplace or open stove, and suitably supported.

1078. Steam Generators for Utilising Waste Heat of Coke Ovens, &c., *C. Kingsford, London. —6th March*, 1882. 6*d.*

The inventor claims, First, a steam generator having a flue tube or tubes passing through the same, and each provided with one or more flues or apertures for admitting the heated air and products of combustion into the said flue tube or tubes at any point or points between the ends thereof. Secondly, the combination of the steam generator with one or more coke ovens or other suitable furnaces, in such a manner that the waste heat from the same may be utilised for generating steam for motive power or other purposes.

1079. Improvements in the Construction and Manufacture of Incandescent Lamps, &c., *W. Crooks, F.R.S., London.—6th March*, 1882. 4*d.*

This refers to the employment of silk, hair, wool, or silkworm-gut, and other similar materials, instead of vegetable matter, for the carbons of incandescent lamps. The material is treated with cupra-ammonia, and then carbonised slowly. The invention also refers to a method of forming the junctions between the carbons and the conducting wires by the use of a cement of graphitoidal carbon, and other methods; also to various other improvements in the manufacture of the inventor's lamps.

1080. Reels of Reaping Machines, *A. M. Clark, London.—6th March*, 1882.—(*A communication from F. F. Kanne and L. Z. Rogers, Waterville Le Sueur, U.S.*) 6*d.*

This relates to a feathering reel for reaping machines, and to the peculiar construction and arrangement of the parts, whereby the slats or beaters are made to feather, so that as the reel revolves the slats or beaters will seize the uncut grain and lift it upon the canvas or platform, raising lodged grain, and in windy days, when the grain leans from the platform, the beaters will reach over the heads of the grain and move it back to the cutter bar.

1089. Manufacture of Steel, *J. Gjers, Middlesbrough-on-Tees.—7th March*, 1882. 6*d.*

The inventor claims, First, the conversion of steel ingots into a finished or partly finished state without re-heating them in a furnace, by the use of "soaking pits;" Secondly, the manufacture of articles from steel ingots and without employing the ordinary re-heating process, rolling or otherwise pressing the steel in the required shapes.

1090. Weaving Apparatus, *E. O. Taylor and T. Brierley, Marsden.—7th March*, 1882. 8*d.*

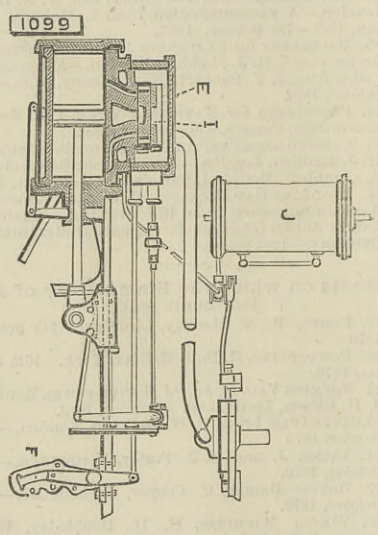
This relates, First, to means by which the weight required to the yarn beam may be removed by the attendant at the front of the loom when required to adjust the motion of that beam; Secondly, to the picker motion; Thirdly, to means for operating the jacquard apparatus.

1091. Looms, *D. Bailey, Lockwood.—7th March*, 1882. 6*d.*

This relates to means for stopping the loom when weft breaks or fails.

1099. Cut-off Valve Gear for Locomotive Engines, *A. W. L. Reddie, London.—7th March*, 1882.—(*A communication from J. Swann, Alabama, and F. R. Fennessy, New York.*) 6*d.*

One feature of this invention consists in the combination with the main slide valve E and an ordinary link motion F for varying its movement, of a cut-off slide valve I, consisting of a single plate driven by connections from the piston-rod or crosshead, so that it has an invariable travel and an invariable motion



relatively to the piston, whereby an earlier and a greater variation of cut-off, with better distribution, are effected. Another feature relates to the better lubrication of valves which are held to their seats by pressure of the motive agent on their backs, and it consists in supplying the lubricant to the face of the valves from reservoir J, where the lubricant is maintained under pressure.

1104. Machinery for Lasting Boots and Shoes, *W. R. Lake, London.—7th March*, 1882.—(*A communication from G. W. Copeland, Malden, U.S.*) 6*d.*

This invention relates more particularly to the use of a series of lasting straps or bands, which are arranged to extend across the machine beneath the last, from one set of side supports or fingers to the other, or which extend upwardly from below the last to the supports or fingers.

1106. Preventing the Shifting of Grain and Loose Cargoes in Ships, *W. R. Lake, London.— 7th March*, 1882.—(*A communication from E. H. Farrar, New Orleans, U.S.*) 6*d.*

This relates to the method of packing and preventing the shifting of bulks of grain, guano, or other substances in a ship, consisting in pressing and holding down the grain or other articles in successive layers, by stretching flexible diaphragms upon the layers as they are formed.

1107. Treating Fibre of the Stalk of the Cotton Plant, *F. Wheaton, Brooklyn, U.S.—7th March*, 1882. 4*d.*

This consists essentially in separating the fibre from the stalk by passing through rollers or by retting, then drying, then scutching or breaking, and then carding or hackling the same, thus producing a staple of the fibre alone.

1113. Combination Stench-traps, *R. Pearson, Kingston-upon-Hull.—8th March*, 1882. 6*d.*

This relates to a double stench-trap, so arranged that the flush of water from the first chamber passes through the second chamber and cleanses it.

1114. Lamps for Bicycles, Tricycles, &c., *W. Skaife, Limehouse.—8th March*, 1882. 6*d.*

This relates to the manner of suspending the lamp so as to prevent the jar of the carriage extinguishing the light.

1117. Napped Hats, &c., *G. Atherton, Stockport.—8th March*, 1882.—(*Partly a communication from G. Yule, Newark, U.S.*) 6*d.*

This relates, First, to means for removing the cotton from the naps of hat bodies; Secondly, to the forming of the napping bat, and to the "sticking" or attachment of the same to the bodies; Thirdly, to apparatus for carrying into effect the formation and sticking of napping bats.

1118. Pickers for Looms for Weaving, &c., *G. Burslem, Stockport.—8th March*, 1882.—(*Not proceeded with.*) 2*d.*

The objects of this invention are to afford a means of attaching the picking band or strap to the picker, so that the pull upon the picker shall be more direct and central, and the edge of the band or strap shall not be exposed to wear by coming against the picker at every blow or pick of the loom.

1119. Combing Wool, &c., *T. H. Wharton and F. Farrar, Bradford.—8th March*, 1882.—(*Not proceeded with.*) 2*d.*

The dabbing brushes commonly used for pressing the fibre between the teeth of the combs are dispensed with, and in lieu thereof circular brushes are used which are actuated by means of gearing in connection with the small circles of a "Noble's" comb.

1120. Hoists, *T. L. Hall, Manchester.—8th March*, 1882. 6*d.*

The invention consists in mounting a revolving or coiling shutter upon the cage of the hoist, so that this shutter shall close all the openings into the hoist, except the one which is at the moment opposite to the cage.

1123. Manufacture of Paper, &c., *J. H. Annandale, Midlothian.—8th March*, 1882. 8*d.*

The object of the invention is the production of machine-made paper, which shall so closely resemble hand-made paper as to be almost impossible to be distinguished therefrom, the novelty consisting in the continuity of the process of manufacture, and in the arrangement and combination of machinery necessary for the carrying out of the said continuous process.

1124. Preventing "Racing" in Marine Engines, &c., *J. Holt, Mossley.—8th March*, 1882.—(*Not proceeded with.*) 2*d.*

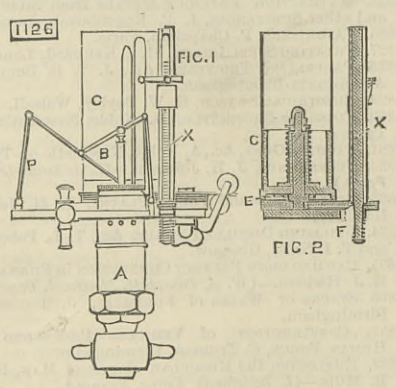
This consists in fixing close to the crank shaft an intermediate shaft driven by spur gear from and at the same speed as the crank shaft, the intermediate shaft carrying a cone and a speed pulley. A second small intermediate shaft is fixed close to the one above mentioned, and is fitted with a speed pulley, and the necessary bevel gear to drive an ordinary governor or its equivalent.

1125. System of Suspension for Beds and Seats to Prevent Sea Sickness, *F. Lebacq, Bruxelles.—8th March*, 1882. 6*d.*

The inventor claims the method of construction and arrangement consisting of three frames or cases fitted and connected together by means of rollers, pivots, links, and springs, so that the bed remains automatically in a horizontal position.

1126. Steam Engine Indicators, *H. J. Haddan, Kensington.—8th March*, 1882.—(*A communication from G. H. Crosby, Massachusetts, U.S.*) 6*d.*

This consists in the combination of a rotary paper carrier with mechanism to revolve the same during a stroke of the engine piston with a marker, and means for imparting to it in a given period movements corresponding in number to the strokes of the piston during such period, in order that marks indicative of the number of such strokes may be made by the



marker on the paper. A is the cylinder of the indicator, B the marker lever, C the rotary paper carrier, and P the parallel motion. To the base of drum C is fixed a cam E, which acts on a lever F, the outer end of which enters a groove in a vertical screw or rack X, and moves it upwards, and through a suitable ratchet the marker will be intermittently raised at each stroke of the piston. Other improvements are described.

1129. Applying Power to the Steering of Vessels, &c., *W. Pepper, Kingston-upon-Hull.—8th March*, 1882.—(*Not proceeded with.*) 2*d.*

The chief object is to provide a means for applying either hand or steam power to the steering of vessels.

1130. Mechanism for Propelling and Controlling Vehicles by Hand, *G. F. Redfern, London. —8th March*, 1882.—(*A communication from P. Collamore, Boston, U.S.*)—(*Not proceeded with.*) 2*d.*

This relates to the construction and arrangement of mechanism in connection with the front axle of a velocipede.

1131. Mats, *E. Smith, London.—8th March*, 1882.— (*Not proceeded with.*) 2*d.*

This consists in the employment of a number of slabs of cork fitted in a frame with spaces between each slab. The mats are for use in bath rooms.

1134. Railway Signalling, &c., *T. Gaddes, London. —8th March*, 1882.—(*Not proceeded with.*) 2*d.*

By the weight on the impact or the contact of the engine or train, acting either mechanically or upon an electric apparatus, the signals are worked, and any given section or sections of railway road or space will be "blocked" and "cleared."

1135. Brakes for Carriages, &c., *H. N. Kivell, Bideford.—8th March*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the employment of a brake strap, which is tightened upon a hoop surrounding the boss of the wheel.

1136. Improvements in Electric Telegraphs, *S. Pitt, Sutton, Surrey.—8th March*, 1882.—(*A communication from H. C. Mance, Kurrachee, India.*)— (*Not proceeded with.*) 4*d.*

This relates to improved arrangements for the translation of signals automatically between two cables, or a cable and land line, when very sensitive relays are employed, and it refers more particularly to cases where the Allan-Brown relay is used.

1141. Carding Machinery, *J. Dobson, Galashiels, N.B.—9th March*, 1882. 6*d.*

This relates partly to the combination with the large cylinders in scribblers or clearers of upper and lower drums placed between the cylinders, and each acting in connection with both cylinders between which it is placed.

1143. Spring Hinges, *E. P. Phillips, London.—9th March*, 1882. 6*d.*

This relates to the combination of a divided pin or its mechanical equivalent with a double-action coiled spring.

1144. Atmospheric Burners, *R. H. Wylde, Leeds.— 9th March*, 1882.—(*Not proceeded with.*) 2*d.*

Gas and air combined are admitted into a mixing chamber, over which are provided two plates or discs, the upper one being by preference concave or dished to leave room for sufficient gas to pass from the chamber. Between them is a small space forming a slit between the two plates or discs at their outer edge, through which the gas is passed before it can be ignited.

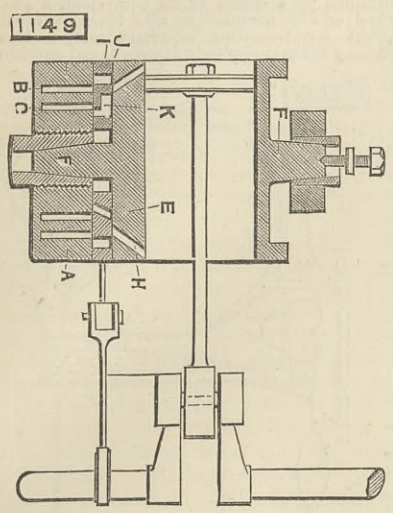
1148. Producing Cut Nails from Hoop Iron, &c., *J. Maynes, Manchester.—9th March*, 1882. 6*d.*

This relates to the arrangement and construction of the parts of the machine for transferring a blank piece of flat metal, whether severed transversely, and across the grain, from hoop or other strip iron, to the action of cutters which will sever or cut therefrom nails, such as sparrow bills, brads, tacks, and the like.

1149. Valves, &c., of Steam Engines, Water Engines, Meters, and Pumps, *A. W. Harrison, Abergavenny.—9th March*, 1882. 6*d.*

The drawing shows the improved valve as applied to an oscillating engine, and it consists in making the steam chest A somewhat C-shaped to avoid the trunnions F, and in it are the steam ports B connected by a passage, and exhaust ports C, also connected by a passage. The steam chest is fixed and fitted with

steam and exhaust pipes. H are the cylinder ports made nearly straight; I the slide valve, also some-



what C-shaped, and provided with steam ports J and exhaust ports K, and it is worked from an excentric on main shaft.

1150. HOLDING AND ADJUSTING LAWN TENNIS NETS, *J. Osmond, The Priory, Lee-road, Kent.* —*9th March*, 1882. 6*d*.

This relates to the employment at each end of a steady pole, and a strut at the middle, which holds the net so as to present along its upper edge the proper curvature.

1151. CASH COUNTERS OR TABLES, *C. D. Abel, London.* —*9th March*, 1882.—(*A communication from F. Witte, Berlin.*) 4*d*.

This consists in forming the surface of a counter or cash table with projections and hollows to facilitate the taking up of a coin therefrom.

1153. SUBSTITUTE FOR GUTTA-PERCHA, *M. Zingler, Belsize Park.*—*9th March*, 1882. 4*d*.

An important point or feature consists in the use of tannin combined with resinous gums and spirits.

1154. ROTARY ENGINE, *J. Bowie, London, D. Dosset, Leyton, and T. Wrigley, London.*—*9th March*, 1882. —(*Not proceeded with.*) 2*d*.

This relates to the general construction of the engine.

1155. PERCOLATING COFFEE JUGS, *E. Jones, Birmingham.*—*10th March*, 1882. 4*d*.

This consists in forming the lower part of the spout proper of a percolating coffee jug with a continuance or internal spout to below the bottom of the bag or strainer, or as long or as short as may be expedient, according to the shape of jug.

1158. RESERVOIR PENHOLDERS, *G. R. Hughes and T. Carwardine, Hampstead.*—*10th March*, 1882.—(*Void.*) 2*d*.

This relates to the construction of the pen in which is contained a small bag for supplying ink from the body or barrel to the nib.

1159. DRESSING, FINISHING, AND LUSTRING STUFFS, &c., *A. C. Henderson, London.*—*10th March*, 1882. —(*A communication from V. Cheviet, Lyons.*)—(*Not proceeded with.*) 2*d*.

At the time of putting the stuffs into the press a card or board is placed between each fold alternately right or left of the piece, the operation being performed by the machine, thus obviating hand labour.

1160. PENCILS, *J. D. Sprague, Upper Norwood.*—*10th March*, 1882.—(*Not proceeded with.*) 2*d*.

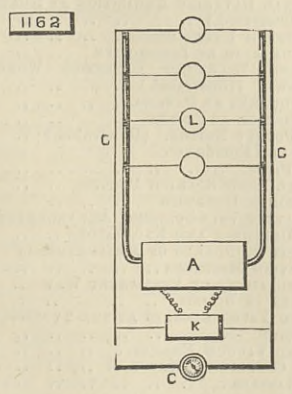
This relates to the construction of pencils in which the lead is made to revolve, and so admit of fine or coarse lines being drawn therewith, without the necessity of sharpening the said lead.

1161. INSTRUMENTS FOR MAKING STENCILS FOR MULTIPLYING COPIES OF WRITINGS, *J. D. Sprague, Upper Norwood.*—*10th March*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to an instrument in which a part of the exterior surface of a hollow ball is made with points or projections for the purpose of making the necessary perforations in the paper.

1162. IMPROVEMENTS IN APPARATUS FOR THE DISTRIBUTION AND REGULATION OF ELECTRIC CURRENTS, *W. R. Lake, London.*—*10th March*, 1882.—(*A communication from H. G. Maxim, Brooklyn, New York.*) 6*d*.

To regulate the intensity of lights placed at any distance from the generator, the inventor uses the



method illustrated in the accompanying diagram. It consists in operating the regulator by a circuit taken across the main lines at a point where their influence, as a varying factor in the resistance, will be nearly or quite eliminated. A is the generator, L L lamps, C C' regulator circuit, R regulator, and G galvanometer.

1165. CLEANSING THE TUBES OF FEEDING BOTTLES, *T. Marshall, East Greenwich.*—*10th March*, 1882. 6*d*.

The appliance is provided with one or more discs or swellings with a scraping edge and of slightly larger diameter than the interior of the tube, to remove any deposit which may have adhered to it.

1166. PRODUCTION OF SURFACES FOR PRINTING, &c., *J. J. Sachs, Sudbury.*—*10th March*, 1882. 4*d*.

This relates to the production of surfaces for printing, &c., upon metallic plates or rollers by means of an etching bath or metallic or galvanic bath.

1167. PURIFICATION OF GAS, &c., *G. C. Trewby, Beckton.*—*10th March*, 1882.—(*A communication from O. A. L. Pihl, Christiania.*) 4*d*.

The object of the invention is to effect the purification of coal gas in closed vessels with a view to economy and the avoidance of any nuisance.

1169. FIRE-ARMS, *P. T. Godsal, Windsor.* — *10th March*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to improvements in the construction of the action of breech loading fire-arms, the objects being to facilitate the removal of the acting parts from the gun for inspection and repair, and to protect such parts from dust and the action of the weather.

1170. FLOATING ANCHORS, *W. M. Bullivant, London.* —*10th March*, 1882. 6*d*.

This consists of a hollow water-tight float or raft with bags attached thereto.

1180. DRESS AND APPARATUS FOR PROTECTION AGAINST FIRE, &c., *O. Y. Rhodes, Leeds.*—*11th March*, 1882. 6*d*.

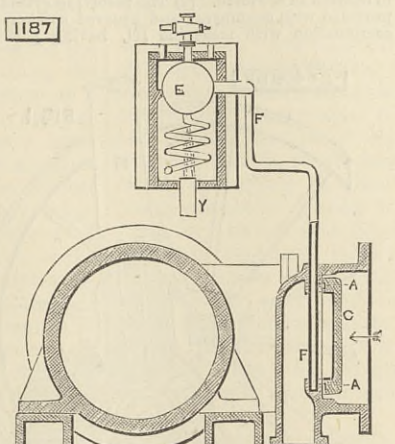
This consists, First, in the use of a dress composed of asbestos; Secondly, in the construction of a storage and purifying apparatus.

1184. TREATMENT OF RICE, *G. P. Witt, London.*—*11th March*, 1882. 6*d*.

This relates to separating the hulled from the unhulled grains of rice by the action of a series of rapidly vibrating inclined screens or sieves, in combination wih plates.

1187. SLIDE VALVES OF STEAM ENGINES, *W. Jones, Manchester.*—*11th March*, 1882. 6*d*.

This relates to means for counterbalancing the force of the steam on valves, which presses them against the surfaces upon which they slide; and it consists in forming grooves A in the surface against which the



slide C works, such grooves communicating by means of a pipe F with a chamber E, containing fluid subjected to the pressure of the motive fluid, and also heated by a gas jet Y.

1188. MACHINERY FOR DRYING, CLEANING, AND DRESSING GRAIN, *J. Walworth, Bradford.*—*11th March*, 1882. 6*d*.

This relates to improvements in the general construction of the machinery.

1192. FOLDING, TUCKING, BRAIDING, &c., *W. R. Lake, London.*—*11th March*, 1882.—(*A communication from E. J. Toof, New Haven, U.S.*) 6*d*.

This relates to improvements in sewing machine attachments for forming a fold or rib in a fabric, such as tucking, hemming, felling, binding, cording, or braiding, and for like purposes, and consists chiefly in a new method of securing these and other attachments to the machine, whereby the usual set screws are avoided, and the attachment or removal effected with greater facility than by the ordinary method.

1194. APPARATUS FOR RUFFLING, PLAITING, &c., *W. R. Lake, London.*—*11th March*, 1882.—(*A communication from E. J. Toof, New Haven, U.S.*) 6*d*.

The object of one part of the invention is to provide a ruffler, simple and compact in form, embodying all the essential features necessary for the purposes required in the formation of gathers and rufflers. Another part consists essentially in combining with a ruffling or gathering attachment for sewing machines, a hinged separator plate, adapted to be thrown or removed out of position when not required to separate a plain strip from the strip to be ruffled, so that shirring may be done with the said attachments. It consists further in the combination with the ruffler, of a piece for covering the feed bar when shirring.

1197. DECORTICATING RICE, WHEAT, &c., *A. M. Clark, London.*—*11th March*, 1882.—(*A communication from G. D. Dennis, Nantes, France.*) 6*d*.

This consists in subjecting the grain to the abrasive action of a granular or pulverulent material of a hard abrasive character by mixing and agitating the grain therewith in a drum or other receptacle receiving rotary or other motion.

1198. FOUNTAIN PENS, *W. E. Kay, near Bolton.*—*11th March*, 1882. 6*d*.

This consists in the application of an india-rubber spring in lieu of the metal spiral mostly employed; of an automatic valve for the double purpose of ink exit and air entrance; of special arrangements whereby a flat or ordinarily shaped pen may be used; of the application of a movable air tube whereby the ink passages may be cleared; and of a method of filling the reservoir with ink.

1200. MINCING MACHINES FOR SAUSAGE-MAKING, &c., *F. Des Vœux, London.*—*13th March*, 1882.—(*A communication from R. Huebner, Berlin.*) 6*d*.

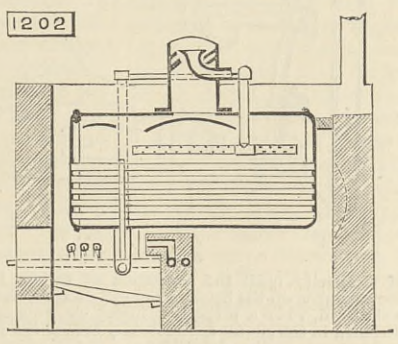
This consists, Firstly and mainly, in the manner in which the knives are fitted; and Secondly, in methods of fastening before the discharge aperture of the machine plates with tubes for placing the sausage skins upon.

1201. IMPROVEMENTS IN THE CONSTRUCTION OF DYNAMO-ELECTRIC, &c., MACHINES, *R. Matthews, Hyde, Cheshire.*—*13th March*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to the construction of machines for giving continuous currents.

1202. STEAM BOILERS, *H. J. Haddan, Kensington.*—(*A communication from W. H. Harris, Brooklyn, and G. Farr, New York, U.S.*) 6*d*.

The objects are, First, to prevent incrustation on the boiler shell by furnishing the boiler with pure water; Secondly, to effect the nearly perfect combustion of fuel by a proper supply of heated air and feed-water at the proper places; and Thirdly, to dispose of the fuel so that all the combustible gases will be con-



sumed, thereby avoiding smoke and economising fuel; and it consists of a furnace divided by an independent water partition into front and rear combustion chambers, both surrounded by air-heating flues arranged to twice encircle the furnace, and terminating in side apertures in the front chamber, and in a series of perforations in the bridge wall in an upward forward direction. Further, in the combination with the divided furnace chamber of a hollow arched pendent partition, a hollow bridge wall with a forward projecting hood, and the series of air-heating pipes encircling the furnace. Also perforated air-heating apparatus at the rear water leg, so as to form a narrow throat, and force the air and combustible gases to mingle; and lastly, in the combination of feed pipes with a circulating pipe which connects the partition and the water leg, and a sediment blow-off pipe, the whole arranged to feed, heat, circulate, and purify the water before being introduced to the boiler.

1203. APPARATUS FOR THE MANUFACTURE OF HATS, &c., *H. J. Haddan, Kensington.*—*13th March*, 1882. —(*A communication from E. Manginot, Toul, France.*)—(*Not proceeded with.*) 2*d*.

The object is the rapid internal ironing of caps and similar head gear, so as to dispense with the external application of the iron.

1205. FEEDING STEAM BOILERS WITH WATER, *C. W. Wardle, Leeds.*—*13th March*, 1882. 6*d*.

This consists in the use, in combination with an injector for feeding a steam boiler with water, of a vessel, the arrangement being such that water escaping from the overflow port or pipe of the injector is retained in the said vessel until the injector has got fairly into operation, and is then by the action of the injector caused to enter the boiler along with water from the usual feeding source.

1206. STRAINERS FOR PAPER PULP, *R. Laurie, Darley.* —*13th March*, 1882. 6*d*.

The strainer frame is suspended by hinges at one end and from a spring or springs at the other end, which receive motion, so that it hangs in equilibrium, and a gentle vibratory motion is produced by the simple depression and consequent recoil of the spring, thereby avoiding the lifting of the dead weight of the frame and its contents.

1207. GIVING ALARM IN CASE OF ACCIDENTS, BURGLARS, &c., *C. B. Wood, Liverpool.*—*13th March*, 1882.—(*Not proceeded with.*) 2*d*.

This consists, First, in so arranging a non-conducting peg, wedge, or other piece of mechanism between two conductors as to interrupt the current, but the apparatus is so arranged that by withdrawing the non-conducting piece a completed circuit is immediately started; Secondly, in applying this or equivalent mechanism for the purpose of giving alarm.

1208. SACCHARINE COMPOUNDS, *H. H. Lake, London.*— *13th March*, 1882.—(*A communication from E. Wilhelm, Buffalo, U.S.*)—(*Not proceeded with.*) 2*d*.

The object is to produce a homogeneous dry saccharine compound in which the sticky or adhesive property of the grape sugar is completely neutralised.

1209. BREECH-LOADING SMALL-ARMS, *W. M. Scott, Birmingham.*—*13th March*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in the construction, combination, or arrangement of parts for cocking the internal hammers of drop-down guns, by the raising of the breech ends of the barrels from the break off for opening the guns.

1210. KNIFE-CLEANING MACHINES, *R. H Bishop and W. Down, London.*—*13th March*, 1882.—(*Not proceeded with.*) 2*d*.

The object is to provide means for gradually withdrawing the knives from the machine so that every part of the blade may receive the rubbing action of the larger diameter of the discs.

1213. FIRE-GRATES, *R. Wright, Richmond, Yorkshire.*— *13th March*, 1882. 4*d*.

The objects are to facilitate the removal of dust, ashes, and cinders, and the abatement of smoke arising from fuel burnt.

1214. CONSUMING SMOKE IN FURNACES, *H. H. Lake, London.*—*13th March*, 1882.—(*A communication from C. Olson, Chicago, U.S.*) 6*d*.

The invention consists in apparatus of special construction and arrangement for throwing an unbroken horizontal sheet of superheated steam over the fire, just above the fuel.

1216. RIVETTING MACHINES, *E. R. Austin and F. Jackson, Manchester.*—*14th March*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to combinations of mechanism for the purpose of controlling and obtaining greater uniformity of pressure in the work performed by that class of rivetting machines usually called mechanical rivetting machines.

1217. BLEACHING VEGETABLE FIBRES, TEXTILE FABRICS, AND LIQUIDS, *N. J. Holmes, London.*—*14th March*, 1882. 2*d*.

This consists in the employment of an electric current for the purposes of bleaching by passing the same through the liquid or bleaching ingredient used to form the bath, and thus by means of the electrical decomposition set up augment the energy of the bath or bleaching agent employed.

1218. KNIFE CLEANERS, *H. Beach, London, Canada.*— *14th March*, 1882.—(*A communication from E. Ferguson, Westminster, Canada.*) 4*d*.

This consists of a set of tables made of wood or metal and covered with cork, leather, or emery.

1220. CHLORINE, *C. Wigg, Liverpool.*—*14th March*, 1882. 4*d*.

This consists, First, in subjecting hydrochloric acid to the action of chloride of barium or strontium, and reconverting sulphate of barium or strontium into chloride; Secondly, obtaining chlorides of barium or strontium by the treatment of sulphates; Thirdly, adding manganese di-oxide to hydrochloric acid previous to subjecting the same to the action of chloride of barium or strontium.

1228. GLAZING GREENHOUSES, &c., *J. Chaffin, Bath.*— *14th March*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in placing a layer of felt, &c., upon the rafter or sash bar, the glass being then placed upon the felt, and upon the upper surface of the glass a second layer of felt, &c., is placed, and above which is fixed a covering of zinc or other material which is screwed to the rafters or sash bars.

1229. APPARATUS FOR NAVIGATING FLUIDS, *A. W. Lake, London.*—*14th March*, 1882.—(*A communication from T. Hyatt, New York.*) 6*d*.

This relates to apparatus for navigating through air and water, the same being also applicable as "blowers" and as "camels" for raising sunken vessels, and to prevent vessels from sinking, and it consists principally in the use of revolving wheels fitted with wings or fans.

1233. NEEDLE WOVEN TAPESTRY, *A. J. Boult, London.* —*14th March*, 1882.—(*A communication from C. T. Wheeler, New York.*) 6*d*.

The fabric is woven with a tight warp, and also a fine loose warp which, passing at each alternate shoot of the loom, holds the woof threads upon the tight warp threads, so as to display the woof threads with the warp threads crossing them at regular intervals. The embroidery or needle-woven portion is inserted by selecting the proper colours and passing them first by a needle through the woven fabric from the back, and then under the visible portion of the warp threads and over the visible part of the woof threads the required length for the design, and then passing them through to the back.

1234 PUMPS, &c., *G. V. Fosbery, near Bristol.*—*14th March*, 1882. 6*d*.

This relates to diaphragm pumps, and it consists in substituting for the ordinary diaphragm a double ring or tube of india-rubber or other suitable substance.

1236. VENETIAN BLINDS, *W. R. Lake, London.*—*14th March*, 1882.—(*A communication from A. H. Lindefedt, Sweden.*)—(*Not proceeded with.*) 2*d*.

This relates chiefly to the employment of rollers to raise and lower Venetian blinds.

1237. PRODUCING LIGHT AND HEAT, *A. Reckenzaun, Leytonstone, and J. H. Redfield, New York.*—*14th March*, 1882. 6*d*.

This relates to the production of light and heat by the employment of air charged with other gas or vapour in combination with special burners. The air is forced through a chamber containing sponge or other porous substance charged with hydrocarbon, and then passes to a burner consisting of a hollow metal body capable of resisting ordinary reflective heat and non-conducting tips of mineral or other refractory substance, on to which is fitted a coil of wire gauze or a piece of platinum or iridium.

1238. METALLIC FASTENERS FOR ATTACHING BUTTONS, *H. Andrews, Birmingham.*—*14th March*, 1882. 6*d*.

The shank of the button is passed through a hole formed in the article to which it is to be attached, and secured by a metallic hook made in one piece with a flat plate.

1239. APPARATUS TO MITIGATE THE DESTRUCTIVE EFFECT OF RAILWAY COLLISIONS, *E. Clarke, Liverpool.*—*14th March*, 1882.—(*Not proceeded with.*) 2*d*.

This relates to the use of a telescopic wagon to be placed in front and in the rear of each train, and filled with trusses of hay and bags of wool.

1240. SEWING LEATHER, &c., *W. Hollingworth, Bradford.*—*14th March*, 1882. 6*d*.

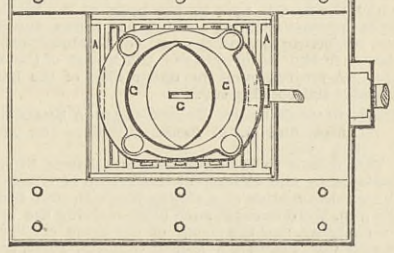
This relates to apparatus to sew two pieces of leather or other material together by means of a continuous thread, without the use of a shuttle or additional thread.

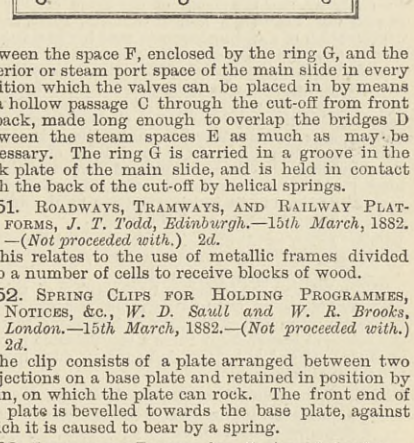
1242. WIND MUSICAL INSTRUMENTS, *V. I. Feeny, London.*—*14th March*, 1882.—(*Not proceeded with.*) 4*d*.

According to one improvement the reed chamber is formed so as to permit of the reeds being arranged chromatically and within a much less compass than hitherto. A Second improvement consists in means to enable the instrument to be operated automatically or by hand; and a Third improvement relates to means for operating the driving mechanism by hand or foot.

1244. EXPANSION VALVES FOR STEAM ENGINES, &c., *J. Hopwood, Poulton-le-Fylde, Lancashire.*—*14th March*, 1882. 6*d*.

In carrying out this invention the ordinary gridiron expansion or cut-off valve A is combined with a back plate B—shown in the drawing as cast with the valve—and over which is placed a balance ring G, having an open area equal to the aggregate area of the steam ports E at the back of the main slide, the centre of the open area being directly opposite to, or in same line, or perpendicular to the plane of motion, as the common centre of those several openings. An uninterrupted channel of communication is provided





between the space F, enclosed by the ring G, and the interior or steam port space of the main slide in every position which the valves can be placed in by means of a hollow passage C through the cut-off from front to back, made long enough to overlap the bridges D between the steam spaces E as much as may be necessary. The ring G is carried in a groove in the back plate of the main slide, and is held in contact with the back of the cut-off by helical springs.

1251. ROADWAYS, TRAMWAYS, AND RAILWAY PLATFORMS, *J. T. Todd, Edinburgh.*—*15th March*, 1882. —(*Not proceeded with.*) 2*d*.

This relates to the use of metallic frames divided into a number of cells to receive blocks of wood.

1252. SPRING CLIPS FOR HOLDING PROGRAMMES, NOTICES, &c., *W. D. Saull and W. R. Brooks, London.*—*15th March*, 1882.—(*Not proceeded with.*) 2*d*.

The clip consists of a plate arranged between two projections on a base plate and retained in position by a pin, on which the plate can rock. The front end of the plate is bevelled towards the base plate, against which it is caused to bear by a spring.

1253. LABELS FOR PLANTS, &c., *S. Arnold, London.*— *15th March*, 1882. 4*d*.

This consists in moulding the labels in pipeclay, and when baked writing the inscription thereon in ink.

1255. REPEATING SMALL-ARMS, *F. J. Cheesbrough, Liverpool.*—*15th March*, 1882.—(*A communication from J. Nemetz, Vienna.*) 6*d*.

This relates to repeating guns, and consists in certain breech, hammer, and lock mechanism, whereby the consecutive or repetition firing is effected, the cartridges being held in a casing which travels across the breech. The percussion and explosion of the cartridges take place in the breech of the barrel, the cartridges being in rotation pushed forward from the holder into the barrel after each explosion, by which means a lighter breech and stock can be used, as the danger of bursting the cartridge holder is avoided.

1259. WEAVING TAPE LADDERS, *J. Carr, Manchester.* —*15th March*, 1882. 6*d*.

This relates to improvements on patent No. 229, A.D. 1869, in which a complete ladder was formed in the loom by weaving the tapes and cross strips simultaneously, and attaching them together by weaving at the required points of attachment. The cross strip is woven sometimes into the lower tape and sometimes into the upper one, but it occasionally happens that when the strip is being woven into the upper tape the ends are lowered to the lowest point, to prevent which stops are brought into action at the required times to prevent the ends falling into the lower shed, when being woven in with the ends in the upper shed, their action being controlled by special needles in the jacquard or by a special dobbie.

1261. PRODUCTION AND PRESERVATION OF ORNAMENTAL DESIGNS, &c., UPON GLASS, *C. Cutler, Birmingham.*—*15th March*, 1882. 2*d*.

The glass is silvered in the usual way, and then part of the silver removed by means of a stencil plate, the design being then filled in with colour if required.

1262. KNITTED FABRICS, *R. Mackie, Stewarton, N.B., and W. Start and H. Scattergood, Nottingham.*— *15th March*, 1882. 6*d*.

This relates to machines for producing knitted articles of round, conical, and other forms, and consists in producing an effect similar to narrowing and widening of the courses, by arranging the same radially on the articles, and diminishing or increasing the depth of the work by diminishing or increasing the number of stitches knitted for successive courses, but without taking stitches off the needles.

1263. WORKING RAILWAY POINT AND SIGNAL LEVERS, *W. Stroudley, Brighton.*—*15th March*, 1882.—(*Not proceeded with.*) 2*d*.

This consists in moving points and signals in one

direction by means of compressed air, a weight or spring effecting the return.

1265. Chain Clips for Machines Used for Stretching, &c., Textile Fabrics, *J. Smith, Thorliebank, N.B.*—*15th March*, 1882. 6*d.*

This relates more especially in the arrangement whereby the upper jaw of the clips of the traversing chains of stretching or tentering machines is acted upon by a spring so as to grip the cloth, and by which the withdrawal of the upper jaw is enabled to be easily effected when removing the cloth from the clips. The spring is placed partly within a movable horizontal tube capable of sliding within a fixed tube forming part of each link to which the clip is secured, and acting against the upper jaw.

1266. Artificial Indigo, *J. H. Johnson, London.*—*16th March*, 1882.—(*A communication from the Badische Aniline and Soda Fabric, Baden.*) 4*d.*

This consists, First, in the production of artificial indigo from orthonitrobenzaldehyde by the action of pyruvic or pyroracemic acid, acetone or acetic aldehyde in the presence of alkaline condensing agents; Secondly, the preparation of orthonitrocinnamyle formic acid by the action of pyruvic or pyroracemic acid upon orthonitrobenzaldehyde in the presence of dry hydrochloric acid; Thirdly, the conversion of orthonitrocinnamyle formic acid into artificial indigo by the action of caustic or carbonated alkalies or of alkaline earths.

1285. Composition for Use in Manufacture of Grinding Stones, &c., *G. W. von Nawrocki, Berlin.*—*16th March*, 1882.—(*A communication from G. Oest, Berlin.*)—(*Not proceeded with.*) 2*d.*

This consists in forming grinding stones of a composition consisting of from 10 to 12 parts of kilned bauxit, 2 parts crucible blacklead fragments, 1 part loam, and 1 part clay, to which any desirable cement may be added.

1307. Foot Skate, *J. M. Gorham, Lincoln.*—*17th March*, 1882.—(*Not proceeded with.*) 2*d.*

This consists of a single wheel to go on the outer side of the foot, and a strap of metal from the axle towards the ground, and bent at right angles for fixing a footboard, the back end of which carries a roller or stud, to be brought on to the ground and enable the skater to stand still.

1314. Coal Gas, *R. Morton and C. G. Williams, Nine Elms.*—*18th March*, 1882. 2*d.*

This consists in purifying coal gas from soluble ammoniacal compounds by submitting it to the action of water or ammoniacal liquor which has been artificially reduced in temperature.

1320. Breech-loading Small-arms, *W. M. Scott, Birmingham.*—*18th March*, 1882. 6*d.*

This relates to drop-down guns, and consists in the arrangement of parts for cocking the internal hammers by the raising of the breech ends of the barrels from the break-off for opening the guns, such arrangement considerably reducing the power required to effect the same, and thereby facilitating the manipulation of the gun. According to one arrangement the internal hammers are provided with the ordinary main springs, and in the body of the gun opposite each hammer is an inclined recess extending from near the joint on which the barrels turn to the back of the break-off. In each recess a sliding cocking rod works, the inner end projecting beyond the back of the break-off, and the other end being opposite the breast of the hammer. A projection on the under side of the barrels actuates the cocking rod.

1361. Sliding Block Breech-loading Small-arms, *J. Rigby and L. F. Banks, Dublin.*—*21st March*, 1882. 6*d.*

This relates to breech-loading small-arms in which the opening and closing of the breech is effected by the vertical motion of a sliding block in the body of the gun, the descent of such block opening the breech for charging, and the rising of the same closing the breech for discharge, and it consists, First, in the combination of a sliding hammer working in a tubular case in the butt of the gun, and actuated by a helical or coiled spring, also the adaptation to the rear end of the sliding hammer of a light coiled spring for withdrawing the nose end from the sliding block after the discharge of the gun; Secondly, the combination of an arm, link, and tumbler for cocking the sliding hammer by the depression of the hand lever of the gun, the arm being also used to raise and lower the sliding block; and Thirdly, in the use of a safety axis automatically placed in its locking position by the descent of the sliding block to open the breech.

1402. Tubular Boilers, *J. Imray, London.*—*23rd March*, 1882.—(*A communication from F. Deloye and A. Guebhard, Paris.*) 4*d.*

This relates to the insertion in the tubes of tubular boilers of pieces of conducting metal, arranged so as to break up the direct streams of hot gases through the tubes, to absorb from them a considerable portion of their heat and to radiate and conduct such heat to the tubes themselves.

1453. Colouring Matters, *J. A. Dixon, Glasgow.*—*27th March*, 1882.—(*A communication from Dr. C. Koenig, Germany.*) 4*d.*

The object is to produce artificial indigo and substituted indigoes. When monobenzylidene-acetone is nitroylised, a mixture of ortho and para nitrobenzylidene-acetone is formed. The separation of the isomeric compounds is effected by means of alcohol, in which the paranitro-benzylidene-acetone dissolves with difficulty, whereas the orthonitro compound dissolves in it easily. If ortho-nitro-benzylidene-acetone is left some time in the cold in contact with an alcoholic soda-lye, it is converted into a new substance, which appears to be contained in the liquid in the form of a sodium salt, and which, after being separated from its sodium combination by means of acids, yields artificial indigo by heating to boiling point or by treating with diluted alkaline lyes. The ortho-nitro-benzylidene-acetones substituted in the benzol nucleus behave exactly like their mother substance, and under equal conditions they produce correspondingly substituted indigo.

1491. Saddle Bars, *J. Oldmeadow, Cheltenham.*—*28th March*, 1882. 6*d.*

This relates to improvements on patent No. 5477, A.D. 1880, the object being to lessen the number of parts of the bar, and thereby reduce the cost and increase its efficiency, and it consists in dispensing with the spring and the slot in the bar to receive the same, while the cranked or horizontal bar is split longitudinally from its free or pointed end to a sufficient distance to enable the same, when the parts are slightly open, to form a spring.

1502. Sewing and Trimming Knit Goods, &c., *J. H. Johnson, London.*—*28th March*, 1882.—(*A communication from S. Borton, Philadelphia, and C. H. Willcox, New York.*) 10*d.*

The machine is more particularly for use in the manufacture of hosiery and other knit goods, and is also partly applicable to sewing, trimming and welting or hemming of other articles and fabrics. It relates, First, to a combined sewing and trimming machine operating to trim the edges of the fabric automatically as the sewing proceeds; Secondly, to a new mode of sewing knit fabrics; Thirdly, to a new mode of forming a welt or hem; Fourthly, to a series of guides for guiding a welt or hem to a sewing or combined sewing and trimming machine; Fifthly, to a tension and thread controlling apparatus for the upper thread of a lock stitch or single thread of a chain stitch machine; and Sixthly, to a feed lock for preventing the length of stitch from being changed except by an authorised person.

1579. Locks and Latches, *A. Summerfield, Aston, near Birmingham.*—*31st March*, 1882. 8*d.*

This consists in forming locks so that the springs are dispensed with, and one weight is made to operate both the lock and latch bolts.

1791. Wire for Making Lockets, &c., *E. Richardson, Birmingham.*—*14th April*, 1882.—(*Complete.*) 4*d.*

This consists in forming the wire used for the closing edges of lockets, watch cases, and other articles, by drawing it to the form of a rectangular bar with an acute angle cut out from one corner, so that when bent to the form of the edge of the locket the requisite snap action will be obtained.

1620. Plaster for Casts, Mouldings, &c., *P. M. Justice, London.*—*4th April*, 1882.—(*A communication from M. B. Church, Grand Rapids, Michigan, U.S.*) 4*d.*

The plaster consists of pulverised calcined gypsum, glue, and sulphate of zinc.

2596. Organ Pedals, &c., *W. C. Dyer, Weston-super-Mare.*—*1st June*, 1882.—(*Complete.*) 4*d.*

This relates to mechanism for connecting the bass keys of a pianoforte with pedals similar to those used in organs, and placed under the piano, so that the player may play simultaneously with hands and feet as on the organ, and it consists in the use of a double back-fall lever, consisting of two single back-fall levers connected together and to the pedal and key respectively.

2623. Improvements in Devices for Coupling or Connecting the Armatures and Commutators of Magneto or Dynamo-electric Machines, *W. R. Lake, London.*—*3rd June*, 1882.—(*A communication from J. J. Wood, Brooklyn, New York.*) 6*d.*

This relates to an improved device for connecting the ends of the armature coils—of the Gramme class of machine—with the commutator sections. The improvement consists in affixing to each strip of copper projecting from the several sections of the commutator, of a clamp to receive the ends of the coil wires to be connected thereto, the wires being firmly clamped therein, thus avoiding the use of solder, and affording a ready means of detaching them when required.

2632. Improvements in Electric Lamps, &c., *W. R. Lake, London.*—*5th June*, 1882.—(*A communication from J. J. Wood, Brooklyn, New York.*) 6*d.*

This relates to arc lamps in which the regulating armature carries a vibrating train of wheels which is engaged at the leading pinion with a rack on the upper carbon holder, and which has a terminal escape wheel or detent which is brought up against a stop-tooth when the armature is attracted to separate the carbons, and is withdrawn from the stop when the armature is retracted, to allow the upper carbon to descend. The object of the present invention is to keep the arc at a constant focus, to do which both carbons must be moved. To accomplish this, a simple connection is made between the negative carbon holder and the spindle of the gear train, consisting of a rotary spindle mounted in stationary bearings and geared on one side with the spindle of the vibrating train which meshes with the positive holder, so that as the train moves up or down, so both carbons will be moved simultaneously in opposite directions to each other, thus keeping the focus of the arc constant.

2644. Improvements in Underground Electrical Conductors, *L. Varicas, London.*—*6th June*, 1882.—(*A communication from G. Richardson, Philadelphia, U.S.*) 10*d.*

One part of this invention consists in encasing bare conductors directly in hydraulic cement. Another part relates to the construction of conduits of terra-cotta or cement for accommodation of insulated wires; whilst another relates to improvements in laying conductors so that additional wires may afterwards be laid in the conduit with ease and speed.

2646. Car Brakes and Starters, *S. Pitt, Sutton.*—*6th June*, 1882.—(*A communication from H. Hinckley and E. Culver, Philadelphia.*)—(*Complete.*) 6*d.*

This relates to the use of springs connected with the brake blocks, so that when the latter are applied the springs are wound up; and when the brake blocks are withdrawn from the wheels the springs act on the car axles and start the car.

2719. Coupling and Buffing Apparatus for Rail way Vehicles, *W. R. Lake, London.*—*9th June* 1882.—(*A communication from E. H. Janney, Virginia, U.S.*)—(*Complete.* 6*d.*

This relates to apparatus for coupling the carriages of a train, and for buffing and maintaining the coupled vehicles in their proper positions, and consists of a lever arm attached to the nose of the coupling, and which when swung back into a recess in the drawhead, an inclined face at one end of it comes in contact with the end of the long arm of the locking block, and swinging it on its bearings passes in behind it. The locking block being released by the passage of the arm, returns to its normal position and looks the same.

2770. Two-wheeled Vehicles, *S. Pitt, Sutton.*—*13th June*, 1882.—(*A communication from P. Herdic, Philadelphia.*)—(*Complete.*) 6*d.*

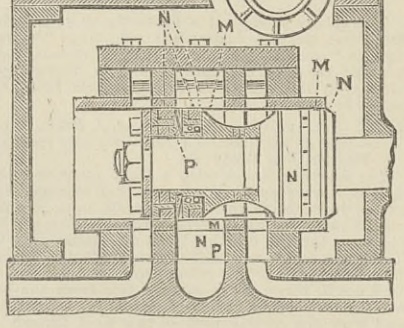
The objects are to obviate the shaking motion or lessen the jolting of a two-wheeled vehicle by the movements of the draught animal, and to relieve the animal of the repeated blows ordinarily inflicted by the violent vibrations of the shafts and load.

2794. Boilers for Heating Greenhouses, *C. Hulseberg, Finsbury.*—*14th June*, 1882. 6*d.*

This relates to the method of manufacturing the boiler, consisting in making the boiler in two separate and distinct parts of wrought or cast metal, with or without a corrugated internal shell, and placing the said two parts close together, so as to form a saddle boiler.

3132. Valves for Steam Engines, *A. M. Clark, London.*—*3rd July*, 1882.—(*A communication from W. S. Phelps, U.S., and W. Hofford, Canada.*)—(*Complete.*) 4*d.*

The inventors claim, First, the grooved follower ring P, compressing rings M, and packing rings N of the piston valve; Secondly, a piston valve provided with



two compression rings M and packing rings N separated by a follower P, the outer rings M being fitted to receive steam from the chest, and the inner rings from the cylinder.

3187. Regulating the Supply of Air to Furnaces, *R. H. Brandon, Paris.*—*6th July*, 1882.—(*A communication from A. Howatson, Paris.*)—(*Complete.*) 6*d.*

This relates to apparatus for regulating the supply of air to furnaces by the feeding or admission of an additional supply of air thereto above the firebars immediately after the fire door has been opened and closed for coaling, the admission being automatically produced by the opening and closing of the door, and caused to cease gradually in any given period of time. Two forms of apparatus are described for effecting this object, in one of which mercury is employed, and in the other a weight is employed to close the supply of air when desired.

2813. Shirts, *D. P. Belknap, San Francisco.*—*14th June*, 1882.—(*Complete.*) 4*d.*

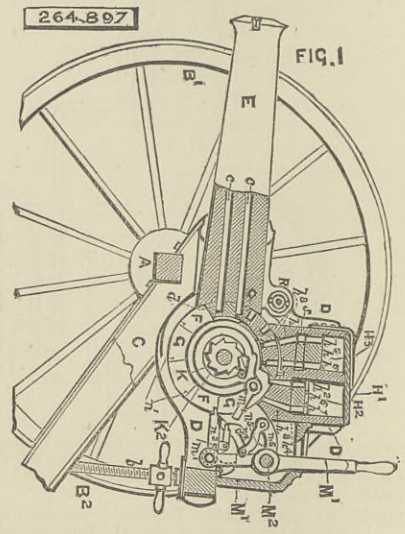
This consists, First, in providing the shirt with an open bosom or front made double-breasted, or furnished with two flaps, one overlapping the other, and interchangeable; Secondly, in providing an attached collar to such shirts of such shape that it can be worn either high or low in the neck.

SELECTED AMERICAN PATENTS.

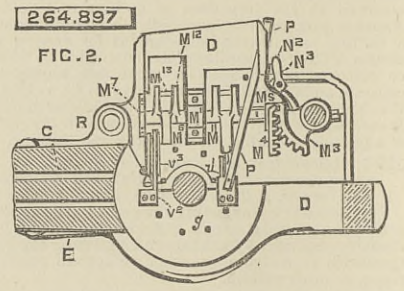
From the United States' Patent Office Official Gazette.

264,897. Machine Gun, *Sivert Pederson, Menomonee, Wis.*—*Filed January 3rd*, 1882.

Claim.—(1) The cylinder F, adapted to be revolved, and having a series of cavities provided with nipples *g*, in combination with sections G, provided with grooved ribs e^1, fitting into the cavities in cylinder F, and having chambers *d* communicating with the grooves in the ribs, the several parts being arranged and adapted to operate as set forth. (2) The revolving cylinder F, provided with chambered and grooved sections G, in combination with magazine H^1, having perforated



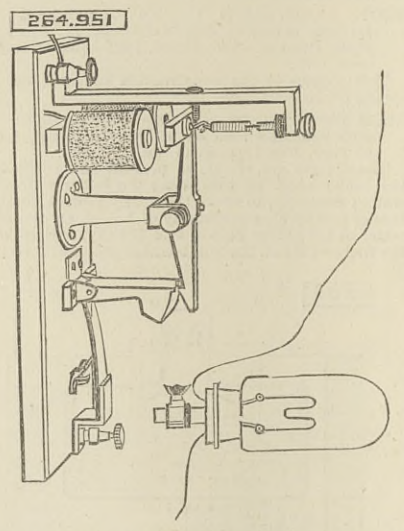
bottoms h^1 h^2 h^3 and intermediate perforated slides h^4 and h^5, the slide h^4 being adapted to receive a ball, and slide h^5 a charge of powder, the several parts being arranged and adapted to operate as set forth. (3) The revolving cylinder F, provided with chambered and grooved sections G, in combination with magazine H^1, having perforated bottoms and slides for the passage of balls and powder to the cylinder, the face of the magazine next to the cylinder being cut away so as to form a wedge-shaped cavity, as and for the purpose set forth. (4) The combination with cylinder F, provided with ratchet K^1 and chambered and grooved sections G, having cavities n^1, the collar K^2, having a dog to engage with the ratchet, a spring pawl n^2, and a lever M^1, connected to and operating pawl n^2, the several parts being arranged to operate as set forth. (5) The combination of cylinder F, provided with chambered and grooved sections G, the magazine H^1, provided with perforated bottoms and slides h^4 h^5, shaft M^2,



provided with segmental gear M^3, shaft M^6, provided with segmental gear M^4, clutch N^1, and arms M^{10} M^{11}, and shipper N^2, the several parts being arranged to operate as set forth. (6) The combination of cylinder F, provided with chambered and grooved sections G and nipples *g*, hammer V^4, formed with arm V^3, lever V^1, provided with a toe adapted to engage with lever V^3, and arm M^{15}, connected to shaft M^6, and adapted to act upon lever V^1, the several parts being arranged to operate as set forth.

264,951. Apparatus for Making Incandescent Lamps of Equal Resistance, *Hiram S. Maxim, Brooklyn, N.Y.*—*Filed November 15th*, 1881.—*Renewed August 19th*, 1882.

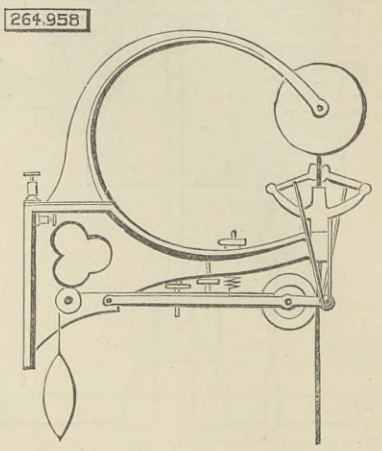
Brief.—The lamp is charged with hydrocarbon vapour, and the carbon is then heated by a current



of electricity until the deposition of carbon from the vapour upon the filament reduces its resistance to a standard, when a properly adjusted electro-magnet included in the circuit automatically breaks the same and prevents further deposition.

264,958. Electric Arc Lamp, *Joseph Olmsted, New York, N.Y.*—*Filed September 7th*, 1881.

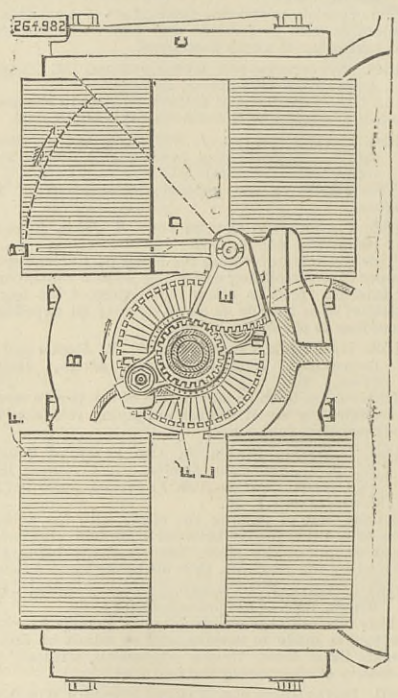
Claim.—(1) In an electric lamp having a fixed and movable electrode, substantially as described, the combination, with the said movable electrode and mechanism for feeding the same, of a mechanical locking device connected with the feeding mechanism, and adapted to check the movement of the electrode, substantially in the manner herein set forth. (2) In an electric lamp having a fixed and movable electrode, substantially as described, the combination, with the said movable electrode, of a swinging lever or frame sustained by a spring or its equivalent, a grooved wheel or disc mounted in said frame, a cord and weight for imparting a rotary motion thereto, whereby the said electrode is raised, and mechanism



connected with and operated by the movement of the swinging lever to lock or release the movable electrode in substantially the manner herein set forth.

264,982. Electro-magnetic Motor, *Edward Weston, Newark, N.J.*—*Filed May 8th*, 1882.

Claim.—(1) The combination, in an electro-magnetic motor, with a brush holder and brushes carried thereby, of a shifting mechanism for turning said brushes, and a resistance coil or coils arranged to be thrown in and out of circuit with the brushes by the movement of the shifting mechanism, as and for the purpose set forth. (2) The combination, with brush



holder H, brushes carried thereby, cog wheel F^1, of the toothed segment E and lever D, these parts being constructed and combined in substantially the manner set forth. (3) The combination, of brush holder H, brushes carried thereby, cog wheel F^1, toothed segment E, lever D, and resistance coils R, said coils being placed as described, and arranged to be thrown in and out of circuit with the brushes by the movement across them of the lever D as described.

CONTENTS.