THE NATIONAL BAVARIAN EXHIBITION AT NUREMBERG.

No. I.

BAVARIA, with a population of 5½ millions, has long been distinguished among continental nations for its industrial and artistic development. Without going back to the mediæval glories of Nurnberg and Augsburg, it will be sufficient to remember that the first industrial exhibitions in Germany were held at these towns in 1818, which were followed by others in 1821, 1822, and 1823, in Munich. Afterwards they were held at regular intervals of three years under Government management, a particular subject being selected for each. The first considerable exhibition at Munich, in 1834, had 772 exhibits, and that of Nuremberg, in 1840, 1002, this being the last that received State aid. The general exhibition of German art and industry at Munich in 1854 called forth a larger number of contributors, and the building in which that was held has served for smaller purposes on several subsequent occasions, the last being that of German art in 1876. On all these occasions the Bavarian manufacturers fully maintained the reputation of their country, but it was found that, in international competitions especially, a certain amount of preparation is required that can best be attained by more complete local exhibitions; and with this view the Bavarian Exhibition now open at Nuremberg has been organised under the auspices of the Bavaria trade museum. The Exhibition is divided into seventeen groups, of which Groups I. to XI. include trade and industrial products, while XII. and XIII. are devoted to fine arts and education, XIV. to transportation—railways, telegraphs, and carriages, XV. to machinery, XVI. to agricultural implements, and XVII. to horticulture, contributed to by rather more than 1800 exhibitors. It is arranged in several buildings in the park called the Maxfeld, about half-a-mile from the city on the Baireuth road, of which buildings the largest, measuring about 450ft. by 360ft., contains the first eleven classes of products. The machinery department covers 400ft. by 150ft., without counting a long shed for carriage and railway plant; and two smaller buildings are allotted, one to the fine arts, and the other to technical instruction and locomotion. In addition to these, however, there are numerous separate buildings erected by individual exhibitors, besides trophies of large objects, which, taken together with the numerous refreshment establishments, recall the garden of the Champ de Mars and Trocadero in 1878. In some respects, however, the comparison is to the advantage of the present Exhibition. The garden is an old one and well wooded, and much greater sobriety is evinced in the construction and decoration of the buildings, while the stalls for the sale of rubbish from all parts of the world, but more especially from Algiers and Morocco, which were so conspicuous in Paris, are happily wanting.

For a manufacturing country Bavaria is but poorly endowed with the prime requisites of coal and metallic minerals. The former is confined to the small portion of the Saarbrücken basin in the Palatinate, the most important working being the Government mines of Ingbert and Mettelbaxbach; the former has forty-two yards thick of workable coal in thirty-eight seams, and the latter ten yards and fourteen seams. A smaller basin at Stockham also belongs to the coal measures. In Upper Bavaria mines of considerable importance are worked in coals of tertiary—lower miocene—age, the seams in some cases being upwards of ten yards thick. It is a pitchy black lignite, approximating to coal in character; besides these, woody and earthy brown coals are worked on the newer strata, but to no great extent. The total coal production of the country in 1880 was 544,913 tons from thirty-four mines.

Iron ores are found in many different localities, but the total production is small, amounting only to 73,750 tons in 1880. The most important of the mines are in the neighbourhood of Arnberg and Sulzbach; the ore is a brown hematite, associated in depth with some granular spathic ore. The former contains about 50 and the latter 39 per cent. of iron, with from 1 to 2 per cent. of phosphorus. The deposit is of an inclined bed-like character, and where driven through is from seventy-five to eighty-five yards across. Oolitic red ore is found in an almost continuous chain of beds at the foot of the Franconian Jura in the lias, which are said to be inexhaustible, but the quality is inferior, containing much sand, and does not yield more than 35 per cent. Small quantities of calcareous oolitic ore are obtained from the nummulitic strata along the base of the Alps, most of which is exported to Wurtemberg. The continual increase in the price of charcoal has nearly put an end to the existence of the native blast furnaces. The number of these smelting with charcoal in 1857 was seventy-seven, of which only five were still blowing in 1880, and only two coke furnaces had been added at the latter date. The principal ironworks exhibiting is the Maximilians Hütte, which carries on smelting furnaces and rolling mills both in Bavaria and Thuringen. The principal establishments are at Rosenberg in the upper Pfalz, where there are three blast furnaces smelting with coke; a similar number of furnaces at Unterwellentin in Thuringen, to which is attached a Bessemer works with two converters and a three high rolling mill; and the Max Hütte proper, near Ratisbon, which is confined to the manufacture of puddled iron and steel, having thirty-two double puddling and thirty heating furnaces, with ten hammers and thirteen rolling mills. The production of steel is confined to the Thuringen works, which smelt the spathic and brown ores of Kamsdorf, producing besides Bessemer pigs ferro-manganese, with 20 per cent., and spiegel with 10 to 16 per cent. of manganese. The same ores are used in addition to the charge in the Bavarian works, where puddling and foundry iron is smelted. The spiegel is remarkable for the large size of the crystalline plates in the lower qualities containing less manganese. The Thomas and Gilchrist process has been tried with the Rosenberg pig iron, and samples are exhibited of an exceedingly mild temper, which welds like ordinary puddle iron. The building in which the collection is contained is built of slag bricks made from a white glassy slag in fragments of about ¼in. diameter, which at first sight might be mistaken for ordinary white clay bricks. A section of one of the newer furnaces shows that the Buttgenbach type has been adopted in its fullest development, the furnace top being entirely supported by four iron columns connected at intervals by rings, within which the furnace stack, of a single thickness of bricks, stands completely free. Of the smaller ironworks, that at Achthal, which has been in existence since 1527, sends good samples of charcoal smelted pig suitable for chill casting, specimens of which in the shape of finished rolls are exhibited; but unfortunately they have suffered from the damp air to which they have been exposed. The Hammeran forge, also dating from the sixteenth century, is well represented by a collection of stamping sheets, horseshoe and nail bars, manufactured from Styrian white iron with charcoal. This is entirely a water-power forge, and was remodelled about four years since, turbines being substituted for the old-fashioned wheels. There are very few metallic mines other than those of iron. Lead ores have been found in a few places, and at one of these, the Vesuvius Mine at Freihung, belonging to the Bavarian Mining Company, Limited, a certain amount of work has been done upon a deposit of great interest. This is a sandstone belonging to the highest part of the Trias, which is impregnated with galena in a manner similar to the famous deposit of Mechernich in the Eifel. Fossil tree stems are found in the bed also converted into lead ore. In the surface portions of the deposit the galena is mostly converted into carbonate, which occurs not only in a white mass but in large crystalline masses, forming the so-called glazey ore into a mixture of white lead and sand, which, when concentrated up to a certain degree, can be sold for potters' use. The rough ore, containing about 6 per cent. of lead, is concentrated by dressing up to 65 or 70 per cent. and sold to the Westphalian smelters.

There is one particular mineral product of which Bavaria has a monopoly, namely, lithographic stone, which occurs in the beds in the white Jura limestome, in the quarries of Soluhofen, Monsheim, Langenaltheim, and Müdliheim, producing about 5382 tons, worth £37,670. The inferior qualities of the same stone are largely used for flooring and table tops, being of an agreeable colour and taking a very fine polish. Of scarcely less interest, and almost as valuable as the lithographic stones, are the fossil remains of reptiles and fish, which are from time to time discovered in them. Such, for instance, as the Archeopteryx or feathered lizard, which was purchased for the British Museum for £500, while similar prices have been paid for other reptiles for Berlin and America. A very fine specimen of a fish, allied to the skate, is exhibited, for which the sum of £225 is asked.

Graphite is worked to the extent of 1450 tons annually in Lower Bavaria, and is consumed by the crucible makers of the neighbourhood of Passau, where the manufacture has been carried on since the fourteenth century. The supply is, however, insufficient to meet the demand, and is therefore supplemented by a further quantity imported from Ceylon. Another peculiar Bavarian product is steatite, which is found in five mines at Göpfersgrüna and Thiersheim in irregular masses in and upon granular limestone. The quality is extremely good, and it is principally employed for making gas burners. The proprietor of the mine has been at considerable trouble to show the character of the deposit, having built up a series of levels with full-sized timbering, in the ends of which the mineral actually strewed is represented. Where it is best developed it is a mixture of quartz and steatite; but, strangely enough, crystals of the former mineral are also found entirely replaced by steatite, while preserving their original form.

THE IRON AND STEEL INSTITUTE AT VIENNA.

THE annual meeting of the Iron and Steel Institute takes place this year at Vienna. It is perfectly well understood that the reading and discussion of papers at such a meeting as the present is a very secondary consideration. The members go abroad with the intention of finding enjoyment and relaxation from business. For this purpose they could not have selected a better place than Vienna. Everyone has been to Paris; comparatively few will undertake a journey of a thousand miles to the capital of Austria. In Vienna will be found much that reminds one of Paris; plenty that is totally unlike any other city on the Continent. A visit to Vienna will be found a new sensation, and that is worth having in days like the present. Up to a very recent period, however, it was doubtful, not only whether the meeting would be a success, but whether it would take place at all. The invitation to visit Vienna was issued by the Austrian Iron Trade as far back as November, 1881. It was promptly accepted; but the hosts rested content with issuing an invitation, and even so late as last month little or nothing had been done in the way of appointing committees, or making arrangements for the reception and entertainment of the guests. As for the members of the Iron and Steel Institute, they were, to say the least, extremely lukewarm about the matter. The Council of the Institution and the indefatigable secretary, Mr. Jeans, made arrangements for a special train to Vienna; but so few members sent in their names as intending to go to Vienna, that the scheme for a special train fell through, and everyone has had to find his way there as best he can. It is estimated that about three hundred members of the Institute and their friends are present; but the number of English representatives of the iron and steel trades is comparatively small, while a great many foreign members, from America, Austria, France, and Germany, are present.

We need hardly say that there are no ironworks near Vienna, so excursions have been planned which will take the visitors into Styria. Local committees were formed in Buda-Pesth and Leoben, whither excursions have been projected, the first presided over by Ritter von Kerpely, and the second by Professor Ritter von Tunner. A third committee has been formed in Gratz to provide for the reception of such members of the Institute as propose to visit the capital of Styria.

Among the absentees is Mr. Smith, the president, who has been unable to visit Vienna, we regret to say, from illness. Proceedings commenced on Tuesday in the great hall of the Vienna *Ingenieur und Architekten Verein*, Herr Frey, in the name of the Vienna Committee, welcomed the visitors to the Austrian capital, and a letter having been read from the president, Mr. Josiah Smith, apologising for his absence, the vice-president of the Institute, Mr. I. Lowthian Bell, took the chair. The British and other foreign guests were then welcomed in the name of the Government, by Baron Possinger, the Governor of the province of Lower Austria, and in the name of the City by the Burgomaster. The Stadtholder, who referred to the amicable relations between England and Austria, said that the proceedings of this Congress would be watched with much interest by the Austrian Government, who would be ready to encourage any attempts that might be made to realise the ideas advocated by this Institute. The chairman, in thanking the Austrian Government and the municipal authorities of the capital for the hearty reception accorded to the members, proceeded to speak of the friendly relations between England and Austria and between the Iron Institutes of the two countries.

Mr. Richards, of Oldham, then proposed that Mr Samuelson should be elected president next year, and the motion was carried without a division. It was also settled that next year's meeting should be held in London. After several papers had been read and discussed, the members were conducted in a steamer to see the works proposed by the City Council for the improvement of the river. They were then taken to Mussdorf and ascended the Kahlenburgh. Lunch was provided by the Town Council.

It may be stated that, according to the final programme, a special train will convey the members from Vienna to Pesth to-day—Friday—and on their arrival they will be met by the local committee, preparatory to being entertained at dinner in the Grand Hotel Hungaria. To-morrow—Saturday—they will proceed by steamer on the Danube to visit the engineering works of Messrs. Ganz and Co., who employ 1050 men at Buda-Pesth, and 350 more hands at their branch establishment. The shipbuilding works of the Danube Shipbuilding Company will be next visited, and then they will be taken over the locomotive works of the Hungarian State Railways, and be entertained by the City of Buda-Pesth on an island in the Danube, amid magnificent scenery. As far as regards the excursion to Styria, a party will leave Vienna this—Friday—morning, and finish at Gratz on Monday afternoon. The members during this period will visit the works of Neuberg, already fully described in THE ENGINEER, Donawitz, as well as of the Styrian Ersberg, which from a metallurgical point of view may fitly be described as one of the most interesting sights in Europe. The Ersberg—iron mountain—is 4870ft. above the sea level, and is said to have been worked for upwards of 1000 years. The members will be entertained by the Styrian iron trade, and by local committees at Leoben and Gratz. We cannot give a full report of the meeting until next week. We may say, however, that the reading and discussion of papers took place daily.

On Tuesday morning the first paper read, of which the following is an abstract, was by Professor Tunner:—

ON THE IRON INDUSTRY OF STYRIA AND CARINTHIA.

Herr Tunner began by saying that guests from England, the members of the Iron and Steel Institute, on visiting the ironworks of Styria and Carinthia, may possibly be disappointed in their expectations. They may, perhaps, find less progress in the manufacture of iron than they had expected. He thus felt himself in a manner bound to give a short account of the situation occupied by Styria and Carinthia, as a defence for those members of the profession of the land of his birth, to whom neglect and insufficiency might be imputed. He then glanced at the history of the Styrian and Carinthian iron trade, and proceeded to explain how it is that Austria, and in particular Styria and Carinthia, are so far surpassed by England, Germany, and even by Belgium and France, not merely in the output of iron and the cost of production, but even partly so in quality. Many reasons can be given, but the following are the principal ones:—(1) It is generally known that the last-named countries have an abundance of first-rate mineral fuel. Delivered to the ironworks at a relatively low figure, this fuel can be used in all reverberatory furnaces with scarcely any preparation, while it can also be used in the blast furnace, either as it comes from the pit or after being coked, at very little cost. On the other hand, the Austrian Alpine districts of Styria and Carinthia are mostly confined to the use of the much more expensive vegetable fuel, spread over a wide area, and in many cases obtainable in a comparatively limited quantity only. Both Styria and Carinthia have tried to raise the production of pig iron by importing coke from Moravia and Hungary. This method of working must, however, be obviously restricted by the high railway freights. (2) The cost of producing iron in the Alpine districts is furthermore materially increased by the expense of carriage; for quite apart from the high railway tariffs, the cost of transport in those mountainous districts is necessarily very high. Another not unimportant cause which raises the price of production in the Alpine districts lies in the relatively high cost of labour, the heavy taxation, and the high rate of interest paid for money. Similar loss is induced by the numerous Roman Catholic holidays and Saints' days, which are not kept, as in other Catholic countries, for twelve hours, but, according to ancient usages, for thirty-six hours, the ordinary Sundays included; and, besides, many of the holidays fall in the middle of the week. (3) One important reason why the manufacture of iron has made relatively so little progress in our Alpine countries lies in the very fact that this industry has existed so many centuries, and has thus consequently become so much divided in regard to the ownership. (4) Though the

Alpine countries are not alone in being affected by the inefficiency of the laws for the protection of the iron industry, still he would also allude to this point. There is no doubt that in the same measure as a too high import duty which excludes all competition is an injury to trade, so too low a duty—if any at all is necessary—prevents any trade from prospering. There was no doubt that not merely the Alpine districts, but the whole of Austria, needs protection for their iron trade, and particularly against England and Germany. He was sure that to no Austrian having the interest of his country at heart is it immaterial whether it has an iron trade or not; the only question in doubt is the proper amount of protection required. During the last twenty years the iron trade here has not suffered so much by a too low rate of import duty, but rather from the manifold exceptions and evasions that have been made in the protective laws. The repeated changes in the rate of import duty have had the worst possible influence upon trade. They have induced a want of confidence, and capitalists have, therefore, been afraid of investing. Strong and healthy plants will sometimes thrive on bad land, but in quicksand no plant at all can grow. In conclusion, he would say a word as to the reason why England surpasses the Austrian Alpine countries, even in part, in the good quality of its iron. Before England began to import a large quantity of ores from foreign countries, its superiority in quality was confined to the better kinds of cast steel, and to particular kinds of soft iron, very uniform in its grain. This could only be attained by using the best Swedish iron, and by the great care observed for many years in the manufacture of cast steel. Add to this, also, the excellent quality of the fuel used, whereby the highest temperature can be easily obtained. England has not only gained great advantages by the magnitude of its production, which allows a thorough method of sorting, but has also been able, by a suitable division of labour, to educate a superior class of workmen. Since England imports about 2½ million tons annually of the best iron ores from Spain, Algiers, Italy, and Russia, the superiority in the quality of its iron has been increased still further. This is felt all the more, as the cost of the first-rate pig iron made from these ores in England is about 25 per cent. lower than the price at which it can be produced in our Alpine countries. England produces about twenty times as much iron as Austria; therefore it may be assumed that twenty times as much brain-work is employed in the English iron trade as in Austria. Financially and commercially, England has certainly more than twenty times the amount of power to rely upon.

Among the papers read on Wednesday was one by M. A. Pourcel, Terre-Noire,

Notes on the Manufacture of Solid Steel Castings.

The studies still continued at Terre-Noire are now being directed to two points in the process:—(1) The manufacture of large castings; (2) the methods of annealing and tempering to be applied to the metal, in order to give it all the mechanical properties corresponding to its chemical composition. The end in view is the substitution of steel for cast iron in all pieces of mechanical construction. But the final solution of this problem is still a long way off. The production of castings of any form and of any dimensions in steel of a well-determined chemical composition, combining the resistance and rigidity of steel with the smooth surface and homogeneity of iron castings, is a very complicated problem, and one which presents material difficulties of more than one kind. The last progressive step made at Terre-Noire is worthy of notice. An engineering firm in Paris required some cylinders of cast steel, having a diameter of 2·04 metres, and a height of rather more than 2 metres, with a uniform thickness of metal of 50 mm. These cylinders were to support an internal hydraulic pressure of 45 atmospheres, without showing any sign of percolation. The annealed metal was to have a minimum resistance of 50 kilos. per square millimetre, and a minimum extension of 8 per cent. Of these cylinders six have already been cast. The external surfaces of the castings are quite as smooth as if made of cast iron, and yet the metal is comparatively soft. It contains on the average—Carbon, 0·65 per cent.; manganese, 1·00 per cent. to 1·20 per cent.; and silicon, 0·25 per cent. to 0·30 per cent. It is, in fact, the quality demanded for rails by one of the French companies. The flanges of the cylinders, after turning, took a very fine polish, even at the gits, and were free from any defects. The metal is cast in moulds of loam, pierced with numerous holes to allow the gases to escape, and dried with great care. It is run in at the top of the mould, and not at the bottom, the time occupied in casting being less than two minutes. This particular point should be noticed. The second point upon which the experimental studies of Terre-Noire are being directed comprises the various methods of annealing and tempering, applied for the purpose of assuring the molecular transformation of the metal, and of establishing the equilibrium of the molecules of a casting of prescribed form, and consequently of enduing it with the highest mechanical qualities corresponding to the chemical composition of the metal. It may, however, be of interest to the Institute to learn the practical results obtained in what is considered an extremely delicate manufacture, that of hoops for cannon. More than two years ago Terre-Noire supplied to the French Navy a considerable number of hoops for guns of 10 centimetres. To-day we are working on an order for hoops of the same type, the specifications for which are more severe. I am only speaking of round hoops, which are of the following dimensions:—

External diameter	360 millimetres.
Internal diameter	246 ,,
Thickness of metal	57 ,,
Height	265 ,,

These hoops are cut out of a round ingot of 385 mm. diameter, cast solid in an iron ingot mould, each ingot furnishing several hoops. The method followed in this class of manufacture is that illustrated at the Paris Exhibition, and consists in casting an ingot, having pretty nearly the external form of the finished casting, and then cutting out the surplus metal by means of powerful mechanical tools, in order to give the piece its definite form. I will pass over the very minute tests to which each hoop is subjected, my wish being merely to place before you the intrinsic quality of the metal. (1) The bar to be subjected to the drop test is of square section, 30 mm + 30 mm., and 180 mm. long. It is placed on two supports or knives 160 mm. apart; the anvil weighs 350 kilos. and the monkey 18 kilos. This bar must stand without breaking fifteen blows at least of an 18-kilo. monkey falling from a height of 2·75 metres. (2) The bars to be subjected to tensile tests have a diameter of 13 mm. and a net length of 100 mm. The minimum conditions to be fulfilled are—

Limit of elasticity	30 kilos. per square millimetre.
Breaking strain	56 ,, ,, ,,
Extension measured after rupture	14 per cent.

Between two bars from the same hoop a variation of 6 kilos. per square millimetre is allowed in the limit of elasticity, and 7 kilos. in the breaking strain. The following table contains a certain number of results obtained at Terre-Noire with cast steel hoops made during the present year:—

Nos.	L	R	a′	$\frac{S'}{S}$	N	F
1	39·4	66·0	16·6	0·74	24	31·0
2	39·0	65·5	16·8	0·72	29	31·8
3	41·8	67·5	15·6	0·715	29	31·4
4	40·3	66·7	14·9	0·66	29	31·6
5	36·1	61·7	17·9	0·55	29	32·8
6	39·3	66·3	15·4	0·70	36	31·0
7	37·2	63·6	18·3	0·56	34	32·0
8	38·5	65·2	17·3	0·64	35	32·0
9	38·0	64·8	20·1	0·52	45	31·8
10	40·0	66·7	17·6	0·55	42	31·0
11	38·9	65·1	18·1	0·54	41	31·7
12	39·3	65·9	17·3	0·54	36	31·6
13	40·8	68·0	13·2	0·68	45	31·0
14	39·8	65·6	18·0	0·55	47	31·5
15	38·3	64·5	17·2	0·53	36	33·0
16	37·5	63·1	16·1	0·68	28	32·5
17	37·4	62·6	14·9	0·64	26	33·0
18	38·5	64·2	14·4	0·72	27	36·0
19	37·9	63·0	16·7	0·52	42	?
20	36·0	56·6	24·2	0·50	25	40·0

L, limit of elasticity; R, breaking strain; a′, extension; S, [original section; S′, section after rupture; $\frac{S'}{S}$, contraction; N, number of blows; F, deflection in millimetres.

Each of these figures represents the mean of two tests, in which the differences observed in the limit of elasticity and the breaking strain varied from 0·1 kilo. per square millimetre to 1·6 kilo. Tests Nos. 9, 10, 11, 12 are those of hoops which had been tempered three times in oil. No. 13 has a somewhat low extension but a high breaking strain. A charge is occasionally produced giving a breaking strain of 70 kilos., or more, and an extension of less than 13 per cent. In this case the series of hoops to which this tested hoop belongs are again heated and tempered in oil at a temperature lower than that at which they were previously tempered. By this means the extension is considerably increased, without diminishing the breaking strain too much. On the other hand, when the breaking strain is too low and the extension high, the new tempering is effected at a higher temperature than the preceding one. In regular working, all the hoops are heated to a yellow oxidising colour, and at that temperature are plunged into a given weight of oil in the direction of their axes. They are allowed to cool in the oil, and are re-heated at a temperature varying from bright cherry-red to a dull cherry colour, according to the chemical composition of the metal, and then tempered again in a bath of oil, in which they are allowed to cool. The first tempering transforms the crystalline grain of the metal into a fine homogeneous grain; the second determines the molecular equilibrium of the casting which corresponds to the chemical composition of the metal, and should be more or less intense, according as the metal contains more or less than 0·3 per cent. of carbon and 0·5 per cent. of manganese. The chemical composition of the metal suitable for this delicate manufacture is comprised between narrow limits. The carbon varies from 0·28 per cent. to 0·32 per cent., the manganese from 0·60 per cent. to 0·45 per cent. The sulphur can scarcely be detected, and the silicon is pretty nearly constant between 0·15 per cent. and 0·20 per cent. I will not close my paper without risking a few words on the famous question of blow-holes in steel, which remains, so to speak, a permanent order of the day in the proceedings of the Iron and Steel Institute. I mention, simply as a reminder, that solid soft steel castings are obtained by means of alloys of silicon, manganese, and iron, with a minimum of carbon. Alloys which fulfil that very essential condition of containing but a minimum of carbon, are those in which the silicon and manganese are found in the proportion of their chemical equivalents.* It is very difficult, if not impossible, to attain this with mathematical regularity. I have, however, succeeded, after numerous observations, starting with a burden calculated to a very great nicety, in producing these kinds of alloys of the desired formula, containing up to 13·5 per cent. of silicon and 18 per cent. of manganese. These alloys are added at a red heat to the bath of metal—Siemens-Martin process—immediately before casting. The process is, in fact, the same as obtains in the manufacture of soft metal with ferro-manganese. But the addition of ferro-manganese to a bath of soft metal is followed by a more or less violent re-action, accompanied by a disengagement of gas. With the addition of the alloy of silicide of manganese, on the contrary, the intermolecular reaction is calm. All ebullition is instantly arrested; the surface of the bath becomes quiet, and no gas rises through the slag. It is universally admitted that the gas disengaged from a bath of metal in the middle of the refining period is carbonic oxide. Well, the addition of three or four thousandths of silicon, in the form of silicide of manganese and silicide of iron, is sufficient to instantly arrest this disengagement of carbonic oxide gas. The sample of metal taken before the addition of silicon is full of blow-holes; that taken after compact and homogeneous. Is this a purely physical is action? Is it a sufficient explanation to say that the silicon has determined the solution of the hydrogen in the metal? But, in any case, it is carbonic oxide that is evolved before the addition of the silicon, and little or no hydrogen, according as the manganese is present in small proportion in the bath of steel, or is entirely absent. Metal made with silicide of iron always remains brittle under drop tests, and gives but low extensions under tensile strain, with a low and variable breaking load. These bad qualities come to light in forging. The metal cracks under the blows of the hammer, whilst metal made with silicide of manganese behaves in a much more satisfactory manner.

* Taking the equivalent of oxygen, according to the old scale, at 100, and silica = SiO_3.

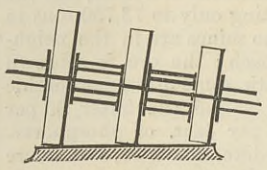
MARINE ENGINEERING AT THE NORTH-EAST COAST EXHIBITION.

No. II.

In the enclosure on the sands in front of the Winter Garden, Messrs. Priestman Bros., of Hull, and Mr. Bruce, of Westminster, show in operation complete dredging and excavating plants, such as have been previously described in these columns, the exhibit of the first-named firm being illuminated in the evening after dusk by several clusters of Swan's incandescent lamps. Messrs. Rose, Downs, and Thompson, of Hull, who have lately taken up the manufacture of this class of work, also show a self-acting grab and bucket dredger and excavator on Hodge and Thompson's patent. While being to a large extent similar to that of Priestman Bros., this dredger is different in respect to details of construction and in the method of working the opening chains of the bucket. The general arrangement of the crane is shown on page 211, the former being a complete view taken from a photograph of a B size dredger, and the latter an enlarged elevation of the gearing. The chief novelty lies in working the opening chain by a small independent crab driven by a pitch chain, and controlled by friction gear; and it is claimed that by doing away with the constantly acting weight previously used for opening, the whole energy of the grab or bucket in its descent is made available upon the material to be excavated, thus enabling a greater cut to be taken with a grab of given size than in the case when a constant resistance of weights has to be overcome. Considerable care has been taken in designing this machinery. The boiler is of steel with a Lowmoor fire-box; all shafts and axles are of steel, and several ingenious notions have been introduced about the brake and friction gear and in the arrangement of levers. Travelling as well as turning gear is provided. The small engraving shows one of Hodge's patent combined buckets and grab for excavating soft materials and ordinary clay. The tines are fastened to strong steel plates, and are easily replaced when worn out or broken. As an example of the speed at which these machines can be worked, it is stated that at Tilbury Docks a B size excavator lifting one ton at a time made sixty lifts in forty-three minutes, or at the rate of about 84 tons an hour.

The other exhibits in the enclosure consist of lifeboats and buoys, and of a large tank with a diving bell, in which visitors may descend. The air-pumps in connection with this apparatus are driven by one of Clayton's vertical silent gas engines, which is shown by Mr. J. A. G. Ross, of Newcastle.

Within the annexe between the Winter Garden and Skating Rink, Sir W. G. Armstrong and Co. show a 6in. breech-loading gun on an Albini carriage, of exceedingly compact design. The carriage is pivotted in front, and has a flat racer in rear, the ordinary coned rollers being each replaced by a group of three discs of different diameters, and about 2in. wide, running loose on a spindle.



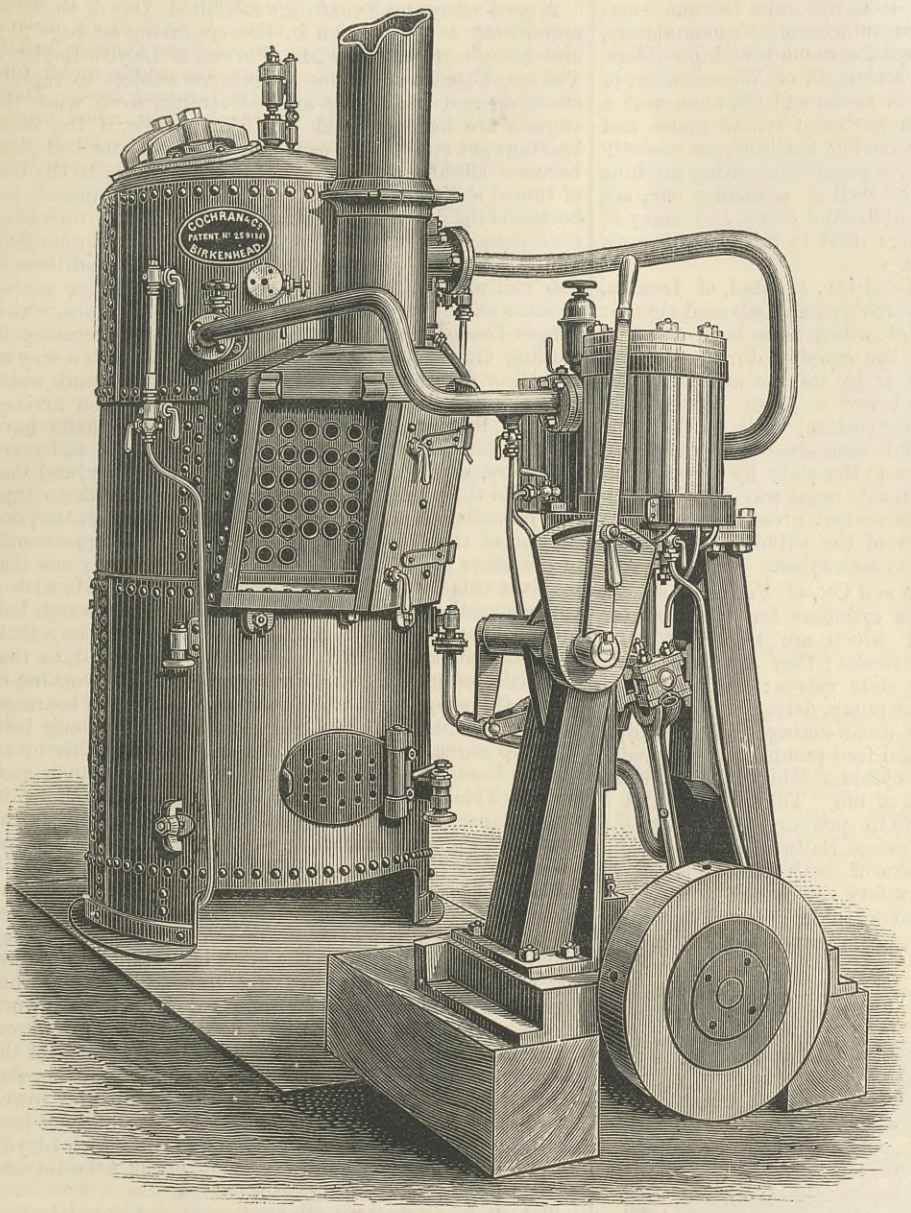
In this manner the difficulty in fitting wide coned rollers to the racers is got rid of. Training is accomplished by rack gear, or, by throwing this out, ordinary hand tackle can be used. The trunnions are carried in bearings at the end of pivotted wrought iron arms, to which also the end of the recoil press piston-rod is attached. Recoil is taken up both in actually raising the gun and in expelling oil from one side of a piston to the other, through passages the sizes of which are controlled by three valves kept up by adjustable C-springs. An apparatus for registering the amount of recoil is provided, and slots in the piston admit of the return of the oil after firing, the weight of the gun being sufficient to accomplish this. The carriage is also fitted with an elevator bar and other usual adjuncts. A similar 6in. gun is also exhibited on a naval broadside carriage and slide of recent design, with Elswick compressor; and a nine-pounder naval gun, on an iron carriage and slide.

Messrs. Smith, Beacock, and Tannett, of Leeds, show one of Barrow's patent turning and screwing machines to take in from 1⅛in. to 3½in. diameter, made to the order of John Redhead and Co. This machine has been already illustrated in our columns. Since the introduction of this machine no less than 100 orders have been taken, and it is now used by nearly all the chief marine engine builders for turning and screwing connecting-rod and cap bolts, as well as for many other similar purposes.

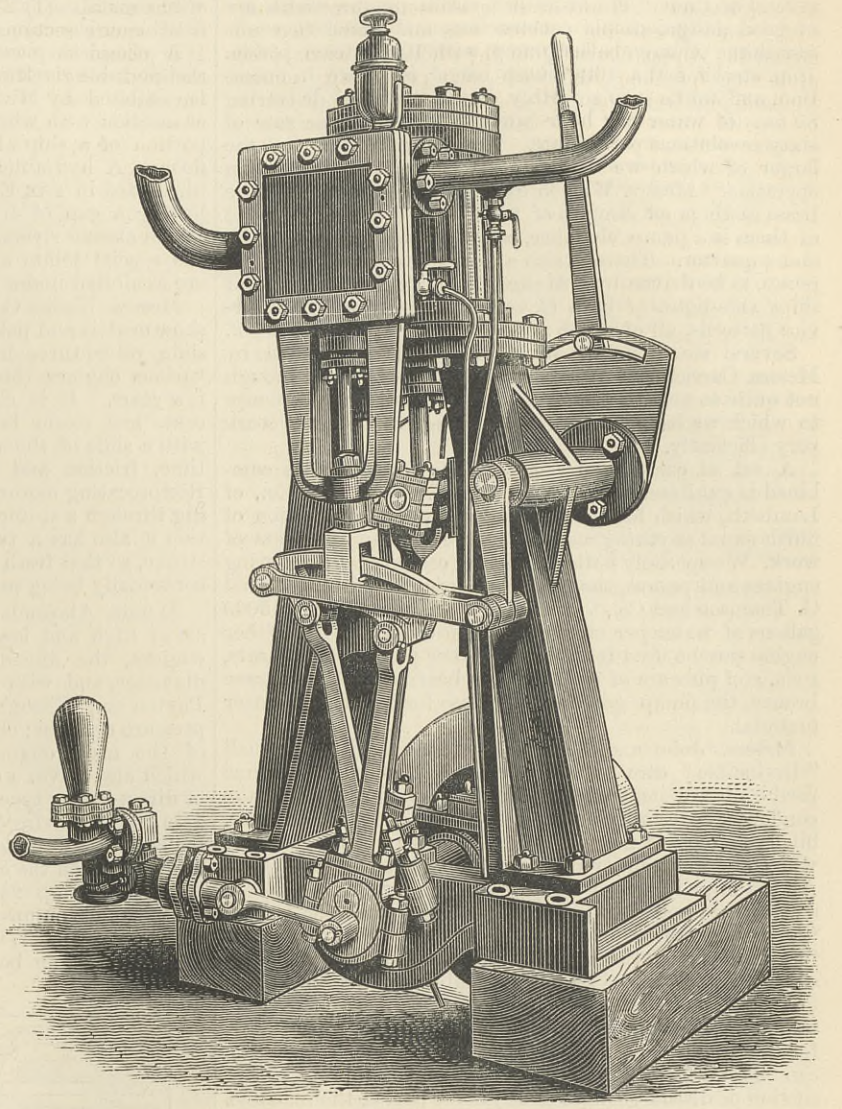
A cheap and ingenious dovetailing and variety moulding machine is exhibited in operation by Messrs. Anderson and Hunting, of Newcastle. It is capable of making every kind of dovetail to any gauge, can be converted into a single-spindle moulding machine in three minutes, and can be used for cutting deck plugs, morticing and recessing, tracing in fretwork, &c. It is impossible to give a proper idea of its construction without drawings; but the principle employed in dovetailing is simply that of a side-cutting slot drill with tapered head, against which the wood is traversed until the required depth is reached. The Barrow Shipbuilding Company, Messrs. Leslie and Co., and many other shipbuilders and cabinet makers already

EXHIBITS AT THE NORTH-EAST COAST EXHIBITION.

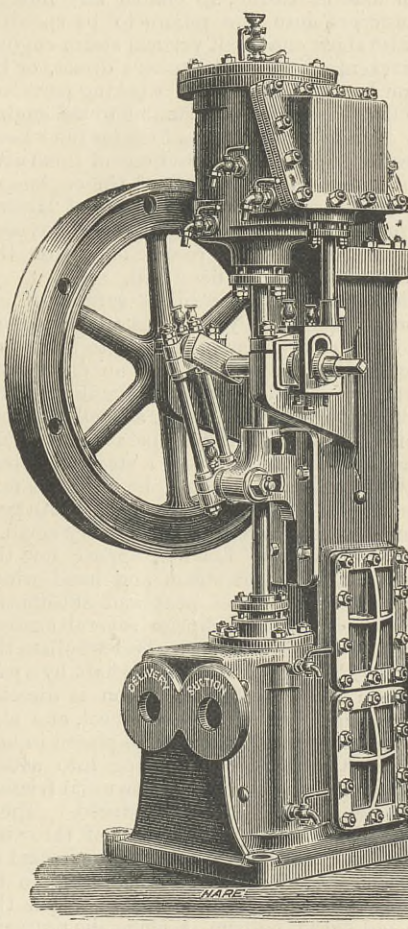
(*For description see page* 210.)



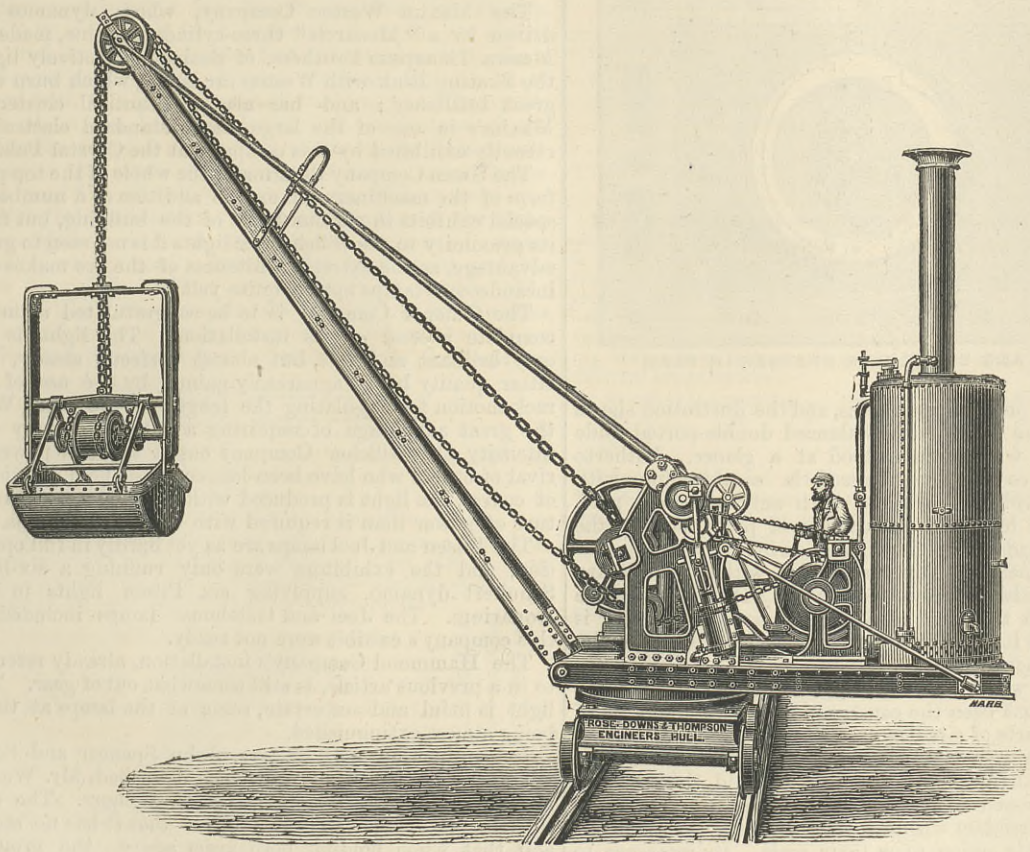
MESSRS. COCHRANE'S LAUNCH ENGINE.



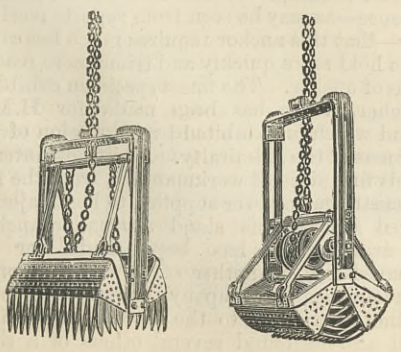
MESSRS. COCHRANE'S LAUNCH ENGINE.



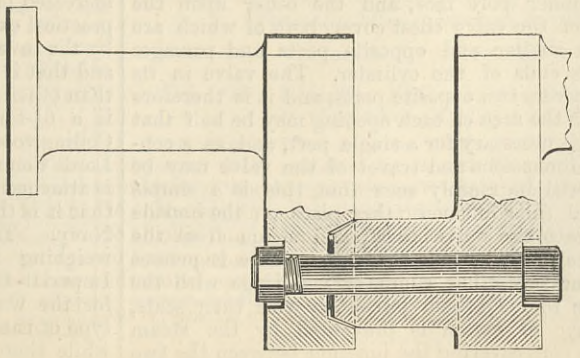
MESSRS. WATSON AND SON'S PUMP.



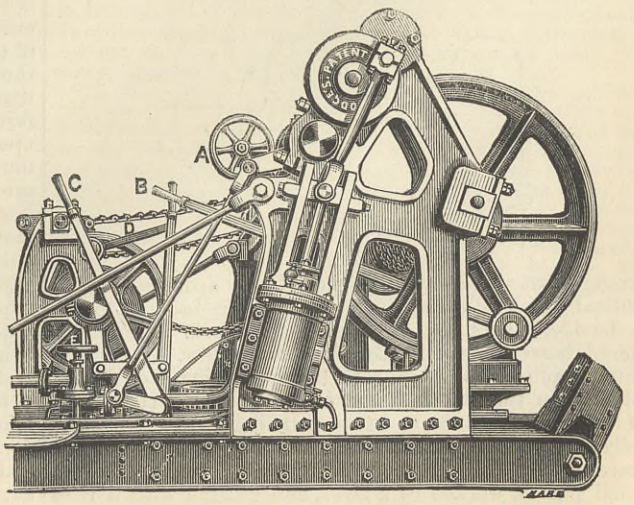
HODGE AND THOMPSON'S EXCAVATOR.



EXCAVATOR BUCKETS.



PURVES'S CRANK SHAFT.



DETAILS, HODGE AND THOMPSON'S EXCAVATOR.

use this handy tool, which was only brought out about eighteen months ago.

Messrs. Henry Watson and Sons, of Newcastle, exhibit several of their "Westminster" steam pumps, which are of good design, simple construction, and excellent workmanship. A large ballast pump, with 10in. steam piston, 10in. stroke, and a 10in. pump barrel, is shown in operation, and works very smoothly. It is capable of delivering 80 tons of water per hour when running at the rate of sixty revolutions per minute. Two boiler feed pumps, the larger of which we illustrate on page 211, are also in operation. Messrs. Watson have at their stand some large brass castings as samples of what they can produce; one of them is a pump chamber, weighing upwards of a ton and a quarter. There is also a neatly designed Downton's pump, to be driven by a Messenger chain, and a number of ships' side-lights of both Government and merchant service patterns, all of which are excellent specimens of work.

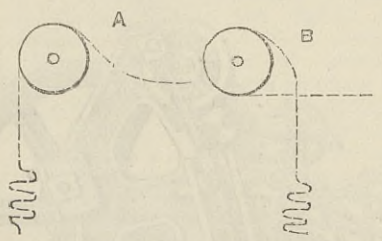
Several steam pumps of various kinds are shown by Messrs. Carrick and Wardale, of Gateshead, which though not quite so neat in design or so well finished as the pumps to which we have just alluded, appear to do their work very efficiently.

A set of centrifugal pumps with steam engines combined is exhibited by Messrs. W. H. Allen and Co., of Lambeth, which for excellence of design and perfection of finish equal anything we have before seen in this class of work. We specially noticed a pair of centrifugal circulating engines and pumps, the last of an order for Messrs. J. and G. Thomson and Co., together capable of delivering 5000 gallons of water per minute, and constructed so that either engine can be used for driving either pump. All shafts, rods, and pins are of steel and the bearings of manganese bronze, the pump spindles being also forged of this latter material.

Messrs. John and Henry Gwynne exhibit one small "Invincible" direct-acting centrifugal pumping engine used on board steamers for circulating water through the condenser for emptying the ballast tanks, double bottoms, bilges, &c., and it may also be employed for other purposes when a large quantity of water is required to be raised. All the forged parts of the engine are of mild hammered steel turned and finished bright. The crank shaft is of the double web or marine form, with the counterweights forged solid with the webs. The crank pin and excentric sheaves are oiled from a pendulous lubricator attached to the end of the crank shaft. The pump case is made with a cover to take off, for easy access to the interior, and, if necessary, for the removal of the disc and spindle, which operation can be performed without disturbing joints in either suction or discharge pipes or any other part of the machine. Hand-hole covers, fitted with bayonet joints, are also provided on each side of casing, to enable any foreign matter which may get into the pump to be speedily removed. They also show one small vertical steam engine, for driving dynamo machines and exciters direct, or by means of ropes or by belts. All the working parts are of hammered steel, and are generally similar to the engine described above. Several of this type of engine have been fitted to steam vessels and elsewhere, and one of them may be seen in action turning the main shaft of the engines of H.M.S. Dolphin, which is on view in the stand of Messrs. R. and W. Hawthorn. They also exhibit one "Invincible" patent sea-valve, for use in connection with the Invincible pumping engine before described.

Mr. J. H. Kidd, of Wrexham, exhibits several of his direct-action steam pumps recently fully described in The Engineer. The inventor is specially anxious to bring this apparatus to the notice of shipowners as an emergency pump for vessels; and certainly from its simplicity, and freedom from liability to get out of order, as well as from the ease with which it could be put into operation, it would seem to be an excellent adjunct on board a steamer, where in case of collision or accident it could be brought into action in a few moments. The space occupied by it in proportion to volume of water discharged is also very small.

Messrs. Harfield and Co., of London, appear for the first time as exhibitors of patent steam and hand windlasses and capstans. These are of neat and substantial design, occupy little room, and comprise several exceedingly good points. In the steam worm-wheel windlass the engine, which is vertical, drives a horizontal shaft by a pair of bevel wheels, and from this shaft motion is directly transmitted to the drums by a worm and wheel, and also to a vertical warping capstan, which may be placed in any convenient position. Ordinary screws bring into action either one or both drums, but in place of the usual friction cones, compound disc brakes are introduced. These give great holding power and a ready means of throwing the drums in and out of gear by a very small movement of the screws. Another peculiarity, which will be seen by the accompanying sketches, is the manner in which the cable is led on to and over the drum, A being the ordinary plan, and B that used by Messrs. Harfield. By the latter

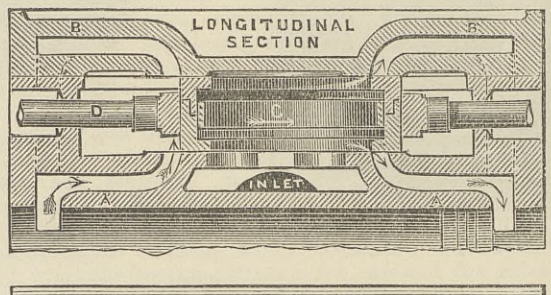


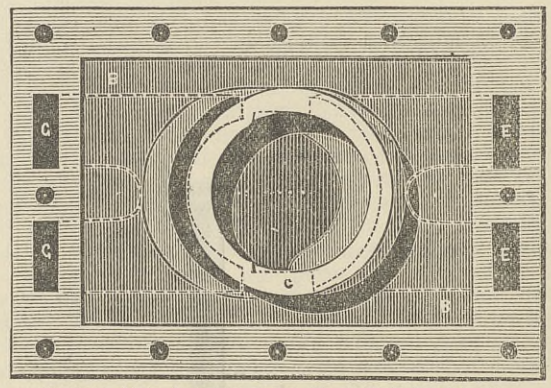
arrangement about seven-eighths of the drum surface is utilised for holding, and the cable being brought to the underside, is kept low down on to the deck. A suitably placed hawse pipe leads the slack chain clear. Harfield's patent automatic wire rope stopper, now exclusively adopted in the Royal Navy, is also shown. It consists of an inclined plane or wedge running on a set of live rollers in such a manner that the grip on the rope is increased or diminished according as the pull varies. A small pinion, worked by a lever, and gearing with a rack on the wedge, brings the grip into action, and releases it at will. There is also a kind of universal capstan with wrought iron body, exhibited by the same firm. It is arranged for taking both hempen rope and cable, but when wire rope is used in place of chain, portable whelps can be fitted over the cupped drum, so as to form a barrel.

A complete plant of hydraulic pumps, accumulators, and portable rivetting machines, suitable for shipbuilders, is exhibited by Mr. R. H. Tweddell, of Westminster, in connection with which Messrs. Leslie and Co. have sent a portion of a ship's keel with garboard strake plates and floors. A hydraulic keel rivetting machine, as recently illustrated in The Engineer, a portable rivetting machine having a gap of 4ft. 6in., as well as a smaller one, are shown closing rivets; and a hydraulic crane, and many of the special joints and fittings used in this class of work are exhibited under pressure.

Messrs. Walter C. Church and Co., Limited, of London, show models and parts of Church's patent balanced circular slide valve, three hundred of which have been fitted to various engines throughout the country during the last few years. It is claimed that by its use at least 10 per cent. less steam is required for a given power than with a slide of the usual construction, while, at the same time, friction and wear and tear are much reduced. Reciprocating motion is given to the slide by a rod working through a stuffing-box in the usual way, but in addition it also has a turning movement given to it at each stroke, so that fresh portions of the rubbing surfaces are continually being presented to each other.

Messrs. Alexander Wilson and Co., of Vauxhall, show a set of high and low-pressure cylinders for small marine engines, the dimensions of which are 14in. and 25in. diameter, and with a 16in. stroke; they are fitted with Payton and Wilson's patent slide valves; one 12in. low-pressure cylinder; one 7in. air pump, driven independently of the main engines by a direct-acting steam cylinder, which also drives a differential feed pump; a boiler feeder of direct-acting type, steam cylinder 4½in. diameter, pump 2½in., both having a stroke of 9in. They also exhibit a boiler feeder designed for 150 lb. pressure, as fitted to the locomotives on the South-Western Railway, cylinders 3½in. diameter, pump 2½in., stroke of both 6in.; a series of "Vauxhall" pumps; some safety valves, and a specimen of Payton and Wilson's patent slide valves after three months' work on board the steam screw tug Stormcock.





VALVE AND UNDERSIDE OF COVER IN PLAN

We illustrate one of these valves, and the ilustration shows that the valve is a circular-balanced double-ported slide valve, which will be understood at a glance. Hitherto circular valves have been used in combination with cylinders provided at each end with only one inlet port, and in order to give a sufficiency of port opening the valves have had a long travel, and owing to their circular shape the dimensions, by comparison with the ordinary rectangular valves, were unduly large. It will of course be recognised that the advantage of a circular valve is that it can be turned round as desirable, so that the wearing may be more equal.

The object which Messrs. Payton and Wilson have had before them has been the construction and combination of the several parts of circular valves in such as manner as to largely decrease their dimensions, and, at the same time, by reducing their weight, their travel, and the pressure upon them, lessen their friction to such an extent as to ensure their freedom within their hoops, and the efficiency of their turning action upon their seats. By reference to the engraving it will be seen that the valve is made in two parts or rings, the outer surfaces of which are alike and form similar but opposite valves, one of which moves upon the cylinder port face, and the other upon the inner surface of the valve chest cover, both of which are provided with similar and opposite ports and passages leading to the ends of the cylinder. The valve in its movement uncovers two opposite ports, and it is therefore quite clear that the area of each opening may be half that which would be necessary for a single port, and, as a consequence, the dimensions and travel of the valve may be reduced. It will be readily seen that this is a simple balanced valve. The exhaust takes place on the outside of the valve into the valve chest, and steam from the boiler is always present inside the valve, where it presses upon the inner projecting edges of the rings with the necessary force to keep them in contact with their seats, and any escape of steam is prevented by the steam expanding the ring covering the junction between the two parts of it. As the valve is thus subject to little or no pressure, the great loads common to ordinary valves are done away with, and it is therefore capable of being moved with the least possible amount of power, while its freedom to turn upon its seat is as great as it can be.

A good many crank shafts are exhibited. One of the most noteworthy is that shown in the engraving on page 211, and being introduced by Mr. Purves, of Lloyd's Registry. The crank-shafts of marine engines are subject to rapidly changing and repeatedly applied strains, even when the engines are kept in good condition; while, if the main bearings get out of line, or if the whole of the bed-plate becomes slightly altered in position relatively to the line of tunnel shafting, through any slight deformation of the bottom of the ship, due to weakness of structure or to the varied conditions of loading, the strains become greatly intensified. While an engine is working under normal conditions of tear and wear, there is, every revolution, a relative gaping to some extent of the planes of the two crank webs, which ranges from ·01in. to ·02in. It is therefore necessary in making crank-shafts to construct them in such a way as will allow for this opening and shutting of the crank webs. It is evident that Mr. Purves's designs have been arrived at from this line of reasoning; for as crank-shafts have been made larger, they have been found to fail more and more, which is due to the increase of rigidity, and that the solid shaft breaks, not from want of strength to turn the propeller shafting, but merely from the fact that one portion of the shaft wants to work slightly independently of the other part. Mr. Purves's shaft is the only one that involves this principle. He forms the crank-shaft with a cup connection at the best place; the long through bolt holds all together; it is reduced in the body to be a little less than the section at the bottom of the thread, so that the little accommodation shift required in the working of the shaft, owing to unavoidable want of fairness of bearings, may be permitted by the safe elasticity of the long bolt. The cup connection in this shaft will allow for this by an almost insensible shifting of the cup surfaces upon each other. This movement, which is provided for as shown in this instance, would be in a solid shaft strain located in the section of the neck of the pin, or in that of the neck of the main bearing, and it is this localised straining which breaks large crank-shafts. The weak point in marine engines at present is the crank-shaft, and this is how broken shafts seem to indicate the way in which they should have been made. The great importance of relieving crank-shafts of the breaking transverse strains that terminate their lives before one-third of legitimate work has been taken out of them, will be valued by shipowners, especially as a broken shaft means total disablement of the propeller power. It has become now an almost every-day occurrence to hear of vessels being picked up and towed into foreign ports with broken crank-shafts; and not long since, in one week, there was property insured with Lloyd's for one million sterling, floating about in the Atlantic, and greatly imperilled from this cause alone.

The electric light exhibits are now almost complete, and though only five out of the many systems now before the public are represented, yet they give a fairly good idea of what is to be expected from this method of illumination.

The Maxim Weston Company, whose dynamos are driven by a "Monarch" three-cylinder engine, made by Messrs. Thompson Brothers, of Seaham, effectively lights the Skating Rink with Weston arc lamps, which burn with great brilliancy; and has also a beautiful cluster of Maxim's in one of the large brass standard electroliers recently exhibited by this company at the Crystal Palace.

The Swan Company illuminates the whole of the top platform of the machinery annexe, in addition to a number of special exhibits in various parts of the building, but from its proximity to the Gülcher arc lights it is not seen to great advantage, as the extreme whiteness of the arc makes the incandescent lamps appear quite yellow.

The Gülcher Company is to be congratulated upon the complete success of its installation. The light is not only brilliant and soft, but almost perfectly steady, this latter quality being apparently gained by the use of the rack motion for regulating the length of the arc. With the great advantage of requiring a current of very low intensity, the Gülcher Company ought to be a powerful rival of others who have been longer in the field, provided, of course, the light is produced without a greater expenditure of power than is required with the other systems.

The Pilsen and Joel lamps are as yet hardly in full operation, and the exhibitors were only running a six-light Schukert dynamo, supplying six Pilsen lights in the Aquarium. The Joel and Gatehouse lamps included in this company's exhibit were not ready.

The Hammond Company's installation, already referred to in a previous article, is still somewhat out of gear. The light is fitful and uncertain, some of the lamps at times being almost extinguished.

In conjunction with Messrs. John Spencer and Sons, whose exhibit has been previously described, Mr. Wasteney Smith shows some of his patent anchors. The distinctive features of this anchor are that it has no stock, and that when holding, both arms are on the ground. The efficiency of the anchor is thus greatly increased, and the disadvantages of a stock are removed, viz., liability of fouling the cable, the addition of unnecessary weight and increased labour in working. It has also been found in practical experience—as may be seen from reports received by the inventor—that this anchor requires much less cable, and that it takes hold more quickly and trims more readily than other forms of anchor. The finest specimen exhibited is a 6¼-ton anchor, which has been made for H.M.S. Collingwood, and which is exhibited by permission of the Lords Commisioners of the Admiralty. Additional interest is attached to this fine piece of workmanship, from the fact that it is the largest anchor ever supplied to her Majesty's Navy. There is also on this stand a smaller anchor, weighing 15½ cwt., which has been made for the Imperial German Navy. Another of 56 cwt., on order for the Cunard Steamship Company, shows a different type of the anchor as supplied to the Mercantile Marine; while there will also be found several others of a third type, as supplied to yachts and other small craft. To show

the method of stowing, a model of the bows of H.M.S. Agamemnon is exhibited fitted with a model of a 5-ton stockless anchor recently supplied for that ship. Over 500 of these anchors, we are told, have been supplied and are in use.

The Patent Anhydrous Leather Company, of Portsmouth, exhibits samples of its patent waterproof leather, including machinery belts, ship's hose, &c. The special advantage claimed for this leather is that it is not affected by moisture, and on account of its impermeability to snow, it was selected by the Admiralty for the manufacture of sea boots, &c., for the officers and men of the last Arctic expedition.

At the adjoining stand, Hay's Patent Waterproof Glue Company shows various samples of its patent glue, pitch, varnishes, &c. A special feature claimed of these manufactures is their elasticity. These glues are used for caulking ships' decks, paying seams, and for coating armour plates; the varnish for coating wood, iron, and brickwork of docks, piers, bulkheads, inside plates of ships, anchors, cables, ships' bottoms, &c.

A very interesting exhibit is made by the Phosphor Bronze Company, which includes worn rolling mill bearings, crank pin bearings, piston rings for the P. and O. and other steamers, already shown at the Islington Exhibition; propeller bolts, spiral springs, pinion wheels, safety valve springs, steam fittings, and some beautiful specimens of statuary. Phosphor bronze is stated to be a combination of phosphorus, copper, and tin, in definite proportions. How far this is true of the phosphorus is, perhaps, open to question. Putting phosphorus in any form into an alloy is one thing; finding it subsequently in definite quantities in that alloy is another. The bronze is made as may be ordered, either to be more ductile than copper, as tough as iron, or as hard as steel. In its manufacture it seems to be certain that the ductility, hardness, or elasticity can be regulated with perfect accuracy. One of the most recent uses of the metal is for the hulls of torpedo boats and steam launches. It was desirable to ascertain its resistance to the chemical action of dilute sulphuric acid. For this purpose two similar sheets of copper and of phosphor bronze were immersed in acid water of 10 deg. Beaume strength, and at a temperature of the surrounding atmosphere. After three months it was found that the copper had lost 4·15 per cent., and the phosphor bronze only 2·3 per cent. For sheathing the alloy is readily rolled, and stands, it is said, the action of sea-water much better than copper. In a comparative experiment made at Blackenberg, lasting over a period of six months, between the best English copper and phosphor bronze, the following results were arrived at:—The loss in weight due to the oxidising action of sea-water averaged for the copper 3·058 per cent., while that of the phosphor bronze was only 1·158 per cent.

Messrs. Cochran and Co., Birkenhead, exhibit a modification of their steam launch machinery, specially adapted by them for canal purposes. The engine is inverted direct-acting, the cylinder being 8in. in diameter, and having a stroke of 10½in. All the wearing surfaces are very large, and the link reversing motion is made extra strong and thoroughly case-hardened. The boiler is Cochran's patent vertical multitubular, 3ft. 3in. in diameter by 7ft. 6in. high; it is suitable for a pressure of 80 lb. per square inch, and possesses 80 square feet of heating surface. From the experience which Messrs. Cochran and Co. have gained with this arrangement of machinery now in regular work there can be little doubt that canal steamers will be largely adopted as feeders to the main lines of railway or to the great ocean-going steamers. Our illustrations, page 211, show the arrangement, without requiring any detailed explanation. In another section of the Exhibition Messrs. Cochran exhibit two models of steam launches, one evidently intended for high speed, and the other for rough harbour work and coast service. The launches which this firm are now making a speciality seem to be well adapted for the purposes for which they are intended, and the design and workmanship is of the best class.

LETTERS TO THE EDITOR.

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

THE FAN TRIALS AT READING.

SIR,—The competing ricks at Reading have now been brought to the crucial test of the auctioneer's hammer. I am advised by one who was present that the following were the results realised, and the figures are confirmed by the Reading newspapers:—

	£	s.	d.
The rick made with Greening's power fan realised ..	26	0	0
,, ,, ,, hand fan ,, ..	24	3	0
,, ,, Phillips' 2nd power fan ,, ..	19	0	0
,, ,, Bamlett's 2nd hand fan ,, ..	19	0	0
,, ,, Gibbs' hot-air machine ,, ..	16	10	0
,, ,, Phillips' 1st power fan ,, ..	14	10	0
,, ,, Phillips' 1st hand fan ,, ..	13	0	0
,, ,, Coultas's power fan ,, ..	12	10	0
,, ,, Wilson's hand fan (small lot) realised	3	0	0

It will be seen that my power fan rick certainly realised more than my hand fan rick, but it was larger. My hand fan rick, on the other hand, distanced in value all the ricks made with other power fans. So far, there is no proof of the inadequate power of my hand fan, tested either by the water gauge at the showyard or by the harvest on the field upon hay. The very worst results in quality appear to have been achieved by the large and costly power fan of Mr. Coultas. The rick operated upon by this latter fan, it will be remembered, contained more hay than any other on the field, so that it has clearly not been a question of quantity, but of quality, which has settled the prices at which the ricks have sold. I read the results as throwing some light, too, upon another question very warmly debated on the trial field and in your columns, and respecting which I was at issue with my competitors. The latter held that it was best to allow their ricks to attain a considerable heat before applying their fans. I held that the fans should be used whenever the heat reached about 120 deg. I lost a considerable temporary advantage by doing so, because it is much easier to reduce the heat of a rick rapidly when you allow it to get up to 150 deg. or 160 deg. before you commence using the fan. The reason for this is very simple. The outside air, which we have to rely upon to cool our ricks, has about 80 deg. of heat on a summer's day. When this mixes with internal air of, say, 160 deg., we get an average of 120 deg. by the time the cooling process has proceeded half way. The result at that middle point is that 40 deg. are scored to the credit of the fan; but, commencing when the internal heat is only 120 deg., the average between the external and internal air will be 100 deg. only at the same middle point of operations, or only just one-half the apparent results scored to the credit of the fan.

Another temporary advantage gained by commencing at a high heat is, that more moisture in the rick being vaporised at a higher temperature, it is easier to remove quickly the immense amount of water which the fan must draw from a rick stacked wet or green. My hand fan rick was stacked green, and my power fan rick was stacked both wet and green. This difficulty of the immense amount of moisture to be removed out of a green stack by the fan has been very forcibly urged against my faith in my hand-power fan. I can make matters still clearer, perhaps, by working out the relation of some of the figures quoted in my last two letters to the influence of a high wind upon a stack. In the following table I have placed, first, the suction power represented by raising a water column; secondly, the speed at which the air must be drawn through a fan to exert such a suction power; and, thirdly, what the speed of air means when described as wind:—

Kind of fans.	Raised the water column in inches.	Equivalent force exerted in lbs. per square foot.	Speed at which the air is then travelling through the fan in miles per hour about.	What we call wind travelling at that same rate.
Three hand-power fans, as tested at Reading (average results) ..	about ½in.	2·60	23 miles.	Brisk gale
Greening's hand fan, as tested at Reading	1 7/16in.	6·76	38 ,,	High wind
Steam-power fan, as tested at Reading (average results) ..	about ⅞in.	13·87	52 ,,	Storm wind
Greening's hand fan under re-test at about 40 revolutions (average result)	about 3½in.	17·34	60 ,,	Great storm wind

I now pass on to consider whether so small a fan as 12in. diameter, which I use, can withdraw the quantity of air required to dry up the moisture of a wet or green rick. The Neilson method, as has been frequently explained, is based upon the idea of round or square stacks not exceeding 20ft. diameter. In arranging a portable system for my hand fan I proceed upon the principle of only attempting to exhaust one such stack at a time. A 20ft. rick will contain on the average from 15 to 25 tons of hay. Young grass contains about 80 per cent. of moisture; grass in flower about 70 per cent.; dry hay contains about 15 per cent., so that if we had to deal with absolute grass and make it into hay we should have to remove perhaps 70 tons of moisture to make 20 tons of hay. But the Neilson system does not contemplate dealing with absolute grass. Mr. Neilson uses every opportunity which three or four days' exposure will offer to half make his hay at all events. How rapidly grass dries after being separated from the ground and exposed to the air we all know. Speaking generally, we may take it for granted that a much less weight of water will be stacked than exists in growing grass. We can see clearly the work which we have to do with our fan is not child's play. The diameter of the circular inlet into my fan is 6¼in. When this inlet is closed I find that I can raise the water column on the average of trials 3½in. with forty revolutions of the handles—a fairly slow speed to turn. This, as I have said, would pass the air through my fan at the rate of about sixty miles per hour. But when the whole area of the inlet is opened I cannot of course pull in the larger volume of air at the same rate. My tests show that it enters very unevenly at different parts of the orifice, and an average had to be taken which came out thus:—

Position of water gauge.	Water column was raised in in.	Revolutions of the handles.
Held at top of orifice	2·00	46 per minute.
,, ,, bottom of orifice	3·75	44 ,, ,,
,, ,, left side of orifice	2·50	42 ,, ,,
,, ,, right side of orifice	3·25	42 ,, ,,
,, ,, centre of orifice	2·75	44 ,, ,,
Averages	2·85	43·60 per minute.

Raising the water column 2·85in. proves that the fan is passing about 81½ft. of air per second through its whole area of inlet. This is equal to 4890ft. per minute. As the area allows 30⅝ square inches of a column to enter, I thus pass 1018 cubic feet of air per minute or 61·080 cubic feet in an hour. How much moisture will such a column of air carry with it out of the stack? Of course the higher the temperature the more moisture carried. The following table shows how much moisture is contained in the air a different temperatures:—

50 deg. of thermometer ..	·80	parts of water in 100 parts of air.
80 ,, ,, ..	2·01	,, ,, ,, ,,
90 ,, ,, ..	2·70	,, ,, ,, ,,
100 ,, ,, ..	3·60	,, ,, ,, ,,

I have already said that I commence using my fan at 120 deg. The outside air I expect to be about 80 deg. So that during the use of my fan I am drawing air with an average heat of 100 deg. This means that each cubic foot contains 3·60 per cent. of water, or 1·59 per cent. more than the outside air. Clearly, therefore, I draw off something like 1½ cubic feet of water with every 100 cubic feet of air. A cubic foot of water weighs 62·425 lb., say 62½ lb. Thus it will be seen that by working steadily without intermission or loss of a moment I could actually draw off and discharge 27 tons of the moisture in an hour's work. But of course in practice great allowances must be made, and taking these into account, I venture to put it that my hand fan is fairly calculated to draw off all the probable moisture of a full-sized Neilson's stack in an hour's work daily for a week.

EDWARD OWEN GREENING.

Agricultural and Horticultural Association,
3, Agar-street, Strand, W.C.

[It should be mentioned that the crop of which Mr. Greening's ricks were made was of the better quality, while that of which the Coultas rick was made was amongst the rankest, and the ricks were all of different sizes, and Mr. Greening's estimate of the velocity, temperature, and quantity of water extracted are wholly misleading when not qualified by a consideration of the various conditions under which the work of the fans is performed.—ED. E.]

[*For continuation of letters see page* 216.]

CODE OF RULES FOR THE ERECTION OF LIGHTNING CONDUCTORS.

THE following rules, from the "Report of Lightning Rod Conference," 1882, published by Messrs. E. and F. N. Spon, 16, Charing-cross, have been abstracted under the directions of Major V. D. Majendie, H.M. Chief Inspector of Explosives, and sent by the Explosives Department of the Home-office to the occupiers of factories, magazines, or stores of explosive materials, and to the police authorities. Reasons, based on practical and theoretical evidence, are given at length in the Report for each rule and recommendation:—

1. *Material of Rod.*—Copper, weighing not less than 6 oz. per foot run, the electrical conductivity of which is not less than 90 per cent. of that of pure copper, either in the form of rod, tape, or rope of stout wires; no individual wire being less than No. 12 B.W.G. ('109in.). Iron may be used, but should not weigh less than 2½ lb. per foot run.

2. *Joints.*—Every joint, besides being well cleaned and screwed, scarfed, or rivetted, should be thoroughly soldered.

3. *Form of Points.*—The point of the upper terminal* of the conductor should not have a sharper angle than 90 deg. A foot below the extreme point a copper ring should be screwed and soldered on to the upper terminal, in which ring should be fitted three or four sharp copper points, each about 6in. long. It is desirable that these points should be so platinised, gilded, or nickel plated, as to resist oxidation.

4. *Number and height of Upper Terminals.*—The number of conductors or upper terminals required will depend upon the size of the building, the material of which it is constructed, and the comparative height above ground of the several parts. No general rule can be given for this, except that it may be assumed that the space protected by a conductor is, as a rule, a cone, the radius of whose base is equal to the height of the conductor from the ground.

5. *Curvatures.*—The rod should not be bent abruptly round sharp corners. In no case should the length of a curve be more than half as long again as its chord. A hole should be drilled in string courses or other projecting masonry, when possible, to allow the rod to pass freely through it.

6. *Insulators.*—The conductor should not be kept from the building by glass or other insulators, but attached to it by fastenings of the same metal as the conductor itself is composed of.

7. *Fixing.*—Conductors should preferentially be taken down the side of the building which is most exposed to rain. They should be held firmly, but the holdfasts should not be driven in so tightly as to pinch the conductor or prevent contraction and expansion due to changes of temperature.

8. *Other Metal Work.*—All metallic spouts, gutters, iron doors, and other masses of metal about the building should be electrically connected with the conductor.

9. *Earth Connection.*—It is most desirable that, whenever possible, the lower extremity of the conductor should be buried in permanently damp soil. Hence proximity to rainwater pipes and to drains or other water is desirable. It is a very good plan to bifurcate the conductor close below the surface of the ground, and to adopt two of the following methods for securing the escape of the lightning into the earth:—(1) A strip of copper tape may be led from the bottom of the rod to a gas or water main—not merely to a leaden pipe—if such exist near enough, and be soldered to it. (2) A tape may be soldered to a sheet of copper 3ft. × 3ft. × 1/16in. thick, buried in permanently wet earth and surrounded by cinders or coke. (3) Many yards of copper tape may be laid in a trench filled with coke, having not less than 18 square feet of copper exposed.

10. *Protection from Theft, &c.*—In cases where there is any likelihood of the copper being stolen or injured it should be protected by being enclosed in an iron gas-pipe reaching 10ft.—if there is room—above ground and some distance into the ground.

11. *Painting.*—Iron conductors, galvanised or not, should be painted. It is optional with copper ones.

12. *Inspection.*—When the conductor is finally fixed it should, in all cases, be examined and tested by a qualified person, and this should be done in the case of new buildings after all work on them is finished.

Periodical examination and testing, should opportunities offer, are also very desirable, especially when iron-earth connections are employed.

THE ROYAL AGRICULTURAL SOCIETY'S HAY AND CORN-DRYING COMPETITION.

THE judges in this competition, for the prize of 100 guineas, completed their duties on Friday last, and on the following day presented their report to the stewards—Lord Vernon and Lord Morton, M.P.—at a conference held at the Society's rooms in London. The following is the text of the report:—

"We, the judges appointed to test the merits of the different appliances adopted by the competitors for the prize offered by Mr. Martin J. Sutton for 'the most efficient and economical method of drying hay or corn crops artificially, either before or after being stacked,' report that the undermentioned exhibitors entered into competition for the prize, the different methods adopted being shown by the classification:—

Sub-class.	Exhibitors.	No. of article in the catalogue.	Method adopted.	Time of application of method.
A	W. W. Champion, Reading..	6094	Hot air; Gibbs's method	Before stacking
B	Agricultural and Horticultural Association, Limited, London ..	4394 4395		
,,	A. C. Bamlett, Thirsk..	4025 4026		
,,	James Coultas, Grantham	2224	Exhaust fans; Neilson's system	In the stack
,,	W. A. Gibbs, Chingford, Essex	3855 3856		
,,	R. A. Lister and Co,, Dursley	376		
,,	C. D. Phillips, Newport, Mon.	5232 to 5244		
C	C. Kite and Co. London.	4000	Ventilation, assisted by hot air	In the stack

"A. Mr. Gibbs's machine, exhibited by Mr. W. W. Champion, was tried on meadow hay and afterwards on sewage rye grass. In the first trial, which was made under fairly favourable conditions, the exhibitor failed to make hay of as good quality as might have been made in similar weather without any artificial means. The result of the second trial, which was upon sewage rye grass, was more satisfactory, and we are of opinion that on sewage farms, where rye grass has to be converted into hay, the machine might be a useful auxiliary; but that even if the results obtained were more certainly and completely effectual than they have proved to be, the prime cost of the machine would place it beyond the reach of ordinary farmers, while the difficulty of its removal would be a serious obstacle to its general use.

"B. The various adaptations of the Neilson system exhibited have been tried on meadow hay in the stack, and three of the most powerful fans, exhibited by Mr. Coultas, Messrs. Lister and Co., and Mr. Phillips, were afterwards tested upon barley stacks. The result, as regards hay, can in no case be considered satisfactory, taking into consideration all the circumstances under which the hay was put together. None of the exhibitors proved that they were able to make good hay in wet weather. In a few instances where fairly good hay was obtained, equally good, if not better hay might have been secured without the application of fans. The trials of the three selected fans upon corn were even less satisfactory than those upon hay, none of the machines having succeeded in effectually drying the corn in the stack.

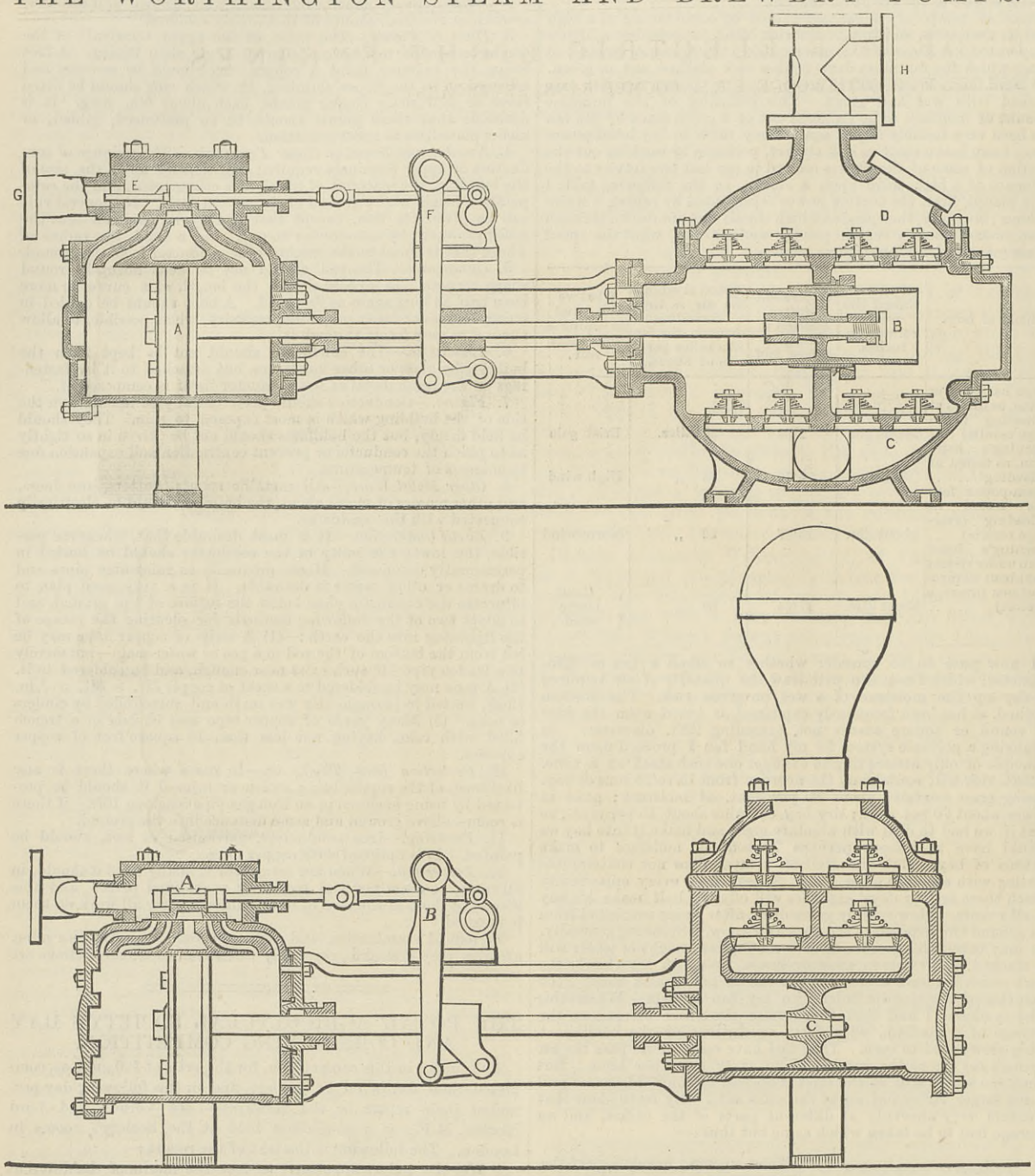
"C. Mr. Kite's system of ventilation in the stack was not successful in its application, nor do we think that it has any practical value.

"Under these circumstances we do not feel justified in awarding the prize.

"Sept. 16th, 1882. "Signed, MASON COOKE, WILLIAM C. LITTLE, GEO. H. SANDAY."

* The upper terminal is that portion of the conductor which is between the top of the edifice and the point of the conductor.

THE WORTHINGTON STEAM AND BREWERY PUMPS.



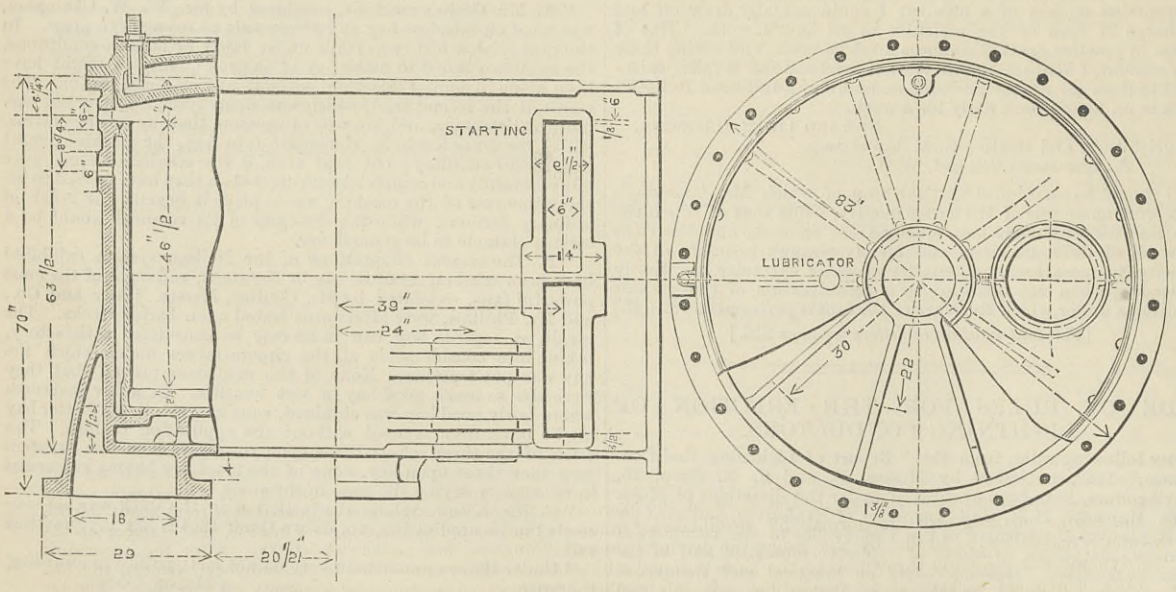
By the accompanying engravings we illustrate a direct-acting steam pump, and a pump on the same principle arranged specially for brewery purposes. The pumps are made by Mr. H. R. Worthington, of Broadway, New York, and are now being introduced into this country. The pumps are well designed and made, and one we recently saw at Messrs. Simond's brewery, Reading, had given great satisfaction.

The above is a sectional view of one half of the steam pump, the object of the arrangement being to obtain simplicity of interior arrangement and certainty of action of the steam valve. This, as may be seen at E, is an ordinary slide valve, working over ports in a flat face a slide valve with positive action being considered the best. The motion of this valve is produced by a vibrating arm F, which swings through the whole length of the stroke of the piston rod. As the moving parts are always in contact, the blow inseparable from the tappet system is avoided. The double-acting plunger B works through a deep metallic packing ring, an accurate fit, being neither elastic nor adjustable. Both the ring and the plunger can be quickly taken out, and either refitted or exchanged for new ones at small cost, and if it be desired at any time to change the proportions between the steam pistons and pumps, a plunger of somewhat larger size, or decreased to any smaller diameter, can be readily substituted so as to retain exact proportions between the power and work. The plunger is placed above the suction valve. The water enters the pump from the suction chamber C through the suction valves, then passes partly around and partly by the end of the plunger, through the force valves, nearly in a straight course, into the delivery chamber D, thus traversing a very direct and ample water-way. The bottom and top plates furnish a large area for the accommodation of the valves. These consist of several small discs of rubber, or other suitable material, easy to examine, and inexpensive to replace. To effect the steam valve motion, two steam cylinders and two pumps are cast together to form one machine. The right-hand division moves the steam valve of the left-hand one, and *vice versâ*. Under this arrangement one pump takes up the motion when the other is about to lay it down, thus keeping up an uniform delivery without pulsation or noise.

In the brewery pump, the plunger C works in a composition lined cylinder. As it is important, especially in lifting hot beer by suction, the amount of air space or clearance in this cylinder is reduced to a minimum, by the arrangement of the valves shown in the lower figure.

ENGINES OF THE S.S. LEERDAM.

DETAILS OF LOW-PRESSURE CYLINDER.



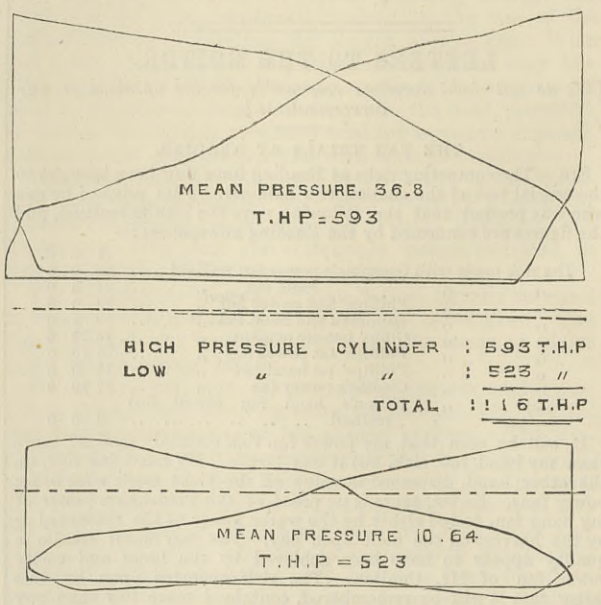
We commence this week the publication of a complete set of dimensioned drawings of the machinery of the s.s. Leerdam of the Netherlands American Steam Navigation Company, built by the Netherlands Steamboat Company, of Rotterdam, at their Fyenoord Works, well known to many of the readers of The Engineer. The engines will be found to compare satisfactorily with the very best types of marine engines built in this country, and we venture to think that our engravings will be found full of instruction, especially to the junior members of the profession. For the last fifteen years the steam navigation companies in Holland ordered almost all their steamers in England or Scotland, and the only orders, which were executed at the Fyenoord Works during that time, were for the Royal Dutch Navy, and steamers for their own line trading between Rotterdam and London. The Direction of the Netherland Steamboat Company decided upon showing the public at large that they were able to compete in workmanship with the British firms, and began to build the s.s. Nederland, intending to trade themselves with her to the Colonies; but on approaching completion they saw a better prospect to command success by opening a new line to Baltimore. The ship accordingly made her first trip in August of last year to that port, and was successful in every respect. She got through the severe storms of last winter very well, and showed off her good workmanship in such a manner that the Netherlands American Steam Navigation Company, being in want of another ship for its Rotterdam-New York line, purchased the ship and re-named her the Leerdam. She is now being altered at Fyenoord Works into a spar deck ship, and fitted with emigrant arrangements, and sails again in the course of the month.

The result of the courageous policy of the Direction was that they got the order for a new ship for the Netherlands American Steam Navigation Company, the Zaandam, the trial trip of which was referred to in our pages not long ago. Another order for a Bilbao iron ore steamer, which will be called the Hollandea, was secured in the beginning of the year, and must be completed by December next.

Our engravings will be found so complete as to require little further explanation. The ship is of iron, brig rigged, with a raised forecastle, bridge, and poop deck. Her gross registered tonnage is 2333; net ditto, 1736; length over all, 320ft.; extreme breadth, 38ft.; depth of hold moulded, 24ft. 8in.; dead weight cargo, 2100 tons; coal in bunkers, 600 tons; cargo space, 107,400 cubic feet; load draught, 21ft. 4in., with 2100 tons dead weight cargo and 600 tons of coal. Good accommodation is provided for forty first-class and eighteen second-class passengers, and for captain, officers, and engineers.

A distilling apparatus, capable of supplying 65 gallons of fresh water per hour, and three steam winches with a separate donkey boiler on deck, are provided. The three hatches are 9ft. 10in. by 10ft. 6in. She has six water-tight bulkheads, of which three go up to the main deck. The frames are 5in. by 4in. by $\frac{9}{16}$in., and are 23½in. apart. Plating is, garboard, $\frac{13}{16}$in.; intermediate, $\frac{3}{4}$in. and $\frac{11}{16}$in.; sheerstrake, $\frac{15}{16}$in. thick; the height of the bulwarks is 4ft. 3in.

The engines are 250 nominal horse-power, the cylinders 39½in. and 69in. diameter, 3ft. 6in. stroke; the length of connecting rod, 7ft.; the cooling surface of the condenser is 3150 square feet, given by 1596 brass tubes 12ft. 11in. long, $\frac{5}{8}$in. outside diameter; there is one single-acting air pump 26in. diameter, 24in. stroke; a centrifugal circulating pump is fitted, the diameter of the steam cylinder is 9in.; stroke, 8in.; diameter of fan, 23½in.; diameter of in and outlet pipes, 10in. The two feed pumps are single-acting, 3¾in. diameter, 24in. stroke; there are two similar bilge pumps. One of Messrs. Brown's combined steam and hydraulic reversing engines has been fitted to work the valve gear. The diameter of the crank shaft is 12in.; of the crank pin, 12½in., and it is 13in. long; the screw shafts are 11½in. to 12in. diameter, all of steel. Steam is supplied by two double-ended boilers, 11ft. diameter and 18ft. long, with four furnaces in each 3ft. 2in. diameter, 6ft. 7in. long; the total grate surface is 144 square feet; the total heating surface, 4305 square feet; the pressure, 70 lb. The boilers were tested to 140 lb.; the number of revolutions on trial was 65, in service 62; the speed of ship on trial was 12 knots, in service about 11 knots; the indicated horse-power on trial was 1250, in service about 1100; the coal consumption per twenty-four hours, with 21ft. 4in. draught and 11 knots speed, was 23 tons, or 1·9 lb. per horse per hour; the length of engine room is 21ft. 6in., of the boiler room 33ft.; the diameter of the screw propeller 15ft. 6in., pitch 20ft. 6in.; weight of engines—shafts, propeller, water in condenser, everything included—152 tons; weight of boilers, with water and fittings, 104 tons; total weight, 256 tons. We annex a set of indicator diagrams, taken on her voyage to Baltimore, dated 26th December, 1881.

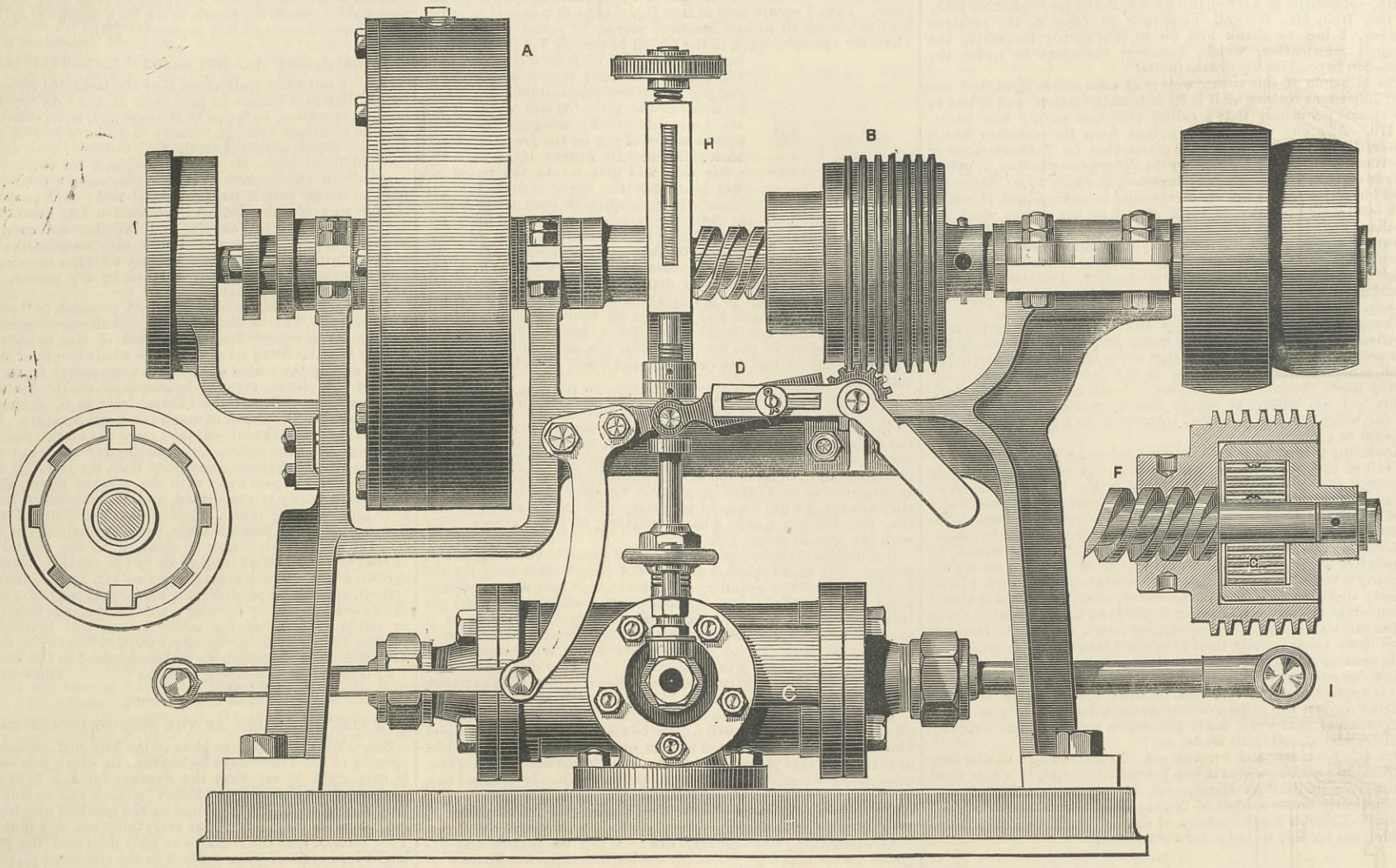


We have to express our thanks to the company for an admirably executed set of tracings, from which our drawings have been prepared, and for the courtesy with which it has supplied minute information concerning its work.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—Charles W. Nibbs, chief engineer, to the Heroine, when commissioned; William H. Gulliver, chief engineer, to the Linnet; Joseph Bamford, engineer, to the Dasher; and George J. Fraser, engineer, to the Osprey, when commissioned; Charles Ephraim Uffindell, chief engineer, to the Constance; J. T. H. Denny, engineer, to the Constance; and John A. Murray, assistant engineer, to the Constance; William Holloway, chief engineer, to the Asia, additional, vice Shearman; Thomas Sagar, to the Pembroke, additional, vice Holloway; William H. Green, to the London.

DURHAM'S GOVERNOR FOR ELECTRIC LIGHT ENGINES.

CONSTRUCTED FOR MR. W. SPOTTISWOODE, F.R.S., COOMBE BANK, SEVENOAKS.



THAT a governor is needed for the control of a steam engine driving electric lighting machines there is no doubt, and that such a machine should be capable of the utmost delicacy and adjustment may be taken as a matter of course. Some experiments recently carried out at Coombe Bank, the residence of Mr. Spottiswoode, F.R.S., near Sevenoaks, serve to show to what perfection a governor can be brought. The machine alluded to, and which we illustrate this week, is one of Durham's patent velometers, and as this machine is now so well-known, it is not necessary to give any detailed description of its action, beyond reminding our readers that the general principle is the combination of a water cylinder with a steam one. The machine is driven from the engine shaft by means of a rope made of cow hide, which passes round a pulley on the main spindle; at a certain point this spindle is cut, and one end is attached to the inside of a coiled spring C, while the other part of the spindle, which carries a fan revolving in a closed water cylinder A, is attached to the outside of the same spring. When the engine is running, the rotary action is communicated from the engine shaft to the pulley on the governor spindle and through the spring alluded to above, to the fan in the water cylinder. It will be at once seen that should the engine for any cause, such as the loss of resistance, tend to run at a speed higher than is desired, the pulley on the first governor spindle will run faster than the fan on the second, and the difference of speed so obtained sets up an action in the spring, which action is used for the moving of a slide valve on a steam cylinder C by the gear B D F, the piston rod of which is connected to the throttle valve of the engine by the rod I, and in this manner the working of the engine is controlled. By simple adjustments and a counteracting spring H, any desired number of revolutions may be allowed, but should the engine tend to run ever so slightly over such a speed, it is immediately checked and rigidly kept to the rate of running settled upon. The counteracting spring is capable of such nice adjustment that by its means alone, the stop valve being full open to the engine, any speed desired may be obtained within the limit of the engine's power, even to the bringing of the machinery to perfect rest.

Some little distance from Mr. Spottiswoode's house a handsome engine-room has been built, and within it is placed all the machinery necessary for the purposes of supplying light, water, &c., not only to the dwelling-house itself but to the stables, outhouses, and the pleasure grounds. All the machines, instruments, tools, &c., to be found within the engine-room are kept scrupulously clean and in order by Mr. Volter, the engineer; indeed, his department looks more like a handsomely furnished mechanical museum than what is conventionally known as an engine-room. At one side is the engine, which is horizontal, and of about 12-horse power nominal, and has been built by Messrs. Middleton and Co., of Southwark; the cylinder, which is steam jacketted, is 11in. in diameter, and has a stroke of 2ft. It is fitted with two expansion valves working on the back of the slide valve, and capable of adjustment and alteration by means of a hand-wheel at the end of the valve chest, which moves the right and left-handed screwed spindle upon which the valves work. A fly-wheel 10ft. in diameter, and weighing some 4 tons, is fitted to the crank shaft. Steam is supplied from a boiler, which is situated in a recess shut off from the engine-room by means of a glass door and partition. The boiler is of the vertical type, stands 12ft. high, is 4ft. 6in. diameter, and is provided with four 9in. cross tubes. It is by the same maker as the engine, and steam is supplied from it at a pressure of 50 lb., hard Welsh smokeless coal being used. Near to the boiler-room door, beside the engine, where the easiest and most direct connection can be made with the throttle valve, and standing on a pedastal, the governor we illustrate is placed. In the centre of the room the dynamo, one of De Meritans', is fixed, a light polished rail running round it as a protection against accident, and by the walls many other machines and instruments are placed, while an alcove or recess has been fitted up with a vice, vice bench, and a quantity of tools for the use of both engineer and electrician. The whole system of lighting, which is under the superintendence of the electrician, Mr. Ward, consists of four circuits of incandescent lamps—Swan's—thirty lamps making up a circuit; four large arc lamps one at each corner of the outside of the dwelling-house, and ten large arc lamps, which are situated among the trees in the park, and which produce a beautiful effect on the foliage and terraces as seen from the drawing-room windows. In the experiment to which we have referred, when the engine was first started it was run slowly for a little while, being occupied in pumping water to the top of the house; but when darkness set in it was called upon to run the dynamo, and the experiments were carried out. The engine being driven at a uniform speed of 58 revolutions, caused the dynamo to make 900 per minute, and in making this 900 it emitted a sharp, clear musical note. That the pitch of this note would form an absolute guide to the speed of this machine was accepted, for were the engine to run at ever so slightly an altered speed, the difference would of course be communicated to the dynamo in the proportion of 58 to 900, or nearly 16 to 1. And if it be accepted that one revolution of the engine would very perceptibly alter the note, a gauge is established by which the regularity of the engine is tested to an increase of one revolution. At the beginning of the first experiment the four large arc lamps, before spoken of as having been placed at the corners of the house, and which Mr. Ward considers require some 5-horse power to drive, as well as one circuit of incandescent lamps, requiring about 3½-horse power, were lighted. By means of a telephone in Mr. Spottiswoode's laboratory, the note of the dynamo could be distinctly heard. At a signal arranged beforehand, Mr. Ward threw off the arc lamps, leaving the Swans on, but the note of the dynamo remained absolutely the same, proving that the governor had attended most promptly to its duties. Previous to the application of the governor in the engine-room, it had been necessary for the electrician to telephone to the engineer of his intention of making any change; the engineer had then to look after his engine, and the constant result was that valuable lamps were destroyed. Now nothing of this kind is needed, and Mr. Volter in the engine-room is quite ignorant of any change, however great, which may be made with the lighting, for the governor works so silently and so steadily as to attract no attention. In carrying out the second experiment the same lights were used, *i.e.*, 30 incandescent and 4 arc. The incandescent lamps were first put out, but the intensity of the light from the arcs remained the same; the operation was then reversed, the arc lamps being suddenly put out, and the light of the Swans was declared to be absolutely unaltered. The third experiment was the most crucial one, but from it also the governor came out satisfactorily. It was decided to light the entire system and then to throw them all off simultaneously. The telephone having now been brought into use in order that the note might be closely listened to, the signal was given and the entire system of lighting was suddenly thrown out, but the note continued in the engine room unaltered. Mr. Durham was anxious that one more test should be made, and the experiment, which we may call No. 4, was carried out in the engine room. At the beginning of the experiment the machine was being driven at its usual speed, 900, only a few lights, however, being left burning. The dampers were then put on to the boiler and firing was stopped, the pressure gauge registering 50 lb. The steam then fell pound by pound without producing the slightest variation in the note of the machine, the engine making still its normal 58 revolutions. When the steam had fallen to 30 lb. by the gauge the driving belt of the dynamo was suddenly thrown on to the loose pulley, but the crank continued to keep at 58 revolutions. It is of course understood that no governor can act unless a change takes place in the velocity of the engine, but whereas there are some governors which maintain a constant relation between their own speed and the position of the throttle valve, there are others—as for example the well known Pitcher governor—which, running faster for a moment, set the throttle valve in a new position, and then return to their own old position. This is also done by the velometer, the alteration in the speed of the engine and dynamo necessary to effect the change of positio in the throttle valve being too brief in duration to be noticed b the ear, or to produce an appreciable effect on the lamps in circuit.

THE NAILMAKERS' ASSOCIATION. — The committee of the Operative Hand Nailmakers' Association of South Staffordshire and East Worcestershire propose to memorialise the local members of Parliament to bring the evils of the truck system before the House of Commons, with a view of a bill being passed which shall enable the police to visit the "tommy shops," and so prevent employers from paying wages in kind.

COLLEGE OF SCIENCE AND ARTS, GLASGOW.—We have examined the syllabus of classes to be held in this institution during the coming session, and find that ample provision, at moderate fees, has been made for the wants of mechanical, civil, and electrical engineering students, as well as science and technical students generally. No less than sixteen subjects of the Science and Art Department are taken up, besides three technical subjects of the City and Guilds of London Institute, including mechanical and electrical engineering in all its branches. In the late science examinations the students seem to have acquitted themselves with marked distinction. Those desirous of further information may refer to our advertising columns.

THE POLYPHEMUS.—The armour-plated torpedo ram Polyphemus, Commander May, got up steam at Chatham yesterday, and in the afternoon left, on her way to Portsmouth. Her engines worked very smoothly, but it is expected her boilers will give some trouble, and although they were made to work up to 120 lb. per square inch, an inspection has shown that it would not be safe to work them over 70 lb., and an order has been issued that on the passage round they are not to be worked beyond that pressure. The result of the journey to Portsmouth will pretty well determine what will be done with the vessel, but it is fully expected that her boilers will have to be taken out and replaced by others. They are of the locomotive pattern, and were put on board more for experimental purposes than anything else, as they do not occupy as much room as ordinarily; but up to the present the trials which have taken place with them have been failures. It is understood at Chatham that she will not go beyond Portsmouth, as it is believed it would not be safe to send her to sea.

THE TRADES' UNION CONGRESS.—The Trades' Union Congress is now sitting in Manchester, under the presidency of Mr. R. Austin, the local secretary for the district section of the Amalgamated Society of Engineers. The first real business before the Congress was the presentation of the report of the Parliamentary Committee, a document drawn up in a spirit of moderation which deserves credit, and it may be of interest to quote the reference made to the general trade of the country. This, the report stated, had not been so brisk during the past year as could be wished. Exception to this general quietness must, however, be taken in the case of the engineering and iron shipbuilding trades. In these branches it was believed that the demand for labour was fairly good. In the iron shipbuilding trade it had never been equalled, and so far as union purposes were concerned, the men appeared to be laying by for the proverbial "rainy day." In the mining industries and building trades employment was still slack and wages low. One of the main causes of slackness in the former industry was, undoubtedly, the increased means of production of recent years. That of the latter industry might be safely ascribed to the fact that the commercial classes had not been making the immense profits they did ten years ago. On Tuesday, Mr. Austin delivered his presidential address, in the course of which he pointed to the progress which had been made in the importance and representative strength of the Congress since its formation fifteen years ago, and estimated that from about 150,000 unionists represented at the Congress in 1869, that number at the present Congress had grown to 500,000. After the president's address the Congress proceeded to the ordinary business, and has since been engaged in discussing a variety of questions. Resolutions have been passed urging the necessity of increasing the number of factory inspectors; reforming the patent laws; devising further means for the prevention of loss of life by boiler explosions; prohibiting any but duly qualified and certificated persons taking charge of steam engines or boilers; calling upon Government to increase the number of sub-inspectors for mines, and recommending the appointment of fitting practical miners to fill such positions; and urging the amendment of the Employers' Liability Act so as to render it compulsory.

LETTERS TO THE EDITOR.

[*Continued from page* 213.]

WISWALL'S TILTING WEIR.

Sir,—Referring to a letter in The Engineer for September 15th, p. 196, from Mr. Wiswall, in answer to mine in the previous number, I beg to thank him for so courteously furnishing the required information, which, however, threatens to widen the discussion beyond its legitimate limits.

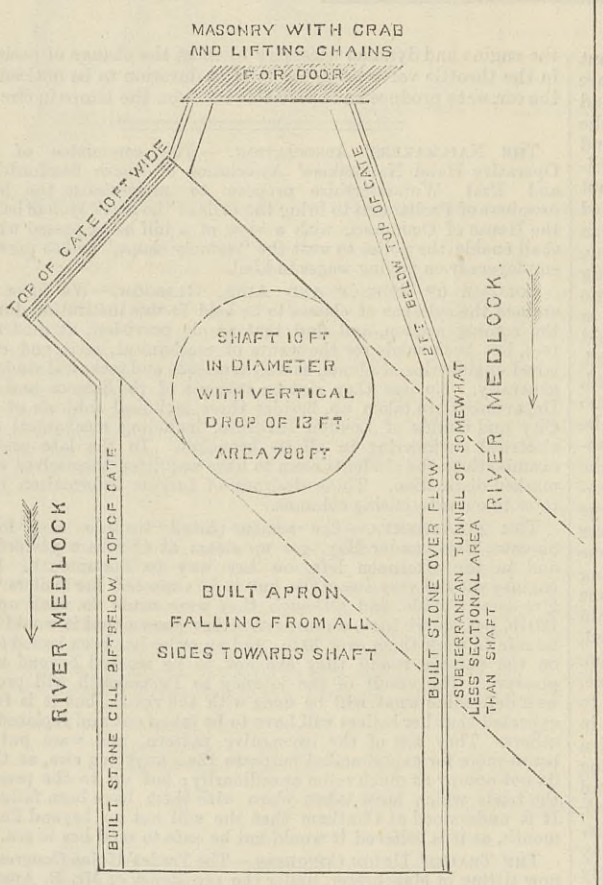
The principle of this tilting weir is at once self-evident, but the most important feature of it is its automatic action, and it was to this special point only that I called attention in my last letter, p. 176. Any one would have judged from the sketches which appeared, and the data that were given, that no "observations or experiments" would be necessary to determine whether the principle is correct, for, if properly designed, it ought to be efficient if placed in any stream; but it seems this is not so, and it would have been well had Mr. Wiswall stated at the outset what the peculiar circumstances of his weir are, and "which could not be known to any one who has not taken observations and made experiments for the express purpose;" for without the explanations which have since appeared it is very misleading. I can see the utility of making observations in the river, but fail to realise the necessity for any experiments.

Though the assertions made by Mr. Wiswall may be open to question, viz., as to the ordinary water level being 1ft. above the weir crest, and, more especially, that every 1ft. of rise in the upper reach causes exactly 2ft. of rise in the lower reach. Yet, not having made special "observations"—I will not say "and experiments"—I am willing to accept this as correct, and also leave out the weight of the gate, and consider it as a plane turning on its pivot as axis.

According to this theory, should a flood occur equal in height to the fall of the weir, the tail water would rise so as to completely submerge the gate—when it becomes, as Mr. Wiswall allows, of the same specific gravity as water—the flow assuming a practically dead level, and the weir remaining in its normal position. Probably such a flood, say of 9ft., has been, and may still be, experienced in this locality, and the weir in that case would be inoperative at the very time it ought most to be relied upon; or, allowing it did still act through the momentum due to what little velocity there would be left in the water, what use would it serve? Inasmuch as the automatic action depends on the more rapid rising of the tail water than the approaching water, the gate is bringing water down more rapidly than at present into the lower pool, probably causing floods to the same extent as now.

Now, no one has doubts about the gate chains acting when the crab is applied, but the very fact of their adoption is a standing evidence against the gates working automatically, in the ordinary acceptation of that word, for if this action were counted on, why furnish elaborate multiple crabs, &c.?

One other remark, and I have done. In instancing a similar case of automatic action, where it has proved successful, in a gate fixed on the river Medlock at Manchester, Mr. Wiswall says, "It acts automatically under a head of 2ft., at which point it was designed to tilt." I send a rough sketch and description of this, which will enable your readers to judge for themselves.



The built stone cill or overflow is about 70ft. long, and is 2ft. lower than the top of the gate. All the water falling over the cill or weir has to pass away by a vertical drop through a shaft 10ft. in diameter into a nearly level tunnel of somewhat less cross sectional area. The gate, we are told, comes into operation under a head of 2ft. The sectional area of the shaft is 78 square feet, while that of the water passing into it before the gate would come into play would be—length of stone cill, 70ft. × 4ft. deep = 280ft.; width of top of gate, 10ft. × 2ft. deep = 20ft.; total, 300 square feet. This requires no further comment from me, but I will just remark that in this case also lifting chains and a crab are provided for its working. William T. Olive.

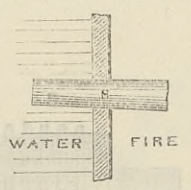
Didsbury, September 19th.

HALPIN'S COMPOUND ENGINE.

Sir,—I quite agree with you in the statement you have made at the end of your description of Mr. Halpin's patent engine, which you published in The Engineer of last Friday, namely, that a consumption of 17·47 lb. of steam per indicated horse-power was a performance unparalleled in economy by any small engine. I will go further, and add that it is a very exceptional performance for any engine, large or small. How was such a result obtained? On this point you are silent; but I believe Mr. Halpin attributes the rare economy of his engines almost altogether to his steam jacketting arrangements. Now I believe that Mr. Halpin is entirely wrong in this respect, and that the economy of his engine is due to a different cause; and as the subject is one of great interest to a great many of your readers, I ask for space to say a few words about it, and I hope that Mr. Halpin will take what I have to say in good part, and will express his views on the subject.

Mr. Halpin, instead of trying to reduce surface in his cylinder, augments it as much as possible. Thus, he puts ribs on the sides of his cylinders projecting into the steam jacket, and ribs on the lid of the cylinder; and he ribs his piston, because he cannot help doing so, because the cylinder cover is ribbed.

The ribs are the late C. W. Williams's "heat pegs" in another form. Peclet has shown that the power possessed by a metal plate of transferring heat from one side to the other is a function of the surfaces, and not alone a function of the conducting power of the plate. Thus 1 square inch of iron ½in. thick will transmit as much heat as about 10 square inches of surface of metal can take up. Thus, for example, let A in the sketch be part of the side of a fire-box ½in. thick, and let B be a peg 6½in. long and 1in. in diameter; then that portion of the peg 1in. in diameter and ½in. long, which is stuck in the plate A, will transmit all the heat that can be absorbed by the 10 square inches of peg on the fire side of the plate, and the 10 square inches on the other side will give up to the water all the heat that the other end of the peg absorbed; consequently such a peg cannot be made red hot. It will be very little hotter than the plate in which it is put. This is an obvious way of augmenting surface, and Mr. Williams made boilers which he stuck full of heat pegs. The boilers steamed very well at first, but soon came to grief because of deposit which the pegs prevented from being removed. It is important to observe that if the peg stopped off at the plate, and did not go into the water then it could be made red hot, because the square inch of end of the peg could not give up all the heat that 10in. absorbed, and so a boiler with pegs all in the fire or all in the water is no better than a boiler without.



Now Mr. Halpin obviously understands all this very clearly, and I see that his heat pegs virtually come through the cylinder lid. So far I will admit that he is right, but the consequence of carrying the projections inwards is that the piston, which is not jacketted, offers an additional cooling surface as compared with that of a plain piston precisely equal to the extra heating surface of the lid. Thus they neutralise each other. As regards the sides of the cylinder, as they are fitted with pegs, so to speak, only in the steam jacket, they are, for the reason I have explained, no better than a boiler with the pegs all on one side.

But besides all this, Mr. Halpin seems to me to be wrong in this theory. All that is needed is that the jacket shall keep up the temperature of the cylinder, so that condensation shall not take place. Now the whole of the condensation which takes place per stroke is effected by an almost infinitesimally small thickness of metal, and a jacket will do the greatest service not when it transfers a great deal of heat to the cylinder, but when it keeps up the temperature to a very high point—two very different things. But heat pegs can only operate to transfer quantity of heat; they will in nowise affect intensity.

The results of the trials made with Mr. Halpin's engine justify all that I have said. It will hardly be disputed that the value of two jackets will be estimated by the quantity of steam condensed in them, and that jacket is, *cæteris paribus*, most efficient in which most steam is condensed. But as you have already pointed out, the weight of water condensed in the jackets of Mr. Halpin's engine is far below the average. What then becomes of the efficiency of his heat peg arrangement?

To what, then, was economy due? When we turn to the diagrams we see that they are, to say the least, indifferent. There is no sharp cut-off in the high-pressure cylinder, but, on the contrary, some wiredrawing. Yet although at first sight the diagrams seem to be, I had almost said bad, in that they are not to be compared for cleanness of cut-off, &c., to those had from Corliss and many other types of engine, it is, I think, in these diagrams that we must seek for the economy of the machine. Now if the diagrams are examined it will be seen that before more than a small fraction of the return stroke in the high-pressure cylinder has been made, the back pressure begins to rise, and goes on rising rapidly—a result due mainly no doubt to the small size of the intermediate receiver. I was much struck with the similarity of these diagrams with those published in The Engineer some time since, taken from an engine by Messrs. Garrett, of Saxmundham, which engine gave, you stated, very high results in economy. You then pointed out that this getting of a high receiver pressure was conducive to economy by drying the steam before it enters the low-pressure cylinder, and I have no doubt that it is to this rise in pressure in the receiver that the exceptional economy of Mr. Halpin's engine is mainly due.

I have no desire to assert this opinion in a bigoted way, and I am quite open to conviction on the other side, but I think the least Mr. Halpin can do is to explain why on his theory his engine works so economically. S. B. Porter.

Nottingham, September 18th.

GRAIN HOPPERS OR BINS.

Sir,—We cannot agree with the deductions of Mr. Isaac Roberts, as described in your impression of September 15th, respecting the pressure of grain on the bottoms of grain hoppers or bins; because the experiments, as carried out, ignore the actual conditions under which grain is usually stored and manipulated, such conditions being as follows:—Firstly: The walls of the structure are always liable to receive vibrations from machinery or other causes; thus the frictional contact of the grain with the sides of the walls may become disturbed at any moment. Secondly: The grain hoppers are usually emptied from below by draw-off spouts, these spouts being set to deliver at any rate from 10 tons to 150 tons per hour. Thirdly: When the hoppers are being discharged, the moving grain moves like a fluid throughout its whole mass from bottom to top. The shape of the sinking mass in its upper part is of the same form as the bin, but in its lower part it is like an inverted cone, the apex of the cone being directly over the discharge aperture, the sides of the cone being at an angle due to the limiting angle of resistance of the grain.

We maintain that the above conditions must be taken into account before any reliance can be placed upon the formulæ given by Mr. Roberts. We must also take exception to his statement that any data founded upon the "rules applicable to hydraulics will not apply" to the strains upon the partition or external walls of grain hoppers, more especially as he is curiously silent as to his reasons for such a statement. We believe that the only safe way to decide upon the strengths requisite for the sides and bottoms of grain hoppers is to treat the grain as a fluid, and not as a static mass, as in the experiments made by Mr. Roberts.

We have witnessed two distinct cases of failure and considerable loss, caused through the use of badly-designed bins, with brickwork external walls; and we therefore consider ourselves justified in entering a protest against the use of any formulæ which treats the grain simply as an inert mass. Higginbottom and Stuart,

Liverpool, September 20th. Milling Engineers.

SEWAGE AND AIR.

Sir,—Mr. Hughes' letter in your last issue suggests that I should try the effect of drying solid and fluid excretions together, and agrees that, if the result is the abatement of nuisance, he will acknowledge the correctness of my hypothesis as to reactionary principles. But Mr. Hughes will, perhaps, permit me to point out, that in making that suggestion he has entirely overlooked the very root of my theory, viz., that such reactionary influence can only exert itself when exercised under the condition of an absence of air. I do not wish to travel out of our immediate subject of the effect of air on sewage more than is possible without altogether ignoring subjects which are collateral to the discussion, and I therefore desire not to enter as fully as Mr. Hughes' letter invites into the subject of the possibilities of mechanical separation of solid and fluid excreta.

I certainly have no desire or inclination to be "dictatorial," as assumed by Mr. Hughes, and shall only be too glad to be convinced that effectual separation under all conditions of indiscriminate usage is practicable; but, as far as my experience at present goes, it justifies me in the assertion of impracticability. We shall all be indebted to your correspondent for the information he kindly promises us, and for myself, I can assure him I am by no means so wedded to my theory that I cannot be won over to his views if reasonable grounds are shown to me for a change of opinion.

St. James's-street, S.W., September 18th. A. F.

GEOGHEGAN AND STURGEON'S JACKETTED PISTON.

Sir,—I can quite understand that the jacketted piston described by Mr. Reginald Bolton in your issue of the 15th September is an original invention, so far as he is concerned, as he could not at the date he mentions—viz., in January last—have known of our previous invention, patented on the 27th October, 1881, and therefore not published when Mr. Bolton designed his engine. I enclose copy of our specification that you may see we describe the very plan he shows, both in our provisional and complete specifications, though we prefer the method illustrated in The Engineer of September 8th, as being simpler and avoiding the complication of telescope pipes and glands. I may also mention that a similar plan for bringing cold water in contact with the interior surface of air-compressing cylinders is covered by my patent, No. 4863, 1877, for cold air machinery.

Our object in this invention is not so much to "provide additional surface," as to dispense with non-effective or mal-effective surface. We regard the chief defect of the outside jacket as arising from its being spread over the whole length of the cylinder. Thus, during the period of one stroke the jacket is, on the acting side of the piston, opposed by steam of nearly the same mean temperature, while on the exhaust side it is, during the same period, opposed by steam of much lower temperature. It therefore follows that the exhaust will take more out of the jacket than the working side of the piston, owing to this difference in temperature; and the bulk of the heat thus robbed from the jacket at the expense of the boiler will pass away with the exhaust steam, the moisture in which is partly re-evaporated, and its temperature uselessly and even mischievously raised. Under such conditions of working the more effective the jacket is made, as regards rapidity of conduction, &c., the less real advantage is obtained, as the greater proportion of that increased effect is taken up by the exhaust steam, and thus thrown away. In our arrangement we aim at eliminating from the system, as much as possible, this wasteful expenditure of heat upon the exhaust steam, by forming a travelling steam jacket as a guard or shield in front of the acting steam, and heating the inner surface of the cylinder by direct contact therewith, and with the very minimum of condensing surface opposed to the live steam.

3, Westminster-chambers, London, John Sturgeon.
September 18th.

THE ELECTRIC LIGHT AT THE NORTH-EASTERN EXHIBITION.

Sir,—We notice in your issue of the 15th inst. an account of the opening of the Tynemouth Exhibition, in which it is stated:—"It is only right to say that the dynamo for this light was, on the opening night, driven by a 'Robey' engine, and as this engine had only been placed in the building on the previous evening allowance may be made for the fact that everything was not quite in order." Your remark that the engine was only delivered the previous day might lead some of your readers to the erroneous supposition that the engine had something to do with the non-working of the light on the first night. While your statement is correct that the engine was only set to work the night previously, yet, as it is our practice to deliver all our engines in complete working order, this circumstance did not cause the partial failure of the light, which was due entirely to the inefficiency of the intermediate gear, and which gear was not supplied by us.

We shall feel obliged by your kindly inserting this in your next issue. Robey and Co.

Globe Works, Lincoln, September 20th.

COMPOUND ENGINES.

Sir,—There are, I think, two fundamental errors in "J. L.'s" communication on the above subject.

In the first place he seems to reason on the theory that the low-pressure piston is acted on by two separate and independent agents, steam and vacuum, whereas it is really urged forward by steam alone, expanding continuously, while the pressure falls from the initial—which may be above or below the atmospheric pressure—to the pressure in the condenser. In the second place he supposes the volume of the high-pressure cylinder to remain constant. Now, if this volume of steam when expanded into a low-pressure cylinder, whose volume is 1, gives a mean pressure of, say, 10 lb.—when expanded into a low-pressure cylinder whose volume is 10, the mean pressure will be only $\frac{10}{10} = 1$ lb. We have then $\frac{1}{10}$ the pressure on ten times the area, so that the power will remain the same. Matthew Paul, Jun.

Kirkton, Dumbarton, September 19th.

THE DETONATION OF GUN COTTON.

Sir,—In the article in The Engineer of the 1st inst., you state that Professor Abel "discovered that all explosives, even including gunpowder, were susceptible of more violent explosions through the agency of detonation." As Mr. E. O. Brown, of the Chemical Department at Woolwich, has usually been mentioned in connection with this important discovery, I should be interested to know what part or parts of it are attributed to these two gentlemen respectively. W. Martin.

36, Great Ormond-street, September 20th.

RAILWAY ROLLING PLANT ON TRAMWAYS.

Sir,—The theory which your correspondent, Mr. J. Smith, wishes to uphold is carried out in actual practice in Paris at the present time, where some of the tramways are worked with American horse cars which only have flanged wheels on one side. The only time I rode on one it left the metals at the first sharp curve. The flanged wheels were nearest to the radius of the curve.

32, Selby-road, Anerley, Sept. 8th. Robt. Ed. Phillips.

Lacour's Pile Driver. — We are requested to state, with reference to our article upon "Lacour's Pile Driver," which appeared in our issue of August 11th, and also to the illustration and short description which appeared last Friday, that Messrs. S. Owens and Co., Whitefriars-street, are the sole licensees and manufacturers for the United Kingdom.

City and Guilds of London Institute for the Advancement of Technical Education.—The Council of the Institute regret that owing to unavoidable delay in the completion of the workshops and the laboratory fittings, the opening of the Technical College, Finsbury, is postponed until January, 1883. Arrangements, however, have been made for carrying on the work of the college, during the winter term, in all its departments in the temporary class-rooms of the Institute, Cowper-street, Finsbury.

Rapid Atlantic Trip.—The Guion steamer Alaska has just completed a most extraordinary voyage from New York. On Tuesday, September 12th, she started on her voyage at seven o'clock in the evening, New York time, or half-past eleven Greenwich. On Tuesday afternoon she passed Browhead signal station—Ireland—at ten minutes past two, and to cross the bar of the Mersey about two o'clock on Wednesday morning at flood tide. It will thus be seen that the problem of a seven days' trip from New York to Liverpool has almost been solved, for the actual time occupied on the trip of this hitherto unrivalled steamer on her voyage from New York to the Irish coast has been six days fourteen hours and forty-eight minutes and to Liverpool, little over seven days.

RAILWAY MATTERS.

ON the 9th inst. the Netherlands mails were for the first time carried through the St. Gothard instead of by the Mont Cenis route.

THE Brighton Town Council, at their meeting on Wednesday, resolved to petition the directors of the London and Brighton Railway to run more third-class trains between the two termini.

A PORTION of the tunnel next to the Central Station, Oldham, fell in on Wednesday afternoon. Repairs were being made to the roof, and part of the scaffolding is said to have given way. No one was hurt, and a train which was shortly due from Mumps received timely warning that the line was blocked. Trains to Middleton Junction are being sent by Rochdale.

IT is stated that Mr. Alexander McDonnell, locomotive superintendent of the Great Southern and Western, has been appointed to the North-Eastern of England, and Mr. Aspinall, who was next to him, has been promoted to the chief command over the Inchicore works; Mr. Joatts, who superintended the works at Cork, being brought up to Inchicore, to fill Mr. Aspinall's late position, and Mr. Smith being placed over the Cork works.

ON Tuesday the *Times* Geneva correspondent telegraphed that continued rain and heavy snowstorms were causing considerable loss and serious inconvenience in many parts of Switzerland. The St. Gothard Railway was blocked by an earthslip at Gurtnellen. The Simplon, Splügen, and Bernhardin Passes are all obstructed by snow-drifts, and the snow lies a foot deep in the valley of the Upper Rhone, a state of things unknown in the middle of September.

STEPS are being taken to promote the construction of a new railway through Crowle, Epworth, and Owston, in Lincolnshire, and application will be made to Parliament in the coming session for the necessary powers. The new line will run through the most fertile portion of the Isle of Axholme, which at present has no railway facilities. The population of the district is over 10,000, and the railway will open up communication with the markets of South and West Yorkshire.

THE Board of Trade inquiry into the explosion and collision which took place on the 1st inst. on the North British Railway near Dunbar station, when the boiler of a powerful goods locomotive burst in ascending a gradient of about 1 in 90, killing three men and causing great destruction of stock, which was increased by collision of a second goods train into the *débris*, is adjourned to the 28th inst., when Major-General Hutchinson will again take evidence.

SEVERAL American papers have lately given expression to the opinion that "the time is not far off when every locomotive drawing a passenger train on every busy railroad will have a pilot. This pilot will have no more to do with the engine itself than the pilot of a ferry-boat. His duty will be to simply look ahead and communicate with the engineer in the cab." On most American country railways there is more chance of obstruction than on our lines, but if a look-out man is required, surely one is wanted on some of our London and suburban lines.

RAILWAY matters had chiefly occupied the attention of the Victorian Parliament during the fortnight prior to the departure of the last mail. The following lines have been agreed to:—Bacchus Marsh to Gordons, Avoca to Ararat, Camperdown to Kerang, Cliftonhill to Royal Park, Dandonong to Cranbourne, Domboola to Tarranginnie, and from Creswick towards Daylesford. The Government have undertaken to let contracts in Victoria for seventy-five engines, and intend sending to England for twenty-five. This, the *Colonies and India* says, will be opposed by Mr. Berry, who will move an amendment that all the engines shall be of Victorian manufacture.

SOME interesting details have been published with respect to the value of the mid-day express train from New York to Detroit, and it is stated that this train is a fair representative of the fast express trains on the leading American railroads. The engine and tender were appraised at £2100; the baggage car, £200; the postal car, £400; the smoking car, £1000; the two ordinary passenger cars, £2000 each; and three palace cars, £3000 each—total, £16,600. This estimate is regarded as beneath rather than over the mark for a fast express, as some of them, containing more cars, are worth £20,000 at least. The palace cars, put down at £3000 each, are in many cases worth an average of £3600. The cars first came into use soon after the sleeping coaches, the first being used about twenty years ago. In certain cases the cars have cost as high as £5000, and £6000 where the interior workmanship was very elaborate. A very comfortable dwelling may thus be built for the cost of an ordinary passenger car, and the question arises how and at what point such luxurious travelling becomes remunerative to the railway companies.

THE Board of Trade returns of accidents and casualties reported by the several railway companies during the first quarter of this year show that there were reported 365 failures of tires, 108 of axles, and 148 of rails. Of the 365 tires which failed, 14 were engine tires, 7 were truck tires, 3 were carriage tires, 10 were van tires, and 331 were wagon tires; of the wagons, 283 belonged to owners other than the railway companies; 312 tires were made of iron and 53 of steel; 18 tires broke at rivet holes, 50 in the solid, 3 at the weld, and 294 split longitudinally or bulged. Of the 108 axles which failed, 65 were engine axles, viz., 61 crank or driving and 4 leading or trailing; 8 were tender axles, 31 were wagon axles, and 4 were axles of salt vans; 11 wagons, including the salt vans, belonged to owners other than the railway companies. Of the 61 crank or driving axles, 34 were made of iron and 27 of steel. The average mileage of 30 iron axles was 199,578 miles, and of 26 steel axles 190,581 miles. Of the 148 rails which broke, 90 were double-headed, 51 were single-headed, and 7 were of the bridge pattern. Of the double-headed rails, 70 had been turned; 58 rails were made of iron and 90 of steel.

THE following information respecting car wheels and car wheel iron has been published by Messrs. Whitney and Sons, of Philadelphia, makers of wheels. Concerning the Hamilton process, which consists of melting together charcoal and anthracite pig irons with Bessemer steel ends, the firm claims:—"It has been fully demonstrated that the use of steel brings into service many charcoal irons that would not otherwise be available for making wheels on account of their deficient strength or absence of chilling qualities, that a percentage of anthracite or coke irons may be used without impairing the strength or durability of the wheel, and that steel is better than white iron to bring up the chill in any wheel mixture." The greatest recorded mileage made by Whitney wheels, with the use of steel, is 178,000 miles, and this is the greatest mileage on the Pennsylvania railroad wheel records up to 1876. It is probable that since that time a much higher mileage has been obtained of which there is no accessible record. Memoranda of tests of wheel mixtures of charcoal irons and steel, wrought and anthracite iron are added thereto:—

Charcoal with	Tensile per sq. inch.	Transverse.	Deflection.
2½ per cent. steel	22,467	7925	·00157
3¾ per cent. steel	26,733	9538	·00185
6¼ per cent. steel	24,400	7938	·00218
6¼ per cent. anthracite			
7½ per cent. steel	28,150	9425	·00224
7½ per cent. anthracite			
2½ per cent. steel			
2½ per cent. wrought iron	25,550	8750	·00221
6¼ per cent. anthracite			
5 per cent. steel	26,500	8200	·00284
5 per cent. wrought iron			
10 per cent. anthracite			

The deflection is given in decimals of an inch per 1000 lb. of load. Transverse strength is reduced to show weight required to break a bar 1in. square, supported at one end, the weight being applied 1in. from point of support. The average tensile strength per square inch of charcoal irons used for car wheels is 22,000 lb.

NOTES AND MEMORANDA.

THE longest span of telegraph wire in the world crosses the river Kistnah, India, between two hills, 1200ft. high, and is 6000ft. in length.

A PARISIAN chemist, M. Lacroix, has succeeded in making pencils of vitrifiable colours for drawing on roughened glass or biscuit.

ACCORDING to M. Emile Lacoine, the increase in the temperature of an electric conductor of given sectional area is less in proportion to the increase in its length.

A NEW determination of the mechanical equivalent of heat has been made by Signors Cantoni and Gerosa by different methods; the mean of their results confirms the accuracy of Joule's equivalent of 772 foot-pounds.

A NEW building material has been found at Suva, Fiji. The *Sydney Morning Herald* says it is called by some "fossil coral," and is found on a small island in the Bay of Suva; *in situ* it is soft, and easily cut into cubes; on exposure it hardens, and looks very much like fire-brick. It has stood satisfactorily the tests applied to it during the short time it has been known, and a large order is given by the Fijian Government for cubes of it. It may be decomposed coral which has become indurated, but it is worthy of the attention of geologists.

THE *Comptes Rendus* contains an account of a new application of the microphone to the determination of the position of nodes and ventral segment in columns of vibrating air by M. Lerri-Carpi. The microphone is mounted on an elastic membrane stretched over a little drum, and then lowered into the sounding pipe. When the apparatus came to a node, the telephone in circuit with the microphone gave out a rumbling sound, similar to that caused by an induced current. On the other hand, when the microphone passed a belly the sounds became very faint and rare, while at intermediate points they increased or diminished, according as the microphonic sounder was brought nearer to a node or a belly. It is believed that the microphone may thus be made useful as a detector of fire-damp in mines. According to some observers such explosions are always preceded by undulations too feeble to be detected by the human ear, but they would be revealed by a system of microphones placed at intervals throughout the mine.

THE British Iron Trade Association statistics of the production of pig iron for the half-year ending June 30th, 1882, shows that the production of pig iron during the half-year ending 30th June, 1882, in Cleveland, was 1,332,543 tons, while that for the half-year ending 31st December, 1881, was 1,310,490 tons; the production in Scotland during the same period was 556,600 (estimated) tons and 604,578 tons respectively; that of West Cumberland was 472,038 tons and 545,770 tons; of South Wales, 476,536 tons and 425,476 tons; of North Wales, 25,672 tons and 17,063 tons; of South Staffordshire, 190,442 tons and 225,586 tons; of North Staffordshire, 157,386 tons and 151,761 tons; of Lincolnshire, 102,861 tons and 77,837 tons; of Lancashire, 392,668 tons and 359,096 tons; of Northamptonshire, 90,475 tons and 105,776 tons; of West and South Yorkshire, 151,096 tons and 176,171 tons; of Derbyshire and Notts, 228,653 tons and 179,755 tons; of Shropshire, 39,275 tons and 37,835 tons; of Gloucestershire, Wiltshire, &c., 25,000 tons and 32,000 tons, making the totals 4,241,245 tons in the half-year of 1882, and 4,249,194 tons in the corresponding half-year 1881. Of the whole production it will thus be seen that Cleveland has to be credited with 31·4 per cent.

A STEP of some importance apparently has been made in the art of polychromatic printing by the invention of Herr F. C. Hoesch, of Nuremberg, of a new method of producing what are in effect photographs printed in colour of pictures, vases, or other objects for art or commercial purposes. In this process, named Hoeschotype, six photographs of the subject to be reproduced are taken of the size required, and the artist, having made a colour plan on one of them, proceeds from this to plot out, as it were, on each of the other five a separate colour scheme, painting out the part which is not to appear in the impression from that particular plate. This part of the process, however, differs essentially from the preparation of a stone for chromo-lithography, as five plates suffice for the reproduction of any work. The impression from each plate looks at the first glance like a copy in monochrome of the original, though, on a closer inspection, it can be seen that portions in each remain uncoloured. One is in yellow, one in red, one in blue, one in neutral or modulating tints, and one in brown, each colour appearing in several shades. The impressions exhibited are printed direct from sensitive gelatine plates, on which the portion of the photograph required to be preserved has been rendered insoluble by exposure to light, the peculiar treatment of the gelatine being part of the invention. For the printing a lithographic press is used and fine and smooth inks.

IN a lecture, "On the Excitability of Plants," delivered at the Royal Institution, Professor Burdon Sanderson said "that the mechanism of plant motion is entirely different from that of animal motion. But obvious and well-marked as this difference is, it is nevertheless not essential, for it depends not on difference of quality between the fundamental chemical processes of plant and animal protoplasm, but merely on difference of rate or intensity. Both in the plant and in the animal, work springs out of the chemical transformation of material, but in the plant the process is relatively so slow that it must necessarily store up energy, not in the form of chemical compounds capable of producing work by their disintegration, but in the mechanical tension of elastic membranes. The plant cell uses its material continually in tightening springs which it has the power of letting off at any required moment by virtue of that wonderful property of excitability which we have been studying this evening. Animal contractile protoplasm, and particularly that of muscle, does work only when required, and in doing so, uses its material directly. That this difference, great as it is, is not essential, we may learn further from the consideration that in those slow motions of the growing parts of plants which form the subject of Mr. Darwin's book, 'On the Movements of Plants,' there is no such storage of energy in tension of elastic membrane, there being plenty of time for the immediate transformation of chemical into mechanical work."

THE agricultural returns for Victoria for the year ending March 31, 1881, were:—Number of holdings, 49,505; extent of land in occupation, freehold, 9,656,879 acres; rented, 1,935,507 acres; total, 11,592,386 acres; land under tillage, 1,993,916 acres. Wheat occupied 976,416 acres, produce 9,719,049 bushels, average yield 9·95 bushels; oats, 133,910 acres, produce 2,358,459 bushels, average yield 17·61 bushels; barley, 68,480 acres, produce 1,063,751 bushels; maize, 1769 acres, produce 49,299 bushels; rye, 1569 acres, produce 13,978 bushels; peas and beans, 23,288 acres, produce 401,922 bushels; potatoes, 44,773 acres, produce 124,706 tons, average yield 2·79 tons; turnips, 460 acres, produce 1932 tons; mangold wurzel, 1281 acres, produce 12,605 tons; beet, carrots, parsnips, 348 acres, produce 2403 tons; onions, 1056 acres, produce 4979 tons; hay, 249,424 acres, produce 300,184 tons, average yield 1·20 ton; green forage, 9617 acres; permanent artificial grasses, 253,825 acres; chicory, 230 acres, produce 960 tons; grass and clover seeds, 2812 acres, produce 26,290 bushels; hops, 428 acres, produce 2744 cwt.; tobacco, 1990 acres, produce 17,333 cwt.; vines, 4980 acres, produce 24,817 cwt., and made into brandy 79,045 cwt.; wine produced, 414,028 gallons; brandy manufactured, 3038 gallons; other crops, 984 acres; gardens, 12,487 acres; orchards, 9788 acres; land in fallow, 194,001 acres. As compared with the previous year there are increases in the yield of wheat of 320,191 bushels; of hay, 7777 tons; of hops, 204 cwt.; of tobacco, 16,036 cwt.; and grapes, 8547 cwt.; and decreases in all others, namely, oats, 1,664,812 bushels; barley, 1679 bushels; maize, 12,588 bushels; rye, 4429 bushels; peas and beans, 173,032 bushels; potatoes, 43,23 tons; turnips, 122 tons; mangold wurzel, 2292 tons; beet and carrots, 101 tons; onions, 2368 tons; chicory, 804 tons.

MISCELLANEA.

THE partnership between Messrs. Proctor and Cobham in the business carried on at Stevenage under the name of Proctor and Co. has been dissolved, and the business will be carried on by Messrs. Cobham and Co.

THE De Lank granite quarries, now called the Eddystone granite quarries, are in full work on contracts for the supply of granite to the Trinity House for the new Bishop's Rock lighthouse, and from the Admiralty for a dock at Haulbowline.

AT Pittsburg, U.S., after sixteen weeks' strike and the loss of ten million dollars in wages, the iron strikers have accepted the old wages, and there is an immediate and general resumption of work. This is the first defeat of this powerful Union, and the cause is a conflict of interests between the different classes of workmen.

MESSRS. JAMES E. AND SAMUEL SPENCER, of Queen-street-place, E.C., have been awarded a medal for tubes and fittings and other appliances at the International Electric Light Exhibition, recently held at the Crystal Palace. Messrs. Spencer received the only gold medal awarded for tubes at the Melbourne and Sydney Exhibitions.

FROM a statement made by Sir William G. Armstrong during the course of his speech at the inauguration of the North-East Coast Exhibition, Tynemouth, it appears that his firm is about to be amalgamated with that of the well-known shipbuilders Messrs. Charles Mitchell and Co., and that by this act the two greatest yards on the Tyne come under one government, the style and title of which is not yet officially stated.

THE Local Board of Smethwick, near Birmingham, are seeking powers to borrow an additional £50,000 for the extension of the gasworks, and an inspector to the Local Government Board has just held an inquiry into the application. The Board have already spent £129,000 on the works. The consumption at the present time is 112,000,000ft. per annum, and there has been an increase in the consumption this year, as compared with last, of 23 per cent.

THE current number of the *Journal* of the British Association of Mining Students, the home of which is in Chesterfield, contains papers on Fire-clay workings in Leicestershire, by W. S. Gresley; Short chronological notes on coal mining, by W. C. Blackett, jun.; Cause and prevention of underground fires, by T. Bertram; Safety lamps and the lighting of mines, by C. J. Murton, and an index to vol. vi. The association is doing good work, and it would be to the benefit of all young engineers of the district to join it.

AT a meeting of the North Moor Spinning Company on Monday evening, one of the principal modern concerns in Oldham, the chairman, Mr. Daniel Marsland, moved a resolution in favour of the proposed ship canal between Liverpool and Manchester. He said that about £3,000,000 was paid annually in carriage, and by the ship canal nearly one-half of this sum would be saved. The project was especially interesting to limited spinning companies, who ought to give it their support. The resolution was carried unanimously.

OUR Birmingham correspondent writes:—"A general desire seems to exist, which it is believed is entertained by all who have seen the electric light in operation at the Town Hall in Birmingham, last week found public expression in the suggestion that arrangements should be made with Messrs. Winfield and Co., who, as was last week pointed out, illuminated the Hall upon Messrs. R. E. Crompton and Co.'s system free of charge, to allow the fittings to remain in their place until the Town Council has had an opportunity of considering whether electricity should not be adopted as the permanent means of lighting the hall upon all occasions when the tenants are prepared to pay the cost. It is very probable that this suggestion will be acted upon."

ASTRONOMICALLY, the tides along the east coast, from September 27th to September 30th, will be as high as those which proved so disastrous on February 19-20th last. It should be remembered that a low barometer, with northerly to north-westerly winds, will considerably augment the heights of these tides, and render it necessary for those living near the banks of the Thames to take precautions against an overflow. The highest tide at London Bridge will occur on September 29th. At Liverpool the predicted height—old Dock Sill datum—for the morning tide of September 29th is nearly 22ft. Should there be a moderate gale from the west or south-west, the low-lying parts of Liverpool and other places along the west coast will be probably flooded.

THE question of electric lighting is rapidly assuming shape. A meeting of the Sheffield Town Council was held on Wednesday, when no less than six companies gave notice of their intention to apply to the Board of Trade for provisional orders to supply electricity for lighting purposes within the borough. The Corporation are determined that no outside companies shall obtain a footing in the town. They accordingly expressed by resolution their intention to oppose the granting of any provisional order to these companies, and as local authorities have the preference granted them by the Board of Trade, they mean themselves to take advantage of the powers created by the Electric Lighting Act, 1882. All the necessary proceedings are to be taken to put the Council in a position to supply the electric light, but it is very possible that the enormous cost, coupled with the experimental character of the undertaking, will deter them from taking any practical measures—at any rate, for the present.

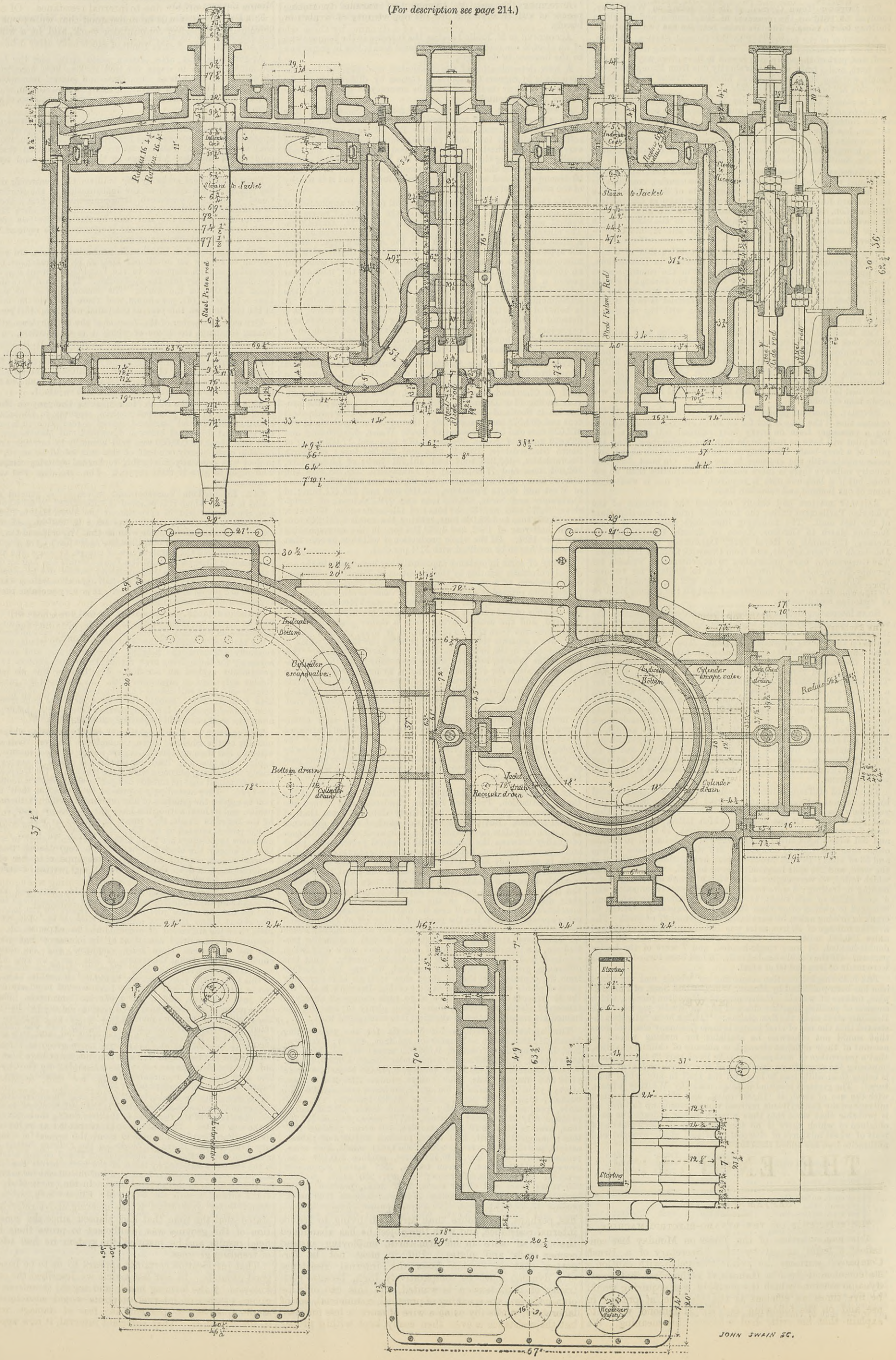
THE half-yearly meeting of the Tees-side Iron and Engine Works Company, Limited, will be held at Middlesbrough to-day, and the directors have just issued their report for the half-year. The report states that the company's position has changed very little since the statement of accounts was issued in March. The company has benefitted somewhat by the increase of business, and has had its works more fully employed, and the directors confidently expect that the results of this year's working will be more satisfactory than the last. There is no balance-sheet made at this time of the year, however, therefore no definite statement can be made. The blast furnaces have worked regularly during the past half-year, and a fair profit has been made. There is every prospect of their doing well during the present half-year. The rolling mills have not done so well so far, as low prices have ruled, wages have advanced, and the regular work was disturbed by the strike. It is expected, however, that a better result will be shown at the end of the year. The engineering and foundry department has been kept well at work, but prices have been very low, and the directors are not sanguine that they can show a profit. The firm has been remarkably fortunate in trading, and have escaped all bad debts except about £200.

CONSIDERABLE uneasiness is felt in and near Hammersmith with respect to the accommodation which it has been proposed to afford the inhabitants of the two sides of the river during the construction of the new bridge. The traffic is so great that it may be hoped the Metropolitan Board will be able to grant the request for a temporary bridge. The Board of Works for the Fulham district have presented a memorial to the Metropolitan Board calling attention to the statistics collected by them of the traffic across the bridge, and point out the complete inadequacy of the scheme for providing for this traffic by means of ferry-boats. In the course of six days of the present month the day traffic amounted to 54,434 foot passengers, and 8705 vehicles, and the contention of the Fulham Board is that, taking the working hours of ferry-boats of the description and capacity specified by the Metropolitan Board as twelve and a-half hours per day, that being the period from sunrise to sunset, they would have conveyed in the six days above referred to 10,800 foot passengers only, leaving 43,634 persons unprovided for; while no provision at all was made for the 8705 vehicles passing during the same period. It is necessary to add that the specification provides that the two ferry-boats shall each be capable of carrying twelve persons, and shall cross the river every ten minutes between sunrise and sunset, unless prevented by thick fogs or floating ice.

ENGINES OF THE S.S. LEERDAM.—DETAILS OF CYLINDERS.

THE NETHERLANDS STEAMBOAT COMPANY, FYENOORD, ROTTERDAM, ENGINEERS.

(*For description see page* 214.)



JOHN SWAIN SC.

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NEW YORK.—THE WILLMER and ROGERS NEWS COMPANY, 31, *Beekman-street.*

TO CORRESPONDENTS.

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

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

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

S. B.—*Apply to the Secretary, International Fisheries Exhibition, 24, Haymarket, S. W.*

B. AND B.—*Railway speeds are not regulated by Acts of Parliament. The ordinary English gauge is 4ft. 8½in.; the Great Western broad gauge is 7ft.*

R. M. S.—*There is no special treatise on rudders and steering gear. They are generally dealt with in works on naval architecture, such, for instance, as Sir E. J. Reed's.*

W. A. (Blackburn).—*We are unable to supply any information concerning Mr. Gamgee's zero-motor. Possibly some of our American readers can say what steps Mr. Gamgee has recently taken to reduce theory to practice.*

W. A.—*Joy's valve gear is patented. We do not understand the gear you have sketched, nor have we ever seen anything like it. It seems to be a combination of three or four different gears. There are at least a dozen "usual" methods of getting a governor to act on a slide valve spindle.*

HEAT (Chapeltown).—*The water in the tank would absorb heat until it attained the temperature of the greenhouse; but this once done it would absorb no more heat, nor would it require any expenditure of heat to maintain its temperature. If the temperature of the air fell below that of the water, the latter would give out heat again, and so tend to equalise the temperature. Your tank will hold 750 lb. of water, and to raise this from 32 deg. to 80 deg. would require 36,000 units, or about as much heat as can be got in practice from 5 lb. of coal burned in a good boiler. A treatise "On Heat," by Thomas Box, will supply you with full information on such questions as those you raise. The price is, we believe, 6s. You can obtain it from Messrs. E. and F. N. Spon or through any bookseller.*

STEAM JET AIR EXHAUSTERS.

(To the Editor of The Engineer.)

SIR,—Can any of your correspondents tell us whether steam jet air exhausters made on the principle described by Dr. Siemens in the "Proceedings of the Institution of Mechanical Engineers in 1869," are to be had from any manufacturers? K. AND S.

Dublin, September 20th.

FELL LOCOMOTIVES.

(To the Editor of The Engineer.)

SIR,—In reply to inquiry in your issue of Sept. 8th, *re* the above, either the Fell or the Wilkinson type of locomotive will do what your correspondent asks, and both systems are built by Messrs. Black, Hawthorn, and Co., of Gateshead-on-Tyne. JAMES MELLING.

Dashwood House, New Broad-street, London, September 12th.

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

MEETING NEXT WEEK.

ASSOCIATION OF MUNICIPAL AND SANITARY ENGINEERS AND SURVEYORS.—Northern district meeting, to be held at Tynemouth on Wednesday, 27th September, 1882. The members will assemble at 11.30 in the Council Chamber, Saville-street, North Shields. Those who purpose attending the meeting are desired to indicate the same by post card addressed to Mr. P. W. Thomson, C.E., District Honorary Secretary, Willington Quay, Northumberland. The following papers will be read and discussed:—Résumé of discussion on paper "On Private Improvement Apportionments," by Mr. Jas. Hall, Borough Surveyor, Stockton. "The Operation of the Canal Boats Act," by Mr. E. C. B. Tudor, C.E., Surveyor to the Goole Local Board. During the day the new Coble Dene Dock Works and Pier Works, by the courtesy of Mr. P. J. Messent, the Engineer to the River Tyne Commissioners, will be thrown open to the members. The Naval and Engineering Exhibition, the largest and most interesting of its kind ever held, is also open, and well worth visiting.

THE ENGINEER.

SEPTEMBER 22, 1882.

THE EFFICIENCY OF THE DYNAMO-ELECTRIC MACHINE.

THE money article of the *Times* on Monday last contained a letter signed by the "Secretary of a Brush Company," warning the public to receive with caution a statement made by Mr. Hammond to the effect that a new dynamo machine which the company was acquiring would be five times as efficient as the machine at present in use, and on the following day Mr. Hammond wrote to explain that his critic had mistaken his meaning. We are in no way concerned to set Mr. Hammond or the "Secretary of a Brush Company" right, but as it is by no means improbable that a good deal will yet be heard concerning the relative efficiency of various dynamos, it may be well to take the present opportunity of explaining what is meant by the efficiency of a dynamo by those who use the words properly. It unfortunately happens that certain words, such as "efficiency," "energy," "momentum," and one or two others, are used generally and freely in ways various and more or less vague, and we cannot undertake to say that the non-scientific portion of the public is alone to blame. In the case we have just cited, for example, it is evident that Mr. Hammond means one thing by "efficiency" and his critic quite another. Mistakes of the kind are awkward. We shall try to prevent our readers at all events from falling into errors on the subject of the efficiency of dynamos.

A dynamo is a machine by which the power exerted by a steam engine is converted into electricity, and it is known exactly how much electrical energy is equivalent to a given expenditure of power. It is also known that under no possible circumstance can we get more electrical power out of a dynamo than we have put steam power into it. Consequently, if we assume that a given dynamo gave out in electrical power 16,500 foot-pounds for every 33,000 foot-pounds put into it, then any statement to the effect that another dynamo was five times as efficient would obviously be erroneous; because to be five times as efficient as the old machine, the new machine must give out $5 \times 16{,}500 = 82{,}500$ foot-pounds per minute for every 33,000 foot-pounds put in, or, in other words, we should get 2·5-horse power for the expenditure of 1-horse power, which is an impossibility. Therefore, the maximum limit of efficiency cannot be greater, as we have stated, than that defined by the return of one-horse power in electricity for each one-horse power in steam put into it. It may be asked very pertinently, what is the limit at the other end of the scale? We cannot say how bad it is possible to make a dynamo, but we can say that if reasonable precautions are taken to secure a fair result, it is not easy to make a very bad dynamo, and the reason why will, we hope, be apparent before we have done. There are two distinct standards—primary standards—by which the efficiency of a dynamo can be measured, and we would impress on our readers the necessity of keeping these standards carefully apart. According to the first, the efficiency of a dynamo is determined by its small size, low first cost, and excellence of construction in the matter of workmanship; according to the second, its efficiency is measured by the proportion which the power given out bears to that put in.

Now there is this peculiarity about the dynamo, that its efficiency, as estimated under the second head given above, may be regarded as a nearly constant quantity, other things being equal. Thus we may have two machines apparently totally different in construction. The one will be small and compact; the other a great lumbering affair. The smaller of the two may require 20-horse power to drive it and may return 15-horse power, while the larger machine cannot use up 10-horse power; but it may be found that this machine will also give out 75 per cent. of useful effect. It is clear that under the first head given above the small machine is the more efficient of the two; but classed under the second head they are both alike efficient. It must be steadily borne in mind that when a dynamo gives a small current it is using but little power. If it gave a small current and used a great deal of power then it would be a very inefficient machine; but, as we have said before, it is almost impossible to make a dynamo which will give a small current and yet require a great deal of power to drive it. Even if such a machine were made it would work its own speedy destruction. This will be readily understood if we consider carefully what is the nature of the work done by the energy expended by the steam engine driving the dynamo. It consists in overcoming certain resistances; namely, the friction of the armature spindle in its bearings; the resistance offered by the air to the rapidly rotating armature; the conversion of power expended into electricity—how effected no one has the most remote conception—and, lastly, the power expended in overcoming the resistance offered by the dynamo itself to the passage of electricity through it. It is evident that the first-named resistances may be regarded as quite within the control of the mechanical engineer; thus no great difference need exist in the matter of journal friction between any two, or, for the matter of that, two thousand dynamos. As concerning the third or principal resistance—that due to the conversion of work into electricity—it so happens that the resistance will in all cases be the precise equivalent of the work done, and this en irely independent of the bad or good construction of the dynamo. This is a very remarkable truth, and some persons may be slow to accept it. A somewhat remote analogy, however, exists between the dynamo and a steam pump. If, of two pumps of the same size, one lifts twice as much water as the other, it will be found that the pump which lifts most water requires most power. There remains for consideration only the internal resistance of the machine. It is well known that a large dynamo will contain in its coils many miles of copper wire, but electricity cannot be made to move along this wire without some expenditure of power; and the difference between the mechanical efficiency of any two dynamos becomes mainly a question of the difference between the internal resistances of the two. If, however, the resistance be very great, the wire will become very hot, and finally the insulating material will give way or be burnt up, and then there is an end to the dynamo. Edison has, perhaps, done more than any man living to reduce internal resistance, and with this object he has abandoned the use of wire in his armatures, employing instead copper rods and plates. But it must not be forgotten that in certain cases the internal resistance of a dynamo must be comparatively high, because electricity of high tension is wanted, and this can only be obtained—we are speaking of practical, commercial, not of laboratory, work—by using a wire of more or less fineness, but the resistance is even then easily kept within proper limits. It is not our purpose here to go into details; we are only laying down general principles, and one of these is that the variations in the efficiency of dynamos are, other things being equal, entirely due to internal resistance. Of course, we assume that it will be understood that we except short circuiting, imperfect commutator work, and in a word, all sources of leakage and waste of electricity after it has been produced.

It will, perhaps, now be perceived that a great deal of inventive genius is being wasted on scheming dynamos with a view to augment their efficiency. For example, many inventors make a great point of giving such forms to the poles of the field magnets that the armature coils shall be included in the whole magnetic field; but so far as is known at present, it is a matter of not the least importance whether the whole magnetic field is cut or not. The more fully the influence of the field-magnet is exerted on the revolving armature, the greater will be the quantity of electricity produced; but the power expended will be augmented in just the same proportion. If a given electrical return is wanted for the expenditure of a given engine power, then it is a matter of perfect indifference whether the field magnets are arranged to the best advantage or not. If they are well arranged the power expended will be considerable and the return large; if badly arranged, there will be a small return and a small expenditure of power. To this statement, however, there is a qualification which must not be overlooked; the internal resistance of a dynamo may be wholly independent of the position of the field magnets, and if these last are badly arranged, nearly all the power they can give out may be absorbed in overcoming internal resistance; but this is a very extreme case not worth dwelling on. The conclusions to which we would lead our readers are: Firstly, that it is impossible to produce a dynamo which shall give a much greater electrical return for a stated expenditure of power than is now obtained from the best dynamos in the market; such, for example, as the Burgin, Edison, Brush, Siemens, and others. Secondly, that inventors who propose to make dynamos more economical of power by adopting novel dispositions of field magnets and armatures are simply wasting their time. Thirdly, that the true object for invention is the reduction of the internal electrical resistances of the machine; the diminution of the chances of short circuiting—of leaking in fact—the improvement of commutators and collectors, and the general cheapening and simplification of the whole machine. In all these latter senses the efficiency of the dynamo may be augmented. It cannot be augmented at all in the sense that, by superior arrangements of parts, more electricity can be had for a given expenditure of power. As a broad rule—to which electricians will detect the exceptions, with which engineers need not concern themselves—the dynamo will invariably, and no matter what its construction, generate an exact equivalent in electricity of the net power expended in rotating the armature. But some dynamos will waste much more of the electrical energy so obtained than others, either in internal resistance, leakage, or both.

BRIGHTON BEACH.

IN the article on this subject published in our issue of August 25th we referred to the success which seemed to us to be attending the system of groynes which has been adopted with the view of staying the inroad of the sea at Hove. Unfortunately, as we now learn, a violent storm has given to these works a very severe testing, and, as the formation of beach we described as in progress was at the time quite in an early stage, it proved to be insufficient to arrest the action of the waves upon the shore, and not only was a considerable amount of the beach already collected washed away, but a great deal of damage was done to the walks of the esplanade. The storm to which this damage was due was, to use the words of a contemporary, in some respects "almost unparalleled in this part of the country." It was, in fact, the same storm which we have recently referred to as having produced such regrettable results at Hastings. The effects at Brighton appear to have given rise to alarm among the municipal authorities of its Hove district, and we learn that a special meeting was summoned to receive a report from Sir John Coode—an authority whose weight on such subjects is unquestioned.

In our earlier articles dealing with this topic we have suggested that it was possible that the expense of a sea-wall would be but little, if at all, in excess of that involved by the extensive groyning works which have been executed, and it is satisfactory to find our opinion as to the greater desirability of the former supported to some extent by Sir John Coode, who considers that even now some such protection is desirable. The Works Committee, however, appear to think that the large cost involved in Sir John's proposals—some £15,000 beyond what has already been spent—is greater than could be afforded, and it was consequently determined that three more groynes should be erected and one of the present groynes lengthened, at a cost of £2800, that course being recommended by the surveyor to the municipality. There is, we find, considerable divergence of opinion as to the desirability of constructing these new groynes at the angles with the shore line which have been adopted by Mr. Ellice-Clark, and Sir John Coode decided that they should be placed at right angles with that line. This decision would appear to indicate that the latter gentleman does not share in the view taken by us of the efficiency of the system of trending groynes. We are, however, without any information as to the reasons which have led him to this conclusion, if, indeed, it be correct that he entertains it. Mr. Ellice-Clark, we understand, when questioned at the meeting above referred to, stated that the time that had elapsed since the construction of the groynes was insufficient to prove their beneficial results, and he justified the system he had adopted of trending groynes.

That justification certainly appears to us to be based on good grounds. In our last article we described the course followed by the forming beach, and argued therefrom that, given a sufficient interval, deposits would accumulate in ample quantity to prevent any fear of damage arising to the foreshore. That sufficient interval, it now appears,

has not been afforded, and the destructive action of the sea has been such as we pointed out would arise if a severe south-westerly gale attacked the shore before its natural defence could fully accumulate. But we certainly think due consideration should be given to Mr. Ellice-Clark's opinion—which is concurrent with our own—that his groynes would, in course of time, give the favourable results he anticipated for them. It is only natural that in the presence of actual damage the authorities should feel some alarm, and be indisposed to await such results; but measures of a character sufficient for temporary protection might be adopted to afford time for the beach to form without at once incurring a large expenditure, which may be found in the future to have been needless. We observe that one member of the Commission suggested that the beach should be "backed up by chalk and clay." This recommendation certainly seems to be of an extraordinary character, for if the beach be wanting in quantity to keep the sea from reaching the esplanade, it would undoubtedly attack the "chalk and clay"—two substances which would of all others disappear most rapidly when exposed to the action of water in motion. The coast line of Sussex does not, we believe, afford many opportunities of obtaining stone of size sufficient for a temporary footing to the parade of *pierre perdue*, but blocks of bêton might be rapidly made, which, if thrown at the base of its slopes, might thoroughly protect them until Mr. Ellice-Clark's groynes have had fair play; for, in spite of what has occurred, we still hold to the opinion formed on the occasion of our last visit that there was every indication of a satisfactory deposit of shingle being ultimately obtained through their agency.

For temporary purposes it is remarkable how easily protection can be afforded to threatened points. It has occurred within our own experience that where portions of a sea wall had been battered down, a temporary wall of heavy sandbags, with a footing of loose stone of comparatively small size to prevent undermining, held a heavy broken sea at bay for several weeks. We cannot, therefore, refrain from the suggestion that some such course as we have indicated should be tried before the experiment now being tried at Hove should be held to have failed. The conclusion that it has failed appears to us to be due to a feeling somewhat akin to panic, and if that feeling results in hasty additions of further defensive works before the effect of those already erected has had time to develope, it may prove to be a source of much after regret. At the same time it may well be that a sea wall with, perhaps, short groynes to secure a small footing of beach, might have proved in the long run better economy and of greater efficiency than the system of long groynes which has been carried out. Anyway, everything we hear strengthens the ground of protest we originally put forth that shore defence should be a matter for Imperial control, for at the recent meeting we observe one member attributed this last disaster to a further erection of groynes to the westward outside of the municipal jurisdiction. Where, as we have before argued, is such a system of attack and defence to end?

THE ROYAL AGRICULTURAL SOCIETY'S TRIALS OF HAY AND CORN-DRYING APPARATUS.

These trials have at last come to an end. The hay and corn ricks have been sold, the quality of their materials examined, and the report of the judges on the whole business has been presented, and we give it on another page. This report shows that the judges entertain but a very low opinion of the work performed by any of the systems of cooling, for they think that equally good hay might have been made without them. For a very considerable part of the time during which the cut crop was lying on the meadows the weather was nearly as bad as it could be, but there is little doubt that tolerably good products might have been obtained had these crops been treated as a farmer would have treated them under the circumstances. This, moreover, is confirmed by the fact that those ricks which were cooled by powerful fans were no better than those cooled by the smaller fans. In another column we publish a letter from Mr. Greening, one of the inventors of the hand fan with the sun-and-planet and other gear for obtaining a high speed by hand, from which it will be seen that he considers that the prices realised for the hay when sold by auction afford a critical test of the value of the work done by the different exhaust fans. This, however, is not the case, as may be gathered from the following extract from the Reading *Observer* account of the sale:—"The ricks, ten in number, were sold as they stood; but the Royal Society stipulated that the hay is to be cut out for examination by the judges within a week. There was not a large attendance, and some of the ricks went at ridiculously low prices. The first lot, a stack, the produce of about 12 acres, was sold for £12 10s.; No. 2, a very heavy crop, about 5 acres, £16 10s.; No. 3, the produce of about 7 acres, a heavy crop, £14 10s.; No. 4, a very heavy crop, about 5 acres, £13; No. 5, about 10½ tons, £21; No. 6, about 3 tons, £3; No. 7, about 17 acres, £26; No. 8, a very heavy crop, about 6 acres, £19; No. 9, a very heavy crop, about 7 acres, £19; No. 10, about 6½ acres, a good crop, £24 3s." It is clear from this that the prices realised afford very little clue to the value of the work done by the fans, and the difference in the quality of the product in the same ricks points to one conclusion of importance, namely, that to obtain the best results the ricks must be made with the greatest care so as to secure tolerably uniform density in all parts of the rick, otherwise only the less dense parts are well aërated by the fans, which will draw the air through those parts through which it passes most easily. Several of the trial ricks were so badly built that much care had to be exercised to prevent their tumbling over, with the result, of course, that one side was densely packed while the other was loose, and where it was most dense there mouldiness was most apparent. The unequal settlement of both hay and corn ricks, and the unequal quality of the hay crops before making into ricks, make it impossible, from the prices realised, to make any deduction as to the work done by the fans, even if the prices really represented the value of the material paid for. Some of the barley is considered worth malting, some good quality for distilling, and some very bad; but as it was stacked in very different conditions, and some stacked very badly, the general result of the work done by the fans seems to indicate that the fans were like "a chip in porridge, neither good nor harm," and taken altogether the results of the trials may be said to be fairly summed up by the *Observer* above quoted, which says:—"So far as we can learn, farmers generally are certainly adverse to the system and consider the trials a failure. They are, however, willing to admit that in case of great necessity the fans might be made of use. For instance, should wet weather set in just previous to the carrying of the crop, the produce might be stacked and the fans set to work to prevent heating, and so save the crop. But to take the corn or hay straight from the machine and stack it at once, and set the fans to work upon it to dry it properly, is in the opinion of many impossible. It is admitted that the fans will keep down the temperature and prevent firing, but the general opinion is that the air pumped into the ricks does not pass through the centre of the sheaves, or the hay when firmly set, and cannot therefore dry the rick properly. A very great objection to the fans is the long time they take to get a stack into a safe and tolerably even temperature." Those who have followed the trials have seen that artificial haymaking was not carried out under the best circumstances at Reading. None of the ricks were as well made as they would have been in ordinary farming, and this alone vitiated the results. At the same time it was generally observed that the exhibitors of the fans entered for trial seemed to wait for the sun almost as much as a farmer would have done before artificial methods were thought of. Forcing air through the ricks from within outwards has been discarded in favour of drawing air through the ricks from without; but it is not at all improbable that if artificial methods are to be made a success, it will be by forcing air, deprived of all moisture and perhaps heated, through the ricks from within outwards.

CHESHIRE SALT MINES.

The report of the Chief Inspector of Mines in regard to the condition of the salt mines of Cheshire has had far too little attention bestowed upon it. Mr. Dickinson traces at length the condition of the salt districts of Lancashire and Cheshire, and describes the positions, the strata, and the means of carrying away the salt, at some length. It is stated in the report that there are eleven rock-salt mines, two of which are in Ireland, as well as several not now in operation. In addition there are numbers of brine pits of two kinds—one to the top of the rock-salt and the other down to the inundated old rock-salt mines. The Winsford district is the centre of the trade—ten pits being on the western side of the river Weaver and eighteen on the eastern side of the river. The production of white salt from brine alone is stated to have been 1,854,000 tons, all except 224,000 tons in Cheshire; and of rock salt last year a total of 197,631 tons is recorded. It is stated that there is a probability of the lessening of the quantity of salt made from brine, because in the newer process of the production of chemicals brine is being increasingly used. At the same time, in the newest of the salt-producing districts—that of South Durham—there is now begun the production of salt on a large scale, and on a scale that is likely to be very considerably increased; and thus it must be supposed that there will be in the immediate future an increase of the tonnage of salt produced. But there seems to be little doubt that the production of soda by the ammonia process—that which uses brine—will increase, whilst should this be the case it is to be expected that it will be at the cost of the older process, and, therefore, less salt will be used for the production of soda and more brine will be used. It is tolerably certain that there will have speedily to be legislation as to the effects of the subsidence of ground in the neighbourhood of the brine pits, but should this be the case it is probable that it would take ultimately the effect of reducing the royalties that are levied on the production of salt or rather on the quarrying of salt or the pumping of the brine from which salt is produced. Large areas are being lost and have been lost from the subsidence of land, and though there is produced a valuable commodity, it is not likely that the Legislature will long allow that loss of land to take place without trying to prevent it, and in some way a proposal will come before it. What shape that may take is as yet uncertain, but the growth of the salt industry in South Durham, its proposed commencement right under the town of Middlesbrough, and the importance that attaches to it, are features that will speedily bring the question up again and again till it is satisfactorily dealt with.

THE RAILWAY RATES FOR COAL FROM YORKSHIRE TO LONDON.

The important and long-vexed question relating to the cost of conveying inland coal to London by rail has been again revived by the meeting held in Sheffield on Tuesday last, which was brought about by the Great Northern directors refusing to make any reduction in the rates. The question is one which has occupied the attention of Yorkshire coalowners for a long series of years, and various schemes have been resorted to in order to open up a new route or bring down the rates. At the present time, when the question is creating so much interest, not only in Yorkshire, but also in Derbyshire, it may not be without interest to state that in 1852 the Great Northern carried more than one half of all the coal conveyed to the metropolis by rail. In the year 1860 the quantity had fallen to about one-third; in 1872 it had so far decreased that the company only carried about one-fifth. From 1852 to 1858 the two great carrying companies were the Great Northern and the London and North-Western. The Midland, however, entered the field of competition in 1859, in which year it carried only 39,570 tons, a very small portion of which was taken from Yorkshire collieries. In 1871 the Midland carried more than either of the two other large companies, and since then it has gone on improving, whilst the Great Northern, which conveys most of the coal from South Yorkshire, has exhibited a falling off. The coalowners hold that the decline is due to the high rates charged. In proof of this they point out that during those years in which they conveyed the highest tonnage the rates were the lowest. The highest tonnage ever sent by the Great Northern was in 1867, when 1,065,125 tons were sent. Last year the tonnage amounted to 1,046,053, against 949,740 in the year 1880. Although nothing was officially made known relating to the decision of the meeting, the source from whence it was called shows that if possible some definite action will be decided upon in order to place the district coalowners in possession of an alternative route.

THE RIGHTS OF SHAREHOLDERS.

An important point involving the rights of shareholders in limited companies has recently been decided at Sheffield. Miss Mary Cartwright, who holds several shares in Messrs. Charles Cammell and Co., Limited, Cyclops Steel and Ironworks, applied for a list of shareholders, offering to pay "the fee legally demandable," and received a reply from the secretary to the effect that her request would be complied with "in a week or ten days." The application was made on the 30th March, and a reply was received on the 31st of March. No list of shareholders was furnished till the 22nd of April—two days after a meeting had been held to ratify a large and important purchase—the acquisition of Messrs. Cammell and Co., of the Dronfield Steel Works, and the Derwent Hematite Iron Ore Company, Workington, for a sum of £350,000. Miss Cartwright therefore summoned the Company, the manager—Mr. George Wilson—and the secretary—Mr. J. S. Robinson—and the case was heard at the Sheffield Town Hall. According to the statement of counsel for the plaintiff, Miss Cartwright was not acting in this matter on her own behalf, but as the agent of Mr. Henry Munster, who holds eight hundred shares in the company, and who is by far its largest shareholder. Mr. Munster opposed the proposed purchase, and the list of shareholders was wanted to enable him to communicate with the other shareholders prior to the meeting. It was urged for the company that the demand had not been refused, and that Miss Cartwright having asked for the list at the "earliest convenience," and not for any specific date, it was sent at the "earliest convenience." The magistrates held otherwise, regarding the conduct of the company as practically a refusal to comply with the plaintiff's request. They therefore imposed a fine of £2 and costs on the company, dismissing the summonses against Mr. Wilson and the secretary.

THE LOSS OF H.M.S. DOTEREL.

The committee appointed to inquire into the circumstances attending the explosion on board the Doterel, which led to the total destruction and loss of that ship off Puerta Menas, have been engaged during the last week at the Royal Marine Office, Spring-gardens, in compiling their report, based on experiments extending over four months. They are understood to be satisfied that the theory accepted at the court-martial, that the explosion was primarily due to the generation of gas in the coal bunkers, has not been borne out by the results of their experiments. As is pointed out, there is an essential difference between a collier laden with coals just drawn from the pit and a ship of war carrying a supply of fuel for her boiler furnaces. In the latter instance the ventilation of the coal bunkers is sufficient under the most untoward circumstances to prevent any other than a very moderate accumulation of gas. It might cause some slight explosion, but it would be quite incapable of firing a powder magazine, and in the case of the Doterel the coals had been travelling over half the world before they entered her bunkers, and were, therefore, so much the less likely to give off a dangerous amount of gas. As regards the storage of xerotine siccative, which was subsequently advanced as the cause of the explosion, it has been proved that, even assuming its presence on board the Doterel, it did not tend to bring about the destruction of the vessel. Some further and quite recent experiments of the Naval Explosives Committee, which have been carried out at Chatham, have illustrated this. Some xerotine siccative and a can of gunpowder were put on board the gunboat Bullfinch, and the former was exploded. It set fire to the ship, but did not explode the powder. It is, however, certain that the volatile paint drier was capable of bringing great danger to a ship, though there is still some mystery attaching to the disaster which sent the Doterel to the bottom of the sea.

THE THREATENED STRIKE OF MINERS IN YORKSHIRE.

Seeing that the Yorkshire Miners' Association, through its officials, took a most prominent part in the Manchester Conference, and the passing of the resolution demanding a general advance of wages or setting down the collieries, a good deal of interest is being attached to their movements. During the past and present week numerous meetings have been held in various parts of Yorkshire for the purpose of discussing the advisability of making a general demand, and of sending delegates to a large Conference to be held at Rotherham on Monday next. Seeing that there is a good deal of misapprehension relating to the Conference called by the Yorkshire Miners' Association, it may not be out of place to say that it is intended to be an open conference to all representatives who choose to attend. Admission will be by tickets, a goodly number of which have already been sent out and accepted. No programme, it is understood, will be drawn up, but the Conference will be allowed to choose its own president, secretary, treasurer, and committee for the transaction of its own business It is expected that there will be a difference of opinion, inasmuch as there are three associations, one of which has already passed a resolution in favour of 7½ instead of 15 per cent., and whilst deprecating a strike, has offered to submit the matter, in the event of the coalowners not conceding the advance, to arbitration. Some of the men are exceedingly anxious to give in their notices, and would probably strike if they saw any prospects of being supported.

LITERATURE.

A Handy Book on the Reclamation of Waste Lands, Ireland. By G. H. Kinahan, C.E., assisted by Alexander McHenry, H.M. Geological Survey. Dublin: Hodges, Figgis, and Co. 1882.

So much has been heard recently concerning the value of land in Ireland, "Earth Hunger," and the circumstance that there is not land enough in the sister isle to support its inhabitants, that the little book before us will probably be read with some care by a great many persons, and may yet be quoted in the House of Commons. The authors are both well qualified by their position and attainments to deal with the question they have undertaken to discuss. Mr. Kinahan was educated at Trinity College, Dublin; is a member of the Royal Irish Academy, and the president of the Royal Geological Society of Ireland. He is also employed on the Government Geological Survey; so is Mr. McHenry. Consequently this book ought to be satisfactory; yet it is not, and the reason why it is unsatisfactory is that the authors have apparently never dived below the surface of the stream of political economy. They jump at conclusions, and have apparently failed to see that the causes which induce any particular social condition are, as a rule, deep seated, and very often totally different in their nature from the apparent causes, which are prominent, showy, and misleading, if not absolutely untruthful. In his preface Mr. Kinahan explains how the book came to be written. In 1881 the annual presidential address to the Royal Geological Society of Ireland was "On the Waste Lands of Ireland," and he was asked to enlarge this address. The result is the book before us. It consists of 141 octavo pages, and, after the introduction, it deals with all the various classes of land which are now waste; such as foreshores and sea marshes, sand hills, land flooded by tide and river, lowland bog, mountain bog, and upland or mountain wastes. The various probable values of these lands are considered, and the means of reclaiming them, and the book will be found very handy and useful by anyone who contemplates reclaiming a tract of waste land, provided he can read it with discrimination. The instructions given for reclaiming are, on the whole,

accurate and satisfactory ; but we cannot say so much for our author's conclusions as regards the value of the land, and as this is really a most important point, we shall devote a little more space to it than the dimensions of Mr. Kinahan's book would appear to warrant.

"The last return to Parliament on Lord Cloncurry's motion gave the whole arable land of Ireland in 1880 as 15,345,598 acres, viz., under grass 12,178,933 acres, and in tillage 3,166,665 acres. According to the estimate made by Griffith there were 6,290,000 acres of waste land out of 20,330,000 acres, the latter being about the area above high-water mark at neap tides. To the waste lands may be added the foreshores above half tide, about 190,000 acres, giving a total of 6,486,000 acres. Griffith supposed half of the waste lands to be capable of being improved ; this and 600,000 acres of the foreshores will give 3,245,000 acres capable of being made more or less profitable—that is, an area equal to more than a seventh of the present surface of the island. Suppose these lands increase in value 5s. an acre, which is a low estimate, the amount gained in revenue to the country would be £811,250. Judging, however, from what our neighbours can do, the gain ought to be much greater." This passage is the key to Mr. Kinahan's book. He holds that there is a great deal of waste land in Ireland ; that there was a great deal of waste land in Holland. That the waste land in Holland has been reclaimed ; and that the land in Ireland ought to be treated in the same way, and that the same results would follow. Now, it is not to be disputed that this line of argument is taking. Its extreme plausibility makes it attractive ; and yet, when we come to examine it closely, it will be seen that there is really little or nothing in it, and that the certainty is that the £8,000,000 which our author thinks might be spent with advantage in reclaiming Irish waste land, might be spent to much better advantage on land that does not come at all under Mr. Kinahan's definition of waste land. There is nothing new about the proposal to drain Irish bogs and reclaim land from the sea. The idea has been broached over and over again. Indeed, in 1846-7-8 and 9, very large sums of money were spent in Ireland under what was known as the Labouchere Drainage Act, in draining, or trying to drain, bog land ; and Mr. Kinahan ought to have known that the result was on the whole eminently unsatisfactory It is said that Handel was once asked to report on the organ in a certain parish church, and he did so. His report was very brief. "Your organ," said he, "is now worth £100 ; you can spend another £100 on it, and then it will be worth £50." The same thing may be said of most of the bog land in Ireland. It is now worth 1s. to 5s. an acre; £10 an acre may be expended on it in drainage, &c., and then it will be worth 6d. to 2s. 6d. an acre. If Mr. Kinahan had made inquiries among the landlords who borrowed money from the Government in 1847 for reclamation purposes, he would have obtained evidence of a very practical nature, which would have led him to regard with distrust any scheme for improving true bog by draining it. He quotes a passage written by Mr. W. Kernaghan concerning the manufacture of peat fuel in Holland, and then says, "If so much can be got from the manufacture of peat fuel in Holland, the same thing ought to be done in Ireland." He totally overlooks the circumstance that all the conditions are entirely different. One most important factor in the matter is the weather, which is, as a rule, much better suited to the peat industry in Holland and Belgium than it is in Ireland. But as a matter of fact, the value of a fuel is settled by the price at which it can be made and that at which it can be sold. Now, in Ireland very large quantities of peat fuel are made ; indeed, in extensive districts the people are chiefly dependent upon it for fires. As much is made as can be used and no more, because peat, from its great bulk and low heating power, will not bear the cost of carriage over long distances. It cannot be stored in quantity in towns because it occupies too much space. It is very easily injured by the weather ; and unless kept under cover is extremely perishable. To attempt to make the manufacture of common peat fuel pay is out of the question. As regards the manufacture of compressed peat fuel, again, if Mr. Kinahan will ask for a history of the peat works at Athy, he will obtain some interesting information. If we state that over £100,000 has been spent in Ireland in the endeavour to produce either compressed fuel or bye-products, such as paraffine, from peat, we shall be under the mark. To the Athy Peat Works is due the credit of producing the first pair of paraffine candles ever made. They were exhibited in the Dublin International Exhibition of 1853, and cost, it is said, £800 each. It has been proved that a ton of compressed peat is about equal—for house fire purposes at least—to a ton of good coal ; but no one has ever yet succeeded in making it at such a price per ton and in such quantities that it could be put into the Dublin market to compete with English coal. The whole question has been discussed and brought to the test of practical experiment, not once but a dozen times, and always with the same result—the financial ruin of those who embarked in a manufacture which has no solid basis on which capital may be expended with advantage. The idea that money may be made out of peat fuel is a dangerous delusion.

Turning to another branch of the subject, we could not within a reasonable space explain fully why it is that the drainage of much of the bog land of Ireland must prove unremunerative. Mr. Kinahan has entirely overlooked the fact that it is not the presence of water only that makes the land unproductive. When thoroughly well drained, a peat bog is usually valueless for growing crops of any kind, simply because the material of which it is composed will not provide either root-hold or nourishment. When it is possible to supply lime in quantity, or limestone gravel, or earth from uplands, or large quantities of manure, then indeed something may be done; but the process is so costly ; the result, as a rule, so unsatisfactory ; the land so subject to injury, both from drought and much rain, that the reclamation of a peat bog is a most disheartening undertaking. Of course, there are exceptions, but they are very few.

But there is a great deal of land in Ireland other than bog calling for reclamation. Thus, for instance, we have many thousands of acres of land now ruined by the overflowing of rivers, and sadly in want of drainage. Here is a legitimate outlet for capital, and the little that our author says on this subject has our warm approval. But we cannot say so much for the rest of his book. We meet in every page with the expression of the most sanguine views, and in many instances we come across what we do not hesitate to characterise as reckless statements. For example, in one place we find the following passage :—"In the neighbourhood of towns sands might be profitably intaken, especially if utilised as sewage farms." This, obviously from the context, refers to sand on the seashore. Mr. Kinahan had no doubt when he wrote the Craigentinny Meadows in view ; but the notion that any large town exists on the coast of Ireland in conjunction with a stretch of sand suitable for irrigation, on which good crops could be grown, is wild in the extreme. The establishment of oyster farms can hardly be termed a work of reclamation ; but Mr. Kinahan treats it as such ; and he very strongly advocates the reclamation of land by embanking from the sea. This is a very large question, concerning which we can only say that hitherto such works have not been found very remunerative in this country. There are, no doubt, large tracts which have been won from the sea, but it is more than doubtful if they repaid those who won them for their labour and capital.

We have said that money could be laid out in Ireland to more advantage than in the way proposed by Mr. Kinahan. A large sum could be expended with the utmost advantage in the regulation of the inland waters, but a yet larger sum might be expended on refencing her fields. Mr. Kinahan calls the waste land of Ireland one-seventh of the whole. Is he aware that competent authorities state that in extensive districts just one-seventh of the whole arable land is wasted by the fences? Only those who are familiar with the country can form an idea of what Irish fences are. To level these with the ground and make new and straight fences which would be really efficient would cost a very considerable sum of money, but the outlay would be amply repaid in a few years. Of course no large sum will ever be expended in this way, but it ought to be expended.

Finally, we would not have it supposed that we deprecate the expenditure of money on the reclamation of waste land in Ireland. We do nothing of the kind ; but we hold that anything like an indiscriminate expenditure would be very bad policy. Mr. Kinahan appears to hold that there is no land now waste in Ireland on which money might not be expended with advantage. Fortunately, he will find few practical men to endorse his views. The probability is that not 3,245,000 acres, but about 1,250,000 acres of Irish land could be reclaimed with advantage. The influence of climate must never be forgotten. There are tracts on the West Coast of Ireland, for instance, which are so swept and buffeted by Atlantic storms, that even if the land were admirable it could not on the one hand grow a corn crop, nor on the other could any cattle or sheep be got to live on it. Nothing can be done with districts such as this. Again, there are peat bogs which if drained would sink many feet below the level of the surrounding country, carrying down their drains with them, and such bogs could ultimately be kept dry only by continuous pumping. It must not be forgotten that the centre of Ireland is little raised above the sea level, and that the carrying out of any comprehensive drainage scheme must be a work of great labour, demanding extraordinary skill on the part of the engineer ; and after all has been said that can be said on such questions, the whole resolves itself into this : Will the reclamation of waste land in Ireland pay ? If it could be shown clearly that it would, the capital would be forthcoming to-morrow. Not £1,000,000, but £50,000,000 could be had to carry out the work. But no one has ever yet succeeded in proving that the waste lands of Ireland as a whole were worth reclaiming ; nor will the task be easy while within a week's voyage and a two days' railway journey may be had the finest land in the world, with roads and railways and an admirable climate. The best plan is to leave the Irish bogs to themselves, and to enable those who now depend on them for a wretched subsistence to seek at the other side of the Atlantic for comfort which no such schemes as those advocated by Mr. Kinahan can ever give them. We cannot conclude our notice of his book without entering our protest against his expression concerning artificial manures. "At the same time we cannot help believing," he writes, "that the present state of the farmers is, in a great measure, due to guano and such like manures." In another place, however, he states that land has been "poisoned" by the excessive application of "natural," that is farmyard, manure. To those acquainted with the practice of agriculture in England and Ireland, both these statements will read as a joke. The notion that Irish land has ever been poisoned by over doses of manure of any kind strikes us as especially humorous.

OPENING OF THE WEST LANCASHIRE RAILWAY.

THE completion of the new West Lancashire Railway connecting Southport and Preston, which, after numerous difficulties and delays in the course of its construction, extending over a period of eight years, was opened for traffic at the commencement of the present month, was formally inaugurated at Southport on Friday. The shareholders and invited guests of the company, to the number of about 400, assembled at the Winter-gardens, and after a carriage procession through the town were conveyed by special trains, under the charge of Mr. T. Gilbert, the secretary of the company, over the new line to Preston, the journey occupying half an hour. Here a short stay was made, and the party then returned to the Winter-garden at Southport, where a luncheon was held. Mr. Edward Holden, the chairman of the Board of Directors, presided, and amongst those present were Mr. J. Dodds, M.P., Captain Aylmer, M.P., and Mr. W. Coddington, M.P. The usual toasts were given, and Mr. Dodds, M.P., in proposing success to the West Lancashire Railway, pointed out that both Houses of Parliament were now much readier than formerly to grant railway facilities to new and independent companies. He therefore urged the company not to be afraid of going to Parliament for additional powers when they were necessary, and, in addition, advised the company to pay special attention to their accommodation for third-class passengers. A special concert in the evening brought the inauguration proceedings to a close.

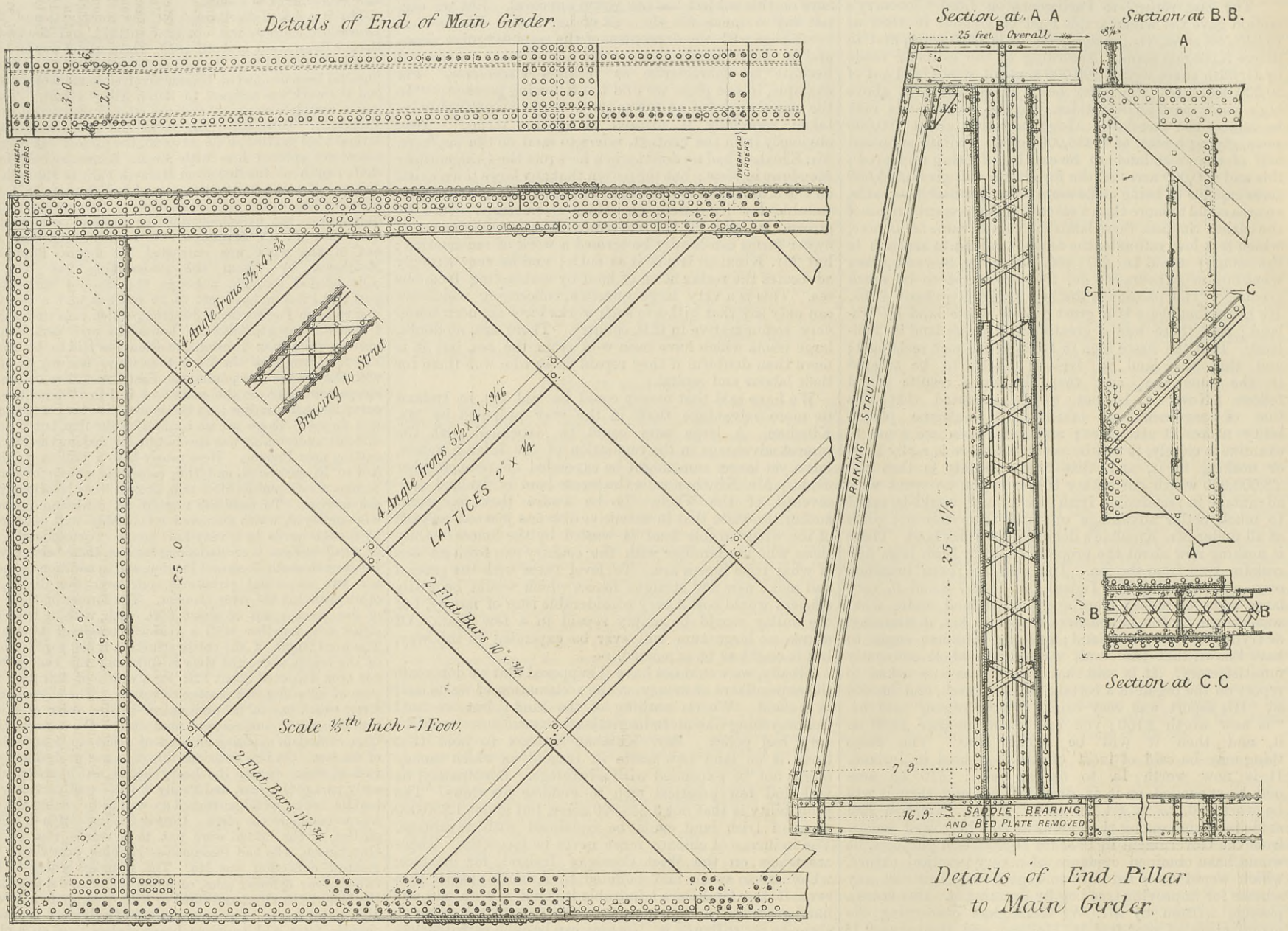
The first Act of Parliament for the construction of the West Lancashire Railway was obtained in 1871, and the first sod of the new line was cut in April, 1873. The contract was let to Messrs. Clarke, Punchard, and Co., of London, who, after a portion of the line had been completed, became involved in monetary difficulties, and the work was assigned to Baron Albert Grant. The result was a complete stoppage, and the scheme threatened to collapse altogether. Ultimately, the works and plant were bought by several local gentlemen for £10,000, the project was resuscitated, a contract entered into with Messrs. Barnes and Squire, and a short length of the line from Hesketh Park to Hesketh Bank, a distance of seven miles, was opened in February, 1878. Again, however, the works were stopped for a time, owing to financial difficulties; but eventually another contract was entered into with Mr. E. C. Maddison, of London, and the carrying out of the work was entrusted to Messrs. Braddock and Matthews, by whom the undertaking has been practically carried through, although the stations both at Southport and Preston have yet to be finished, and a portion of a branch from Penwortham Junction, which runs under the North Union Railway and joins the Lancashire and Yorkshire system, about a mile from Preston Junction, has still to be completed. The total length of the West Lancashire Railway is 15¾ miles, with the branch line joining the East Lancashire Railway. The steepest gradient on the main line is 1 in 100, and the sharpest curve 20 chains radius ; on the branch line the steepest gradient is 1 in 90. There are no tunnels on the line, but a somewhat difficult undertaking was encountered in making the Penwortham cutting near Preston. Here nearly half a million yards of soil had to be excavated, and this, consisting chiefly of clay which became a soft puddle after rain, proved very laborious work for the navvies. To facilitate matters an American steam navvy was employed, which answered remarkably well, shifting about 1500 cubic yards in twenty-four hours. A considerable number of small bridges is erected along the line, there being twenty-two between Hesketh Bank and Preston, and in addition to these there are two important structures, one over the Ribble and the other spanning the river Douglas. The former of these consists of five river spans of about 60ft. each, with a land span on either side, together with a viaduct containing twelve arches. The total length of the entire structure is 300 yards ; the height of the bridge above the river is 45ft., and the bed of the river has been deepened about 12ft. for a width of 82ft., for the purpose of affording free passage to vessels. The deepening of the river, which had to be undertaken by the order of the Ribble Conservancy Commissioners, necessitated the construction of a large cofferdam exposing an area of about 4000 superficial feet of timber. On two occasions this dam was washed away by the rush of water during the heavy floods which prevailed in the early part of the year, and finally it was found necessary to form puddle banks, which answered so well as to enable the contractors to complete the piers. During the inspection of the line the girders of the bridge were put to a severe test by General Hutchinson, who had locomotives running over them, and the greatest deflection was ¼in. The Douglas bridge is built on twenty-four cylinder piles, each one sunk to a depth of 20ft. into the bed of the river, and filled in with concrete to a level above high-water mark. The centre group of cylinders is arranged in circular form, and supports heavy girders fixed on a pivot and rollers, so as to form a swing bridge which, when open, will allow of vessels passing through. Wooden fenders or dolphins are placed round the cylinder piles to prevent injury to the bridge. In constructing the branch line from Penwortham Junction to the Lancashire and Yorkshire system, which, as already stated, is not yet completed, two somewhat serious difficulties were encountered. The chief of these was in carrying the line under the North Union Railway without interference with the traffic. The width of the requisite bridge is 172ft., and the abutments, which are 10ft. thick, are carried to a depth of 45ft. under the North Union Railway. The girders were fixed at three different periods without any accident, or without delaying in the slightest the traffic on the railway above. The second engineering difficulty occurred at the bridge next to the East Lancashire Railway. At this point a bed of spongy peat was encountered, which it was necessary to excavate to a depth of about 20ft. and fill up with some 4000 cubic yards of concrete, as a foundation upon which to erect the bridge. The company's central stations, which are in course of erection at Southport and Preston, will, when finished, form handsome architectural features in both towns ; they are Gothic in style, and have been erected from the design of Mr. Charles H. Driver, of Westminster, London. The line, it may be added, is worked by the block system, the signalling arrangements having been carried out by Messrs. McKenzie and Holland, of Worcester. The iron work for the bridges was provided and fixed by the Stockton Forge, under the supervision of their resident manager, Mr. Blackburn. Messrs. Braddock and Matthews commenced their contract for the completion of the line in 1880, and the first section from the river Douglas to Longton was finished in June last. In order, however, that the line to Preston should be opened by the Guild week, special efforts were put forth, and operations were carried on during the night time by means of the electric light. The object in view was effected, and Major-General Hutchinson, after inspecting the line, not only expressed the greatest satisfaction at the very substantial character of the line, but gave immediate permission for the traffic to commence working. The resident engineer during the progress of the work was Mr. P. Thursby, M.I.C.E., representing Messrs. Fox and Brunlees, and the scientific ability displayed in overcoming the various difficulties met with deserves every credit.

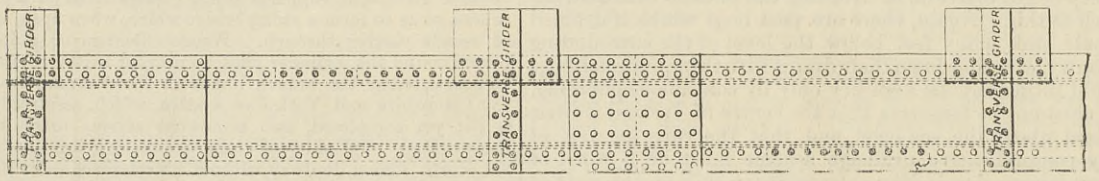
SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Sept. 16th, 1882 :—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 11,753 ; mercantile marine, building materials, and other collections, 5686. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 1782 ; mercantile marine, building materials, and other collections, 670. Total, 19,891. Average of corresponding week in former years, 18,999. Total from the opening of the museum, 21,337,387.

THE Northern Sanitary Association, established at 14, North John-street, Liverpool, upon the same basis as that in London, has now commenced upon its duties, which are to advise members upon sanitary matters, and to provide reports, &c., in cases of necessary works or alterations. At a recent meeting of the executive committee Mr. Flemin Jenkin, M. Inst. C.E., professor of civil engineering in the University of Edinburgh, and consulting engineer to the Sanitary Protection Associations of Edinburgh and London, was appointed consulting engineer. Mr. Coard S. Pain, engineering surveyor of Liverpool, acts as resident engineer ; and the secretaryship and treasurership is placed in the hands of Mr. J. S. Harmood Banner.

IMPERIAL DOM PEDRO II. BRIDGE, BRAZILIAN IMPERIAL CENTRAL BAHIA RAILWAY.

DESIGNED BY MR. JAMES CLEMINSON, M. INST. C.E., WESTMINSTER.

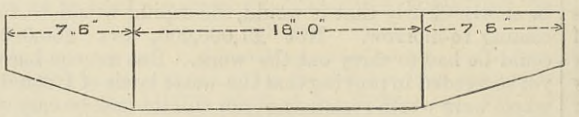




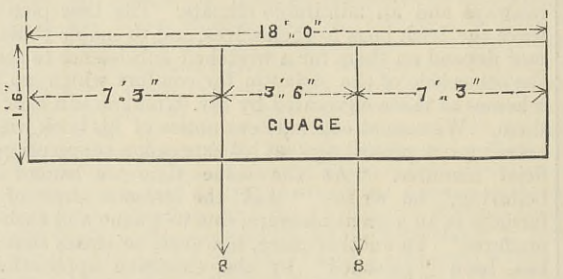
In our impressions of the 18th and 25th ult. we have given a perspective and detail drawing of this bridge, which has been designed to carry the Brazilian Imperial Central Bahia Railway over the river Paraguassa, between Chachocira and Sao Felix, and at the same time to act as a road and foot bridge.

The bridge consists of four spans, each of 300ft. in length, and though it carries but one line of rails, it is made 15ft. in width between the girders, so as to carry a double line of cart traffic, the roadway being of wood level with the crown of the rails. The footway is carried on projecting cantilevers forming part of or attached to the transverse girders, some of which also carry the raking struts by which the girders are steadied. The main girders, as above stated, are 300ft. in length, 25ft. in depth, and have a quadruple system of lattice, the angle of the lattice members being 45 deg. The space between each apex of the lattice is 12·5ft., and there are consequently 24 bays. The live load on the bridge is taken as 0·75 ton per foot, or 0·375 ton on each main girder, giving a live load on each apex of 4·675 tons and 2·33 tons on each end pillar. The dead load on the bridge is 1·25 ton per foot or 0·625 ton per foot on each main girder, giving 7·8 tons on each apex and 3·9 tons on each end pillar. The greatest strain in the flanges of the main girders is thus $\frac{W\,L}{8\,D} = \frac{300 \times 300}{200} = 450$ tons. Each girder having six bays with four systems of right-angled triangulation, the strain on the diagonals due to the dead load will $= \frac{W \text{ sec. } \theta}{4}$. Thus the strain on the tensile diagonal No. 2 from end will be $\frac{7{\cdot}8 \times 12 \times 1{\cdot}414}{4} = 33{\cdot}08$ tons for dead load, and for dead and live load $\frac{150 \times 1{\cdot}414}{4} = 52{\cdot}91$ tons, while in diagonal 10 the strains due to dead load will be $7{\cdot}8 \times 1{\cdot}414 = 11{\cdot}029$ tons, and for dead and live load 19·82 tons. The strain due to the passing load will on the right side n of the weight producing the strain $= \frac{m}{2}$ W sec. θ, and on the left side m of the weight will be $\frac{n}{2}$ W sec. θ, l being the number of bays in the span, W the live load on each apex, m = number of bays in left segment, and n equal number of bays in right segment of girder, m and n being counted between weight and ends of girder along loaded flange. In calculating the strains due to wind pressure, a pressure of 56 lb. per square foot has been taken, although the bridge lies low and is much protected by the surrounding hills and the contour of the river valley. Taking the surface presented to the action of the wind as one-fourth the enclosed area, the total wind pressure at 56 lb. per square foot = 48 tons. Of this, three-fourths is taken by the lower bracing and one-fourth by the overhead bracing.

The cross girders have the dimensions shown in the annexed diagram and above elevation. In calculating the strains on these



the load has been taken as :—



that of the weight of an engine and the platform estimated at 1½ tons per foot run, and the cross girders being 12ft. 6in. apart, the weight on each cross girder = about 16 tons. The depth of girder being 1ft. 6in., and the length from centre to centre of main girders 18ft., the main load being on the rails, the strains are as follows :—Resistance of each support = 8 tons. Strain at centre $= \frac{(8 \times 9) - (8 \times 1{\cdot}75)}{1{\cdot}5} = 39$ tons. The cantilevers carrying the footways and attached to the cross girders are estimated to carry a weight of passengers—maximum—100 lb. per foot superficial. 12ft. 6in. × 5ft. 3in. × 100 lb. = 6550 lb. = 2·9 tons ; weight on each cantilever = 2·9 tons ; strain at support in top flange $= \frac{2{\cdot}9 \times 7}{2 \times 1{\cdot}5} = 6{\cdot}77$ tons ; strain at support in bottom flange = 7·5 tons. On the longitudinal girders under rails the greatest strain is produced when the girder is uniformly loaded throughout. Load equally distributed = 8 tons ; depth of girder = 1ft.; strain at centre $= \frac{8 \times 12{\cdot}5}{8 \times 1} = 12{\cdot}5$ tons. On longitudinal girders under footpaths, the weight equally distributed = 1·5 ton ; depth of girder = 8in. = ·66ft.; length of girder = 12ft. 6in., so that the strain at centre $= \frac{1{\cdot}5 \times 12{\cdot}5}{8 \times {\cdot}66} =$ 3·6 tons. The cross girders to which raking struts are attached are strengthened by using ½in. plates for the flanges instead of ⅜in. as in the others. The sectional areas of material are arrived at by allowing five tons to the square inch in tension and four tons to the square inch in compression, and the covers and joints are all calculated to be of equal strength with the main flanges. As the live load is three-fifths of the dead load, the same sectional areas and factors of safety have been assigned and employed for both dead and live load taken together.

As mentioned in our impression of the 18th ult., there is is hardly any forge work in the whole bridge. In the first place, punching of holes is discarded absolutely, every hole throughout the structure being drilled. Every plate and bar is planed to templets and gauges made from a drawing of a span set out full size on a floor in the works. The flanged plates of the booms are then laid in their respective positions on the packing blocks, which are firmly bedded in the ground in the usual way to ensure the requisite camber in the boom. The webs are then fixed to the flanges by means of cast iron packing blocks or frames planed up to gauges and interposed between the two webs, in order to keep the latter at the required distance apart, and perfectly square with the flange. Every plate and bar being thus made to abut tightly and evenly against each other at their junctions, and in line, the whole are firmly cramped together, for up to this stage there is not a hole of any description in the work.

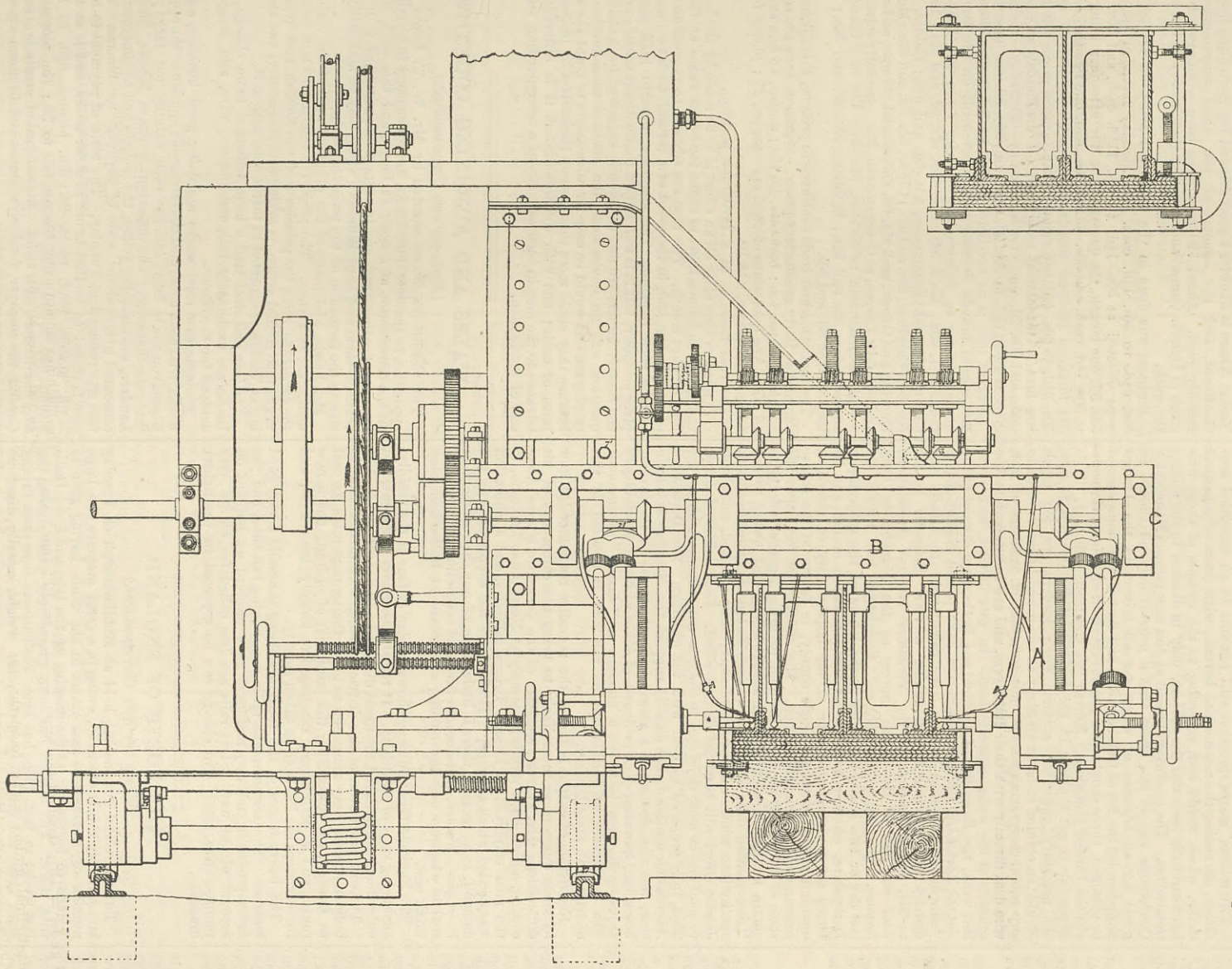
A drilling machine, of which two are employed, each taking half the boom, and whose novel features we describe further on, are then set in motion, and the holes, both horizontal and vertical, of which latter there are nine in a line across the boom, are drilled simultaneously through the whole of the plates and angle bars of the flange and webs.

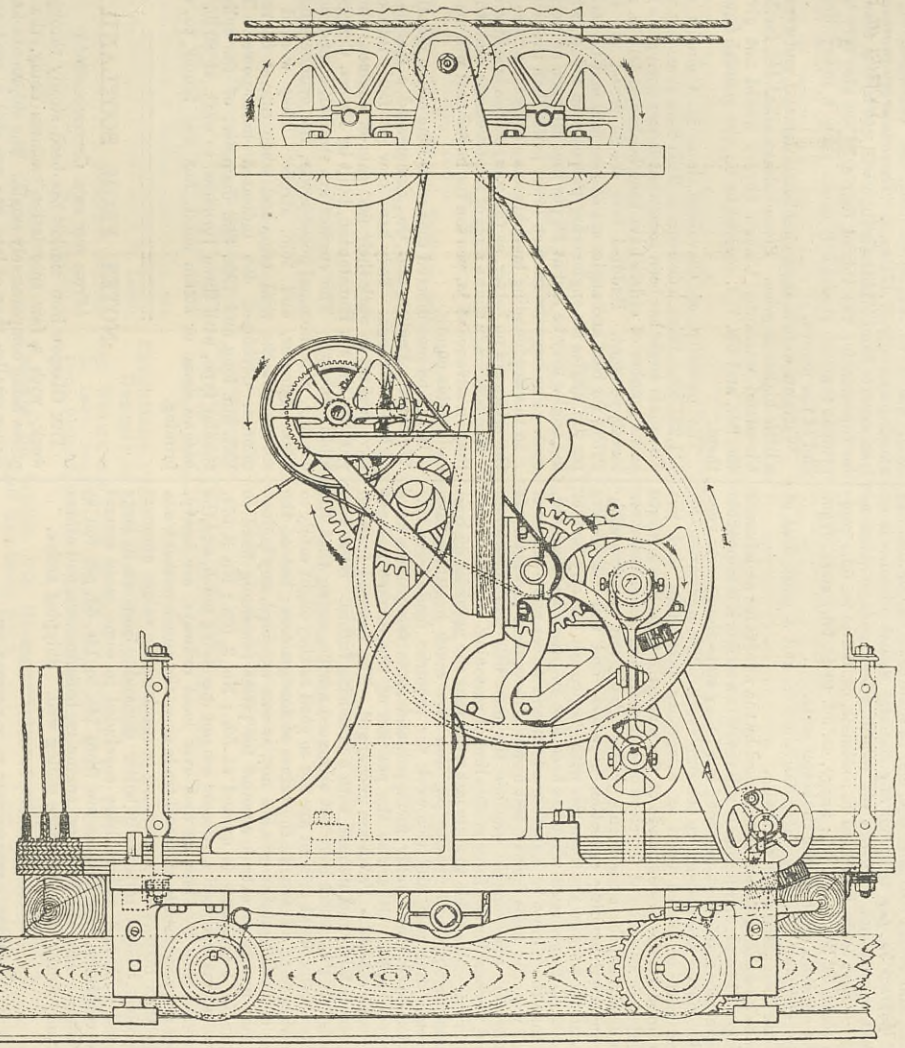
It thus ensues that every hole is perfectly "fair" and smooth throughout the whole of the thicknesses of the plates and bars ; indeed, unevenness is impossible, and it also follows that the drilling of the holes throughout the whole 300ft., the length of the boom, is accomplished in very much less time and with perfect accuracy, instead of the approximation thereto when each plate or bar is drilled separately in the usual way. The one handling of the plates and bars attendant on getting them into position suffices, whereas, by the ordinary process, every plate and bar has to be handled an indefinite number of times according to circumstances. The drilling of the end pillars and vertical struts is treated in the same way. The diagonal bracing being drilled to templet in sets are equally uniform, and in consequence any strut or tie will fit with equal facility and exactitude in any corresponding position of any span.

The machines employed for the work of drilling the booms are constructed under Mr. Arrol's patent, and are illustrated on page 223. They are made to move on a tramway laid alongside the work ; two such machines are used, each doing one-half the boom ; they are driven by ropes carried by an ingenious arrangement of loop and slack gear, which compensates for the travel of the machine along the work. The vertical drills are carried in sliding frames B which render the former capable of adjustment in any position, whilst the horizontal drills are carried in radial arms A, having like means of adjustment, starting at the ends of the boom, or one at the end and the other at the centre ; the machines finish their work as they travel along.

DRILLING MACHINE FOR LARGE GIRDER WORK.

MR. ARROL, GLASGOW, ENGINEEER.

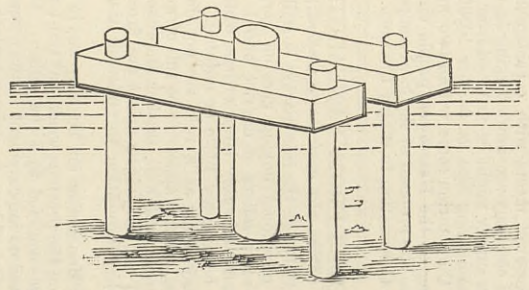




The cost of this drilling machinery is, it will be seen, considerable, but once it is made, and the distance blocks and clamps completed, the work of the engineer in the constructing yard may be said to be completed, and large girders may be so quickly completed by its aid that its cost is a matter of small consideration. Mr. Arrol has completed the whole of these large girders in his works at Glasgow, and the parts have been shipped to Brazil, there to be erected. The rivetting throughout the work is done by hydraulic machines. These are so well known that it is unnecessary to refer further to them, except to note that by them the work is so thoroughly closed up and the rivets made to fill out the holes, that if the work is cut through, but for the direction of the fibre of the rivets and plates, it is almost impossible to trace their relative positions.

Mr. Cleminson's aim throughout the design and construction of this large bridge has been to eliminate all costly manual labour and do everything by machinery, with the object of producing in a rivetted structure that precision which prevails in American pin connected bridges. He has thus succeeded in making large structures with the aid only, so to speak, of a rolling mill, planing machine, and drilling machine, by a system the practical advantages of which are obvious to every one.

Mr. Arrol, it may be here remarked, is now engaged in constructing machines and framing by which he can put together the whole of the plates, channel and angle arms, in the large Tay Bridge double piers, and drill the whole at one setting. These piers are over 60ft. in height and 40ft. wide, but there are a large number of them to be made, and it will pay to make even so enormous a machine to do the work. These piers were fully illustrated in THE ENGINEER, vol. lii., pp. 350-380. When we visited the works, we also noticed in course of construction the pontoons for the erection of the piers of the new Tay Bridge, which he is also now constructing. These pontoons are to be used in pairs, as indicated by the annexed diagram, and each pontoon has a well near



each end through which work cylindric supporting columns. These, as well as the pontoons, may be filled with water or emptied as desired by machinery which will be fixed in the pontoons. The pier cylinder to be sunk is placed and held by suitable means between these pontoons, and when its lower end is placed on the required site, the pontoons which for that purpose had been empty are filled with water, and under control of hydraulic apparatus connected with the four supporting legs, are allowed to descend, the weight of the greater part of the contained mass of water forcing the pier cylinder down into the bed. When the cylinder has sunk as far as the load will carry it the connections to the pontoons are released, the pontoons emptied and allowed to rise to floating level, and the process repeated; or the pontoons may be raised on their legs above water level by the hydraulic apparatus, and then filled with water so as to obtain a greater range of descent; and when the pontoon has sunk down to water level the legs themselves may be raised, and thus the weight of the whole structure hung on the pier.

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

(From our own Correspondent.)

IRON prices on the Wolverhampton Exchange yesterday and in Birmingham this afternoon—Thursday—maintained the firm tone of a week ago. There was no giving way in the advances then reported. The colliers are manifesting increased earnestness in their wages agitation, and the importance of the movement is fully recognised by the coal and iron-masters. The end of the war, too, which is welcomed, strengthens traders' confidence in an improved business in the early future, and this also helped prices.

Sheets still led the market. Consumers reported great difficulty in getting supplies with anything like the needed promptitude; and the order books of all the makers are filled quite as far forward as they care for the present to see. Singles were £8 to £8 5s.; doubles were £9 to £9 5s., while last week's advance of 5s. in some lattens was again demanded, making them £10 5s. to £10 10s.

Galvanisers reported themselves very busy for all the foreign markets. Some firms stated that, as regards the amount of work they have turned out in the sheet department, this year has so far been better than any previous year. For 24 w.g. bundled, delivered at outports, £14 10s. was the quotation; for 26 w.g., £16 10s.; and for 28 w.g., £18 10s.

Tank plates sold rather better. There were offers from local buyers to purchase at £7 15s., but makers demanded a rise upon this figure, which had ruled some previous contracts. Makers' price was generally £8 at works.

Some curiosity was excited on 'Change concerning a statement from Philadelphia that a buyer has been despatched from the United States to buy on this side tank plates that the Pittsburgh ironmasters cannot supply. For Staffordshire tank plates some £8 10s. per ton would be wanted, delivered Liverpool. Such a figure would seem to leave little room for American buying if the English products are to compete with American plates at 3⅛c. per lb. The calculation is that English plates, to make the importation of them profitable, must be offered in the United States at 3¼c. per lb., which, assuming that the tariff is 1¼c. per lb., and the freightage 12s. per ton, means English plates at the low figure of about £7 8s. at Liverpool.

The "list" iron houses quote £7 10s. to £8 2s. 6d. for bars, with a moderately steady demand. Most of the firms would, however, be glad of a considerable accession of orders. Medium quality bars are £7, while

ordinary sorts maintain last week's advance of between 5s. and 2s. 6d. and are quoted £6 10s. Australia and the Continent are good buyers just now of this description of iron.

Hoops are active, but United States inquiries are not resulting in so much actual business as might be imagined. Prices are £6 17s. 6d. to £7 2s. 6d. Bedstead strip is £6 15s.

Tin-plate firms report a steady sale, in much part on export account, but it is difficult to get up prices.

Despatches from Sydney indicate that the galvanised sheet market is recovering. From Melbourne, however, the mail advices report that galvanised iron, owing to the heavy importations, is dull, and when the mail left favourite brands were offering at £21 10s. to £21 15s., while ordinary brands were bringing £20 10s. Bar and rod iron was valued at £9 to £10. Black sheets were firm, Nos. 8 to 18 being disposed of at £11, and Nos. 20 to 26 at £13. Plates were firm at £10 to £11. Hoops might be purchased in small lots at from £9 to £10.

Derbyshire, Northampton, and some other foreign pigs are strong at last week's rise of 2s. 6d. per ton, and 50s. is now the general quotation, while 48s. is promptly refused. Thorncliffe—South Yorkshire—pigs are this week advanced 2s. 6d., making them 62s. 6d. per ton delivered. Lincolnshire pigs are 51s. to 52s. delivered, and Ashton Vale—near Bristol—brand 55s. Consumers of all these brands are generally pretty well bought forward, and sales are not at date of much extent.

Hematites are in under supply. One steel-making firm in this district is consuming 700 tons per month. Prices are strong. Blaina—South Wales—sorts are quoted 63s. 6d.; Ulverstone and Wigan hematites 67s. 6d., though occasional lots may be had at 65s., and the brand of the Barrow Company is quoted strong at 70s. Staffordshire pigs are without any important change.

At an important conference of miners held in Wolverhampton on Tuesday, when delegates were present representing North and South Staffordshire, East Worcestershire, and Salop, it was resolved: "That the Board of the Federation of Miners for the Midland counties agrees with the application about to be made for an advance of 10 per cent. in wages in North Staffordshire. That it hereby instructs each district of the Federation to at once make application for a similar advance; and recommends that joint meetings of employers and workmen on the wages question be held in every district previous to giving notice."

The Cannock Chase district was not represented at the Conference, and their action on the wages question is, therefore, at present uncertain. The chairman of the South Staffordshire Coal Trade—Mr. E. Fisher Smith—has been requested to at once call a meeting of the South Staffordshire employers.

The countermanding of war preparations at Woolwich does not seem yet to have led to any countermanding ot orders distributed amongst the hardware firms in Birmingham and the district, who are still pressing forward deliveries. But negotiations concerning additional contracts which were about being closed when the news of the campaign arrived were at once broken off.

Complaints are very rife of the most exorbitant charges being made for provisions by "foggers" engaged in the nail trade.

The electric light is getting into increased favour in the Midlands for the lighting of works and factories. Several extensive and important factories in Birmingham are in communication with the Birmingham and Warwickshire Brush Electric Light Company, whilst manufacturers in Coventry, Burton-on-Trent, Rugby, Kidderminster, and other towns, are understood to have similar arrangements pending. A decided fillip has been given to such negotiations by the success that has attended the company's lighting at the Worcestershire Exhibition.

It is significant of the change which is taking place in the method of generating steam power, that within the last few days the local authorities of Smethwick have received application from one of the largest manufacturing works in the town to know upon what terms the Board are prepared to supply gas for the driving of gas engines, as gas engines are about to be put down. It is clear that the employment of such engines must lead to an increased consumption of gas in the near future.

The local gas company of Halesowen, near Birmingham, propose to apply to the Board of Trade for a provisional order giving them the exclusive right of supplying gas for the inhabitants. The proposal, however, meets with considerable opposition, for whereas the local company are now charging 4s. 6d. per 1000ft., it is believed that a supply might be obtained from the Birmingham Corporation at something like 2s. 9d. per 1000ft. The mains of the Birmingham Corporation come within two miles of the town, and at a meeting of the Halesowen people on Tuesday, it was resolved to oppose the proposal of the local company, and to invite the Birmingham Corporation to supply the town.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—Although the iron market is still generally dull, a fair amount of occasional buying goes on here and there, and during the week some sellers of district brands of pig iron have been able to secure tolerably large orders, whilst others for the most part have been doing little or nothing. In manufactured iron, although merchants as a rule are not doing more than a moderate business, makers appear to be full of work, and generally confident that trade will still further improve. So far as the market all round can be judged prices are firm, and if anything merchants show less disposition to undersell than was the case a week ago.

The market at Manchester on Tuesday was in some respects an improvement upon the previous week, but the business of any importance doing was confined to a few sellers. Lancashire makers of pig iron reported no improvement in the demand, and although they have still sufficient iron to deliver against contracts to keep the furnaces going, they are getting very few new orders of any weight. For delivery equal to Manchester their quotations remain at 46s., less 2½ per cent., for both forge and foundry qualities, but if good offers were made at a trifle under this figure, it is probable they would now stand a chance of being entertained. I hear of the agents of one Lincolnshire maker having sold pretty largely on Tuesday, on the basis of their full rates, which were equal to 47s. 4d. for forge and 48s. 4d. for foundry, less 2½ delivered at Manchester; representatives of other firms, however, reported business very slow, and Lincolnshire iron could be bought at under the above figures. Derbyshire makers still ask about 49s. to 50s., less 2½ delivered equal to Manchester, but I do not hear of much business stirring in this brand of iron. Reports as to finished iron varied somewhat, some makers being rather quiet, whilst others had no difficulty in getting orders. Sheet iron makers appear to be very full of work, and there is no pressure to sell in any description of manufactured iron, which all through is firm in price on the basis of £6 7s. 6d. to £6 10s. for bars delivered into the Manchester district.

The wages agitation, which has commenced in the coal trade, is causing an uneasy feeling, not only amongst proprietors of collieries but amongst consumers for ironmaking purposes; and in the iron market during the week the probabilities of a strike have entered prominently into calculations as to the future. Notices have now been served pretty generally upon the colliery proprietors for an advance of wages, the bulk of which will expire in the first week of October, and the apprehensions of a stoppage of the pits, with an advance in prices, has caused quite a rush of orders during the past week, very much similar to what occurred this time last year. The chief pressure has been for house fire qualities, consumers of which are anxious to get in their winter supplies, and the pits have been kept on full time, with stocks in some cases also being filled up to meet requirements. Other classes of fuel for ironmaking and steam purposes have not experienced any very materially enlarged demand, but still these also have been going away more freely, as consumers in many cases have been anxious to have some little stock in hand. The extra pressure in the market has brought about a stiffening in prices, but the upward movement has been of a very irregular character. The principal Manchester firms have not as yet made any alteration in their list rates; but at collieries in the immediate neighbourhood prices have been put up 1s. per ton, and in the West Lancashire districts there has been a pretty general advance of 6d., with here and there 1s. per ton, more money being asked for house fuel classes of coal. Iron making and steam coal is firmer, and in some cases engine fuel has been put up 5d. per ton; but any material actual advance is at present exceptional. At the pit mouth prices average about as under:—Best coals, 8s. 6d. to 9s.; seconds, 6s. 6d. to 7s. 6d.; common coals, 5s. 3d. to 5s. 9d.; burgy, 4s. 3d. to 4s. 6d.; slack, from 3s. for common up to 4s. for the better sorts.

The shipping trade has been fairly active, and a good deal of coal has been going away coastwise.

As to how the agitation commenced by the miners for an advance of wages will end, or whether it will result in a strike, it is impossible to form any opinion at present; but I may state the general view of the matter entertained by the employers. The application for an advance is looked upon as altogether premature and not warranted by the present state of the market. Since the advance conceded to the men at the close of last year, and which has never been disturbed, there has been a gradual giving way in prices without any corresponding reduction in wages, and the coal-owners contend that before the men can with justice ask for any further advance, not only must what has been lost in prices be recovered, but that there must be a further advance in values upon the level which was the basis for the last upward movement in wages. It is, however, questionable whether the men will feel themselves bound to consider the force of this line of reasoning.

Barrow.—I was able to state last week that the inquiries on continental account for hematite pig iron were much healthier than for some time past, and this week the inquiries made from this quarter have considerably increased, and some fair parcels have changed hands. Otherwise the position of the market has not materially altered. Prices are unchanged. The demand from all quarters is fairly maintained, with a promising future. Some surprise is felt that prices have not advanced a trifle, seeing that the profits obtainable at present are not so good as they ought safely to be, owing to an advance in the values of foreign ores; but as the prices of local hematite ores are not, as was expected, any higher, this may to a large extent account for prices remaining fixed so long. No. 1 Bessemer is quoted at 59s.; No. 2, 58s.; No. 3, 57s. per ton at makers' works. Stocks are not increasing much, and the deliveries, both by shipping and over local railways, are heavy. Prices are very firm in the steel trade since the announcement was made that makers were intending to regulate the values amongst themselves. Steel rails are in better demand. Iron ore in large demand still, and makers have concluded in some cases several large contracts. Quotations are from 14s. to 14s. 6d. per ton at the mines. Iron shipbuilders, engineers, boilermakers, and others in steady work. Coal and coke selling well. Shipping active.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

THE miners' wages question still remains in an unsettled condition, darkening the commercial horizon with fears of a general strike, which would end, according to the opinion of those who have carefully reviewed the subject, only in disaster to the miners themselves. The resolution passed at the now famous Manchester Conference was to the effect that a general demand should be made for an advance of wages for all miners in the United Kingdom by the 1st of October next, and that if the same cannot be obtained, there should be a general stand of all miners throughout the United Kingdom. Herein lies the main difficulty. It is impossible to get the men in the various mining districts to take the necessary concerted action. Their leaders are too much divided in opinion to be at all likely at the present time to come to any satisfactory arrangement, not to speak of numbers of men who deal directly with their employers, and are indifferent to the counsels of the union nearest them. In this district, as I wrote last week, the Executive of Sheffield and Rotherham district of the South Yorkshire Miners' Association have passed resolutions to "support no policy which is calculated to lead the district into a strike," thus taking a view distinctly hostile to Mr. Benj. Pickard, of the Yorkshire Miners' Association, who was one of the prime movers at the Manchester Conference. The Derbyshire Miners' Association has within the last day or two issued a circular to the whole of the collieries in Derbyshire, whether members of the association or not, and its terms are a virtual admission of the impossibility of obtaining unanimity, even within a single county, in favour of the course recommended by the association. The circular sets forth that the state of trade fully warrants the men in using vigorous efforts to obtain better wages, and then acknowledges that owing to the "disorganised state of Derbyshire and the torpid, almost fossilised, apathy into which the men have sunk," only a united, combined, drastic effort will have the desired effect. Each colliery is asked to send one or more delegates to the Sun Inn, Chesterfield, on the 23rd, fully prepared to deal with the question. The Derbyshire Association leaders do not directly support the Manchester resolution, but the circular is a strong indirect appeal in its favour, betraying, however, clear evidences of doubt as to the possibility of arousing the men to adopt a measure as "drastic" as unsound. The Conference at Rotherham on the 25th is awaited in this district with some anxiety.

Restriction of output is one of the remedies recommended now in many quarters as most likely to bring the collier out of his difficulties. Mr. Parrott, secretary of the Yorkshire Miners' Association, addressed a meeting recently at Normanton Common, to the men employed at Messrs. Briggs' collieries, and a resolution was carried which affirmed, "That whilst the supply exceeds the demand, at at present, there is little hope of any improvement of in wages. We are, therefore, in favour of restricting the output of coal in whatever way the coming conference at Rotherham may think best."

The Sheffield Gas Company shows no sign of fear at the rapidly-advancing steps of electricity. It remains perfectly quiescent, and only this week declared the usual dividend—10 per cent.

The coal proprietors of this district, having been unsuccessful in inducing the railway companies to lower the tonnage rates for coal to London, are considering the possibility of opening out a new route, and a preliminary meeting has already been held, and further steps are likely to be taken shortly.

The heavy trades of the town are doing generally a very good business. The armour-plate mills are running full time, and the firms producing military materials have received an impetus on account of the war. Steel rails are less called for at not very remunerative rates. No change can be reported in the lighter branches.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

THE Cleveland iron market held at Middlesbrough on Tuesday last was very thinly attended, owing in a great measure to a large number of ironmasters and others in the trade having gone to Vienna to be present at the meeting of the Iron and Steel Institute there. The market has been exceedingly quiet during the last week; in fact, there has been less business done than in any week since the beginning of the year. Prices, however, continue steady at what they have been for the last two or three weeks, merchants and producers asking for No. 3 g.m.b. 44s. per ton f.o.b. for quick deliveries, and nothing is being booked under that figure. Some makers asked 44s. 6d., but could only obtain it where buyers were bound to special brands. Notwithstanding the small amount of business done, the tone of affairs was highly satisfactory. Makers, who as a rule have plenty of contracts, are not affected by the quietness for the time being, and are well able to maintain prices. Iron for delivery within the next five or six weeks is very hard to get, few of the makers having any quantity of stock from which they can deliver.

The shipments for this month continue at a most satisfactory rate, even surpassing the exceptionally heavy exports of last month. The quantity shipped up to Tuesday night was 57,976 tons, whilst in August, during the corresponding period, the amount was only 57,171 tons. There is every prospect that the pig iron exports from Middlesbrough will not be less than 100,000 tons for this month; the inland deliveries are also very heavy, so it is evident that the stocks will again show a heavy decrease by the end of the month.

Warrants were in somewhat better demand, and were consequently a little higher in price. Some holders asked 44s. for No. 3 Connal's Cleveland warrants, though buyers would not give more than 43s. 9d., and 43s. 7½d. seemed to be the general figure offered for them.

The quantity of Cleveland iron in Connal's store is now 111,231 tons, being a decrease of 2155 tons since last week's report. The plate trade has been somewhat better during the last few days, and a number of orders have been booked at £6 15s. per ton f.o.t., less 2½ per cent. Puddled bars are £4 2s. 6d. per ton net f.o.t. Prices for bars and angles are easier; bars may be had for £6 2s. 6d. per ton, angles for engineering purposes at £6 5s., while shipbuilding angles may be had at £6 per ton, all f.o.t. at works, less 2½ per cent. For large orders even lower prices than the above are named.

In the ironfounding branches more orders are to be obtained; but the prices are no better, as the competition is still very keen.

The coal trade shows signs of improvement, and it is not unlikely that an advance of 1s. per ton for house coal will be asked at the end of this month.

It will be remembered that some nine or ten months ago Messrs. Westgarth, English, and Co., commenced a marine engine works at Middlesbrough. They have now got fairly into operation, and have just set to work their first pair of engines, which have been put into the s.s. Hunstanton, built by Messrs. Craggs and Sons, of Middlesbrough. The engines are vertical, compound surface-condensing, of 98 nominal horse-power, the cylinders being 26in. and 48in. diameter, and 36in. stroke. They worked satisfactorily throughout the trial trip, and when run at 81 revolutions per minute, developed 488 indicated horse-power. The boiler is 10ft. 3in. long and 13ft. 8in. diameter, of the cylindrical multitubular type, with three furnaces, to work at 80 lb. pressure. It has no dome or steam chest, but was found to work without priming.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THE Glasgow iron market has been steady throughout the past week, with a fair speculative business doing, the variations in prices being comparatively small. The shipments have again been rather smaller than of late, but are still a good average. From Canada and the United States the inquiry continues fair, and quotations of the best iron are reported to have improved at New York. There is likewise a good demand for Scotch pig iron on the Continent, and the amount of the home consumption keeps steadily good. About 700 tons have been withdrawn from the stock in Messrs. Connal and Co.'s Glasgow stores in the course of the week.

Business was done in the warrant market on Friday at from 50s. 0½d. to 50s. 1½d. cash. On Monday forenoon transactions were effected at 50s. 1½d. to 49s. 11½d. cash, and 50s. 4½d. to 50s. 3d. one month, the quotations in the afternoon being 50s. 1d. to 50s. 1½d. cash, and 50s. 4d. to 50s. 4½d. one month. On Tuesday forenoon business was done at 50s. 1d. to 50s. 2d. cash, and 50s. 3½d. to 50s. 4½d. one month, the afternoon prices being a shade less firm. Transactions took place on Wednesday at 49s. 11½d. cash, and 50s. 2d. one month. To-day—Thursday—business was done at 49s. 11½d. to 50s. 2d. cash, and 50s. 5d. one month.

Makers' iron is in excellent request at full prices, those of the best special brands showing an improvement on the week. The quotations are as follow:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 62s.; No. 3, 54s.; Coltness, 67s. 6d. and 55s.; Langloan, 65s. and 56s. 6d.; Summerlee, 63s. 6d. and 54s.; Calder, 62s. and 53s. 3d.; Carnbroe, 56s. and 52s.; Clyde, 54s. 6d. and 52s.; Monkland, Quarter, and Govan, each 51s. 6d. and 49s. 6d.; Shotts, at Leith, 64s. and 56s. 6d.; Carron, at Grangemouth, 53s.—specially selected, 56s. —and 52s.; Kinneil, at Bo'ness, 51s. and 49s. 6d.; Glengarnock, at Ardrossan, 56s. and 52s.; Eglinton, 52s. 6d. and 50s.; Dalmellington, 52s. 6d. and 50s.

The malleable iron trade continues to prosper, there being a good demand at fairly satisfactory prices. Common bars are selling at about £6 5s. per ton; best bars, £6 15s.; angles, £6 5s.; and plates, £7 10s. The quotations of steel are—angles, £9; plates for ships, £10; boiler plates, £11 10s.

The coal trade is in a favourable position.

It appears that after all an effort is to be made by the leaders of the miners to induce them to strike for better wages at the beginning of next month. The men are advised to request an advance of 6d. per day, and, in the event of a refusal, to take measures to enforce their demand. The meetings hitherto held have taken place privately, but it is well known that without outside assistance the Scotch miners are not sufficiently organised for a strike. The question will no doubt have the anxious consideration of the employers. It would be easy for salemasters to grant the advance, because they could more than recoup themselves by increasing the price of coals; but with the ironmasters it is different, as an advance to the men in their case means a corresponding rise in the cost of production.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

THE Cardiff freighters, worsted by Mr. W. T. Lewis in their opposition to the new Bute Docks, are understood to be still intent on the construction of a dock at Barry, and this week there are rumours floating that an important arrangement is in process between them and Lord Windsor, which may be materially conducive to the formation of the proposed dock.

Mr. Lewis, and many of the principal men of the various ironworks, are at Vienna. The project I referred to last week as on the carpet, to bring the principals of the English and Welsh steel works into cordial action, is taking firm consistency, and this meeting at Vienna is expected to further strengthen it.

The iron and steel trades have indicated little change of late. Books are moderately full, and blooms, wire, and scrap are in demand for the States.

Tredegar new steel works are doing good business, and a few weeks' trial have confirmed the favourable opinion of the appliances. Blaenavon too is busy, and has been turning out large yields of first-rate character. The important works of Messrs. Siemens, at Landore, are resuming action, the melters and hammermen having consented to a modified scale of payment for blooms. Work in fact was resumed on Tuesday. The scale of payment to hammermen is stated to be that in use at other works, and is as follows:—3in. blooms, 10½d. to 1s. 2d.; 4in. blooms, 8½d. to 1s.; 5in. blooms, 6½d. to 8½d.; 6in. blooms, 5d. to 7d.; 7in. blooms, 4d. to 6d.; 8in. blooms, 3½d. to 5d. A good deal of credit is due to Mr. Carulla, the manager, for the judgment and firmness exercised in the adjustment of difficulties.

The works in the Forest of Dean are well occupied. Fothergill's late works—the Plymouth—may yet be destined to see some partial start. A tender for them and the collieries has been sent in, and I have the best authority for stating that their disposal by the present trustees is only a question of time. How far the works can be utilised is difficult to state at present.

The sister industry, coal, is as prosperous as ever.

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.

12*th September*, 1882.

4323. TREATING VEGETABLE PARCHMENT, H. Hymans, London.
4324. ENLARGING or REDUCING MAPS, &c., L. A. Groth. —(*J. Eymansberger and M. Menn, Paris.*)
4325. SCREW PROPELLERS, F. J. Croft, Birkenhead.
4326. TEACHING the USE of the RIFLE, W. E. Heath, London.
4327. COMBINED CLOTHES HOOK and HAT PEG, G. A. Folker.—(*A. F. Bechmann, Vienna.*)
4328. COCK or TAP, W. Bright, Exeter.
4329. STARTING, &c., STEAM ENGINES, W. H. Allen, R. Wright, and W. L. Williams, London.
4330. LOOMS for WEAVING, T. Blezard, Padiham, and W. L. Nelson, Darwen.
4331. PRODUCING STAMPED or EMBOSSED FABRICS, J. Coates, London.
4332. PREPARING LINOLEUM, &c., D. Hendry and J. Melville, Glasgow.
4333. MEASURING FABRICS, &c., R. Murdoch, Glasgow.
4334. BOILER FURNACES, J. R. Russell, Glasgow.
4335. MACHINES for HULLING, &c., RICE, J. R. Russell, Glasgow.
4336 GOVERNOR for STEAM, &c., ENGINES, A. Beverley, Stanley, and A. Sykes, Wakefield.
4337. THREAD WINDING MACHINES, J. W. Shepherd and W. Ayrton, Longsight, and S. Hallam, Manchester.
4338. FACILITATING the DISPENSING of EFFERVESCENT LIQUIDS, W. R. Lake.—(*L. Bergen, New York.*)
4339. WIRE CARD POINTS, T. Morgan.—(*F. Gillet, Aix-la-Chapelle.*)
4340. KNITTING MACHINERY, S. Lowe and J. W. Lamb, Nottingham.
4341. KNITTING MACHINERY, J. W. Lamb and E. Attenborough, Nottingham.
4342. SAFETY VALVE APPARATUS, A. W. L. Reddie.—(*A. J. B. Crépin, Dunkerque.*)
4343. CHRONOGRAPH, A. Clark.—(*P. Moreau, Geneva.*)
4344. ELECTRIC LAMP CARBONS, R. Hammond and L. Goldenberg, London.
4345. LANTERNS for SPORTING PURPOSES, A. J. Boult.—(*H. Lages, Zorge.*)
4346. MECHANICAL PIANOFORTES, &c., W. R. Lake.—(*J. Lacape and Co., Paris.*)
4347. STOPPERING BOTTLES, A. J. T. Wild, London.
4348. WHEELS and AXLES, W. R. Lake.—(*E. Orne, U.S.*)
4349. PRODUCTION of CHLORIDE GAS, A. Nolf, Brussels.
4350. VISUALLY INDICATING ELECTRIC SIGNALS, B. J. B. Mills.—(*J. U. Mackenzie, New York.*)
4351. UTILISING STEAM and HEATED AIR as MOTIVE-POWERS, J. M. X. Terlinden, Brussels.

13*th September*, 1882.

4352. ELECTRODES, W. Sinnock, London.
4353. OPENING, &c., FANLIGHTS, &c., H. Pearce, London.
4354. ENDLESS PLATFORMS, P. Robinson, Saxby.
4355. GALVANIC BATTERIES, O. C. D. Ross, London.
4356. GLOBE HOLDERS, G. H. Nash, Birmingham.
4357. CONSTRUCTING OIL STOVES, J. H. Stiles, London.
4358. COUPLING and UNCOUPLING RAILWAY TRUCKS, &c., G. Fenwick, Gateshead-on-Tyne.
4359. TRANSMITTING MOTION to SEWING MACHINES, W. and J. H. Beecroft, Leeds.
4360. NOBLE'S WOOL-COMBING MACHINES, T. H. Wharton and R. Smith, Bradford.
4361. SELF-ACTING MULES, J. Drausfield and J. Isset, Dewsbury.
4362. DISTRIBUTING ELECTRICITY, L. Gaulard and J. D. Gibbs, London.
4363. GAS ENGINES, A. M. Clark.—(*J. Schweizer, Paris.*)

14*th September*, 1882.

4364. PRODUCTION of CAUSTIC ALKALIES, W. L. Wise.—(*C. Löwig, Breslau.*)
4365. FEED MOTIONS for TURNING LATHES, T. Shanks, jun., Johnstone.
4366. JOINT for ELECTRICAL LAMPS, W. Wynne, London.
4367. ELECTRIC LIGHTING, W. Morgan-Brown.—(*F. Schmidt, Prague.*)
4368. VENETIAN WINDOW-BLINDS, G. S. Marshall, Birmingham.
4369. WINDOW-SASH FASTENERS, W. A. MacLeod, Birkenhead.
4370. APPARATUS for GRINDING, &c., of FLAT METALLIC BARS, H. Slack, Sheffield.
4371. DYEING or SIZING HANKS, J. Conlong, Blackburn.
4372. CLEANING GRAIN from IMPURITIES, J. & R. Davidson, Newcastle-upon-Tyne, and A. Miller, Gateshead.
4373. STEAM BOILERS, H. J. Haddan.—(*J. Bergmann, Hattingen.*)
4374. SHIPS, T. Hyatt, London.
4375. HYDRAULIC LIFTS, J. S. Stevens and C. G. Major, Battersea.
4376. DYNAMO-ELECTRIC MACHINES, M. Deprez, Paris.
4377. LOCK-STITCH SEWING MACHINES, L. Silverman, Westminster.
4378. GAS ENGINES, J. Atkinson, London.
4379. IRON and STEEL, J. G. Willans, Kilburn.
4380. SUSPENDING HORIZONTAL BARS, G. Welling, Camberwell.
4381. MATCH-BOXES, W. R. Lake.—(*A. Widerström, Stockholm.*)
4382. STEEL STRIPS, C. Baker and G. Badcock, London.
4383. CONSTRUCTING WALLS, &c., F. Bauder, London.
4384. PREPARING, &c., COTTON, &c., T. Berry, Rochdale.
4385. NAILS and SCREWS, T. J. Sloan, Paris.
4386. LEAD and CRAYON HOLDERS, J. H. Johnson.—(*J. Reckendorfer, New York.*)

15*th September*, 1882.

4387. AERIAL NAVIGATION, U. Green, London.
4388. GAS ENGINES, J. Atkinson, London.
4389. STOPPERING BOTTLES, J. J. Rawley, London.
4390. ELECTRIC LAMP HOLDERS, J. W. Swan, Newcastle-on-Tyne, and C. Swan, London.
4391. PREPARING PLATES for SECONDARY BATTERIES, N. C. Cookson, Newcastle-upon-Tyne.
4392. FRAMES for UMBRELLAS, &c., H. J. Haddan.—(*C. Neumeister, Leipzig*)
4393. APPARATUS for PRODUCING, &c., MUSICAL SOUNDS, J. Burnet, London.
4394. FRONTS of SHIRTS, G. W. von Nawrocki.—(*Messrs. S. Stern and Son., Germany.*)
4395. STOCKS and DIES, C. Neil, Sheffield.
4396. ALLOYS of GOLD, A. Guye, London.
4397. ORE-CRUSHING and AMALGAMATING MACHINE, S. Wekey, London.
4398. PICKERS for WEAVING, I. Sowden, Bradford.
4399. TREADLES for BICYCLES, J. Buckland, Taunton.
4400. SEPARATING TIN from SCRAP METAL, C. D. Abel. —(*F. A. Reinecken and L. Poensgen, Düsseldorf.*)
4401. COMPRESSION PUMPS for AMMONIA GAS, C. D. Abel.—(*A. Osenbrück, Hemelingen.*)
4402. SUPPLY and WASTE VALVES for BATHS, &c., S. S. Hellyer, London.
4403. PRODUCTION of POSTAL STAMPS, &c., S. Pitt.—(*P. A. Tapponnier, Paris.*)
4404. ELECTRIC LAMPS, H. Lake.—(*S. van Choate, U.S.*)
4405. WHITE LEAD, A. J. Smith, London.
4406. MAKING MOULDS for METAL CASTINGS, J. V. Hope, Wednesbury.

16*th September*, 1882.

4407. GALVANIC ELEMENTS, J. H. Johnson.—(*A. Bernstein, Berlin.*)
4408. SELF-ACTING TEMPLES, J. Wrigley, Bury.
4409. COUPLING RAILWAY CARRIAGES, T. A. Brockelbank, London.
4410. BOTTLES, &c., J. H. Drayton, Brixton.
4411. REGENERATING PEROXIDE of MANGANESE, G. von Nawrocki.—(*Verein Chemischer Fabriken, Mannheim.*)
4412. LOCKING POINTS and SIGNALS, S. Brear and A. Hudson, Bradford.
4413. FASTENINGS of TIES, &c., H. Lenn, London.
4414. TRICYCLES, E. Marshall, Birmingham.
4415. REVERSING the MOTION of LEATHER-ROLLING MACHINES, E. Wilson, Exeter.
4416. INCREASING ILLUMINATING POWER of GASES, A. M. Clark.—(*V. Popp, Paris.*)
4417. FRICTION CLUTCHES, W. A. Barlow.—(*T. Daimler, Cannstatt.*)
4418. COMBUSTIBLE GAS, &c , MOTORS, J. Watts and H. E. Smith, Bristol.
4419. ELECTRIC ARC LAMPS, J. Brockie, Brixton.
4420. GASELIERS, &c., M. Merichenski, Poplar.
4421. TELEGRAPHIC and TELEPHONIC APPARATUS, A. C. Brown and H. A. C. Saunders, London.
4422. TELEPHONIC TELEGRAPHY, C. A. McEvoy and J. Matheison, London.
4423. COMPOSITION for PRESERVING WOOD, &c., W. R. Lake.—(*A. Buzolich and T. K. Smith, Australia.*)
4424. PREVENTING DEPOSIT of MUD in RIVERS, W. R. Lake.—(*H. E. Hargreaves, Brazil.*)
4425. ATTACHING SCREW STOPPERS to BOTTLES, A. E. Nicholl, Streatham.

18*th September*, 1882.

4426. PUMPS, T. Willoughby, Leeds.
4427. VALVES, W. Lloyd, Newport.
4428. ARTIFICIAL LEATHER, E. Fischer, Kaltwasser.
4429. INCANDESCENT ELECTRIC LAMP GLOBES, J. Crowder, London.
4430. WATER-CLOSETS, J. Imray.—(*R. H. Lecky and J. Hay, Pittsburg.*)
4431. SECONDARY VOLTAIC BATTERIES, A. Watt, Liverpool.
4432. HOLDERS for BOUQUETS, C. M. Tate, London.
4433. KNIFE-CLEANING MACHINE, C. W. Spong, London.
4434. GALVANIC BATTERIES, S. H. Emmens and S. Mason, London.
4435. CANS or BOXES, J. F. Stoy, London.
4436. BASE MATERIAL for PAINT, G. E. Church.—(*A. E. Brockett, Branford, U.S.*)

Inventions Protected for Six Months on Deposit of Complete Specifications.

4348. WHEELS and AXLES for RAILWAY VEHICLES, W. R. Lake, London.—A communication from E. B. Orne, Philadelphia, U.S.—12*th September*, 1882.

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

3648. APPARATUS for EXTINGUISHING FIRE, N. Jarvie and W. Miller, Glasgow.—12*th September*, 1879.
3651. LATHES for TURNING WOOD, H. H. Lake, London. —12*th September*, 1879.
3654. CUPOLA FURNACES, G. W. von Nawrocki, Berlin. —12*th September*, 1879.
3678. ENGRAVING upon METAL, &c., A. D. l'Heureux, London.—13*th September*, 1879.
3689. HYDRAULIC RIVETTING APPARATUS, A. C. Kirk, Glasgow.—15*th September*, 1879.
3701. SUPPORTING WINDOW-SASHES, &c., J. Livesey and H. B. Greenwood, London.—16*th September*, 1879.
3742. STEEL BOILERS, J. Whitley, Leeds.—18*th September*, 1879.
4170. INTERLOCKING POINTS and SIGNALS, C. Hodgson, Kilburn.—15*th October*, 1879.
3659. ELECTRICAL FIRING, S. J. Mackie, London.—13*th September*, 1879.
3663. SEPARATING, &c., MIDDLINGS, L. Fiechter, Liverpool.—13*th September*, 1879.
3697. ELECTRIC LAMPS, A. M. Clark, London.—15*th September*, 1879.
3824. BOOKS, &c., for HOLDING PICTURES, E. S. Glover, Portland, U.S.—23*rd September*, 1879.
3832. BARBED WIRE, W. R. Lake, London.—23*rd September*, 1879.
4143. ELASTIC WHEEL TIRES, J. L. Hancock and N. Salamon, London.—13*th October*, 1879.
4172. SHRAPNEL SHELLS, B. B. Hotchkiss, London.— 15*th October*, 1879.
3687. SUPPLYING FUEL to FIRES, N. Macbeth, Bolton, and T. Beeley, Hyde Junction.—15*th September*, 1879.
3794. TELEPHONES, A. White, London.—20*th September*, 1879.
3716. STONE CRUSHERS, E. T. Hughes, London.—16*th September*, 1879.
3720. SEWING MACHINES, T. R. Rossiter, Bristol.—16*th September*, 1879.
3770. TYPOGRAPHICAL COMPOSITION, E. de Pass, London.—19*th September*, 1879.
3771. ELECTRIC LAMPS, J. Brockie, Brixton.—19*th September*, 1879.
3888. RIVETTING, &c., METAL PLATES, W. R. Lake, London.—26*th September*, 1879.
4415. OAKUM and YARN, W. R. Lake, London.—29*th October*, 1879.
3747. GAS REGULATORS, J. B. Cox, Torquay.—18*th September*, 1879.

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

3256. FURNACES, I. S. McDougall, Manchester.—17*th September*, 1875.
3278. NORDHAUSEN OIL of VITRIOL, W. S. Squire, London.—18*th September*, 1879.
3204. MOULDING, &c., TOOTHED WHEELS, J. C. Scott, Manchester.—13*th September*, 1875.
3422. PREPARING HEMP, &c., J. Barbour, Belfast.—1*st October*, 1875.
3325. SPRINGS for RAILWAY VEHICLES, I. A. Timmis, Manchester.—23*rd September*, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 6*th October*, 1882.

2164. REGULATING, &c., FLOW of WATER, T. S. Borradaile and E. J. C. Welch, London.—9*th May*, 1882.
2187. ARTICULATED LEVERS, A. Gain, London.—10*th May*, 1882.
2190. AUTOMATICALLY WORKING RAILWAY SIGNALS, W. Goalen, London.—10*th May*, 1882.
2198. PREPARING HIDES, &c., J. S. Stocks and B. Stocks, Leeds.—10*th May*, 1882.
2199. STEAMSHIP SCREWS, G. W. von Nawrocki, Berlin. —A com. from F. Maringer.—10*th May*, 1882.
2201. RAILWAY SIGNALS, A. W. Tuer and J. Cleminson, London.—10*th May*, 1882.
2205. CURING "GAPES" in BIRDS, J. H. Clark, Tardebigge.—10*th May*, 1882.
2218. ELASTIC COUPLINGS for ROPES, &c., J. Greenwood, Southend.—11*th May*, 1882.
2228. FREEZING LIQUIDS, A. Allworth, Camberwell.— 11*th May*, 1882.
2243. CONSTRUCTION of CAPSTANS, A. Kennedy.—12*th May*, 1882.
2266. COMBINED LETTER-BOX and NAME PLATES, W. Newell & T. Tollett, Birmingham.—13*th May*, 1882.
2271. HEATING RAILWAY CARRIAGES, J. Imray, London. —A communication from A. Morel.—15*th May*, 1882.
2318. ELECTRIC MOTORS, J. A. Cumine, London.—17*th May*, 1882.
2331. SPRING MATTRESS and BEDSTEAD, S. Isaacs, Birmingham.—18*th May*, 1882.
2343. SEWING HEAVY FABRICS, W. R. Lake, London.— A communication from G. Gowing.—18*th May*, 1882.
2356. SLIDE VALVES of STEAM ENGINES, J. Emery, Erith.—19*th May*, 1882.
2408. COILING WIRE, H. H. Lake, London.—A communication from G. Gale.—22*nd May*, 1882.
2448. YARN-WINDING MACHINES, E. Ashworth, Bolton-le-Moors —24*th May*, 1882.
2461. FLOUR, W. R. Lake, London.—A communication from W. Warren.—24*th May*, 1882.
2534. PAPER-MAKERS' DRYING FELTS, T. Aitken, Helmshore.—27*th May*, 1882.
2537. PRESSES for GUNPOWDER, W. R. Lake, London.— A communication from H. Gruson.—27*th May*, 1882.
2658. SECONDARY BATTERIES, A. Muirhead, London.— 6*th June*, 1882.
2727. GENERATING STEAM, H. Aydon, Whitton, and E. Field, London.—10*th June*, 1882.
2765. PRINTING MACHINES, J. H. Johnson, London.— A communication from E. Anthony.—10*th June*, 1882.
2836. NITRIC, &c., COMPOUNDS, W. R. Lake, London.— A communication from H. Gruson and A. Hellhoff. —15*th June*, 1882.
2847. PRINTING MACHINES, J. H. Johnson, London.— A communication from E. Anthony.—16*th June*, 1882.
2879. PRINTING MACHINES, J. H. Johnson, London.— A communication from E. Anthony and J. E. Harvey.—16*th June*, 1882.
2886. PRINTING MACHINES, J. H. Johnson, London.— A communication from A. Anthony and J. E. Harvey.—19*th June*, 1882.
2924. PENCIL, &c., HOLDERS, F. Hardtmuth, Bohemia. —20*th June*, 1882.
3106. PROPELLERS for STEAM VESSELS, R. Bell, Liverpool.—1*st July*, 1882.
3236. ARC ELECTRIC LAMPS, F. M. Rogers, London.— 7*th July*, 1882.
3481. PRINTING MACHINERY, W. C. Kritch, Leeds.—21*st July*, 1882.
3573. ORNAMENTAL WINDOWS, &c., A. L. Liberty, London.—27*th July*, 1882.
3857. PREPARING CORRESPONDENCE PAPER, &c., G. W. Simmons, London.—12*th August*, 1882.
3871. STARTING ENGINES, A. B. Brown, Edinburgh.— 14*th August*, 1882.
3953. DREDGING MACHINERY, H. C. Löbnitz, Renfrew. —18*th August*, 1882.
3978. FURNACES for REDUCING, &c., ORES, J. Imray, London.—A communication from J. C. Newbery, J. L. Morley, and B. Cleveland.—19*th August*, 1882.
4054. GAS FURNACES, C. D. Abel, London.—A communication from the Stettiner Chamotte-Fabrik Actien-Gesellschaft vormals Didier, Stettin.—24*th August*, 1882.

Last day for filing opposition, 10*th October*, 1882.

2257. GAS ENGINES, O. Mobbs, Northampton.—13*th May*, 1882.
2260. PLANING METALS, G. Richards, Manchester.—A communication from J. Richards.—13*th May*, 1882.
2262. MANUFACTURE of "PURL," &c., F. Stanton and E. Stanton, Lewisham.—13*th May*, 1882.
2274. FLOUR MILLING MACHINERY, A. B. Wilson, Holywood, Ireland.—15*th May*, 1882.
2275. BEDSTEADS, COUCHES, &c., T. Welton, London.— 15*th May*, 1882.
2276. OBTAINING HEAT, &c., from GAS, A. H. Hearington, London.—15*th May*, 1882.
2277. PRODUCING PICTURES on GLASS, H. J. Haddan, London.– A com. from E. Godard.—15*th May*, 1882.
2279. PRICKING-UP APPARATUS for LEATHER STITCHING MACHINES, J. Day, Stafford.—15*th May*, 1882.
2281. FIRE ESCAPES, J. Gordon, Leeds.—15*th May*, 1882.
2284. ROTARY ENGINES, &c., E. C. Peck, Charlton.— 15*th May*, 1882.
2292. WOVEN FABRICS, E. Briggs, Bradford.—16*th May*, 1882.
2293. INSULATING, &c., WIRES, A. Shippey, London, and R. Punshon, Brighton.—16*th May*, 1882.
2301. FASTENINGS for GLOVES, &c., J. Hinks, T. Hooper, and S. G. Moore, Birmingham.—16*th May*, 1882.
2306. FOUNTAIN INKSTANDS, F. F. Benvenuti, Swansea. —17*th May*, 1882.
2311. SUBMARINE CABLE GRAPNELS, Sir J. Anderson and W. C. Johnson, London.—17*th May*, 1882.
2323. COOLING, &c., BEVERAGES, W. A. Barlow, London.—A com. from H. Hohl.—17*th May*, 1882.
2333. NAVIGABLE VESSELS, J. T. Grindrod, Liverpool.— A communication from E. Jackson.—18*th May*, 1882.
2335. FITTINGS for ELECTRIC LAMPS, C. Defries, London.—18*th May*, 1882.
2344. HAMMERLESS BREECH-LOADING FIRE-ARMS, T. Woodward, Birmingham.—18*th May*, 1882.
2358. STRAP and BELT FASTENERS, B. Marsden, Manchester.—A com. from P. Koch.—19*th May*, 1882.
2362. ENGINES and PUMPS, C. Woodward, Leeds.—19*th May*, 1882.
2367. AIR FILTERING, &c., J. S. Brandstaetter, Liverpool.—19*th May*, 1882.
2368. INDICATORS for STEAM ENGINES, G. Hambruch, Berlin.—19*th May*, 1882.
2382. AXLES for CARRIAGES, J. Gordon, jun., Dundee. —20*th May*, 1882.
2384. SIGNALLING APPARATUS, W. E. Langdon, Derby. —20*th May*, 1882.
2387. MECHANICAL CAB, N. D. Spartali, Liverpool.— 20*th May*, 1882.
2397. ELECTRIC DETECTOR for the SAFETY CLOSING of WINDOWS, &c., B. Coyle, Dublin.—22*nd May*, 1882.
2433. RECIPROCATING SHUTTLE SEWING MACHINES, A. Greenwood, Leeds.—23*rd May*, 1882.
2496. BREECH-LOADING ORDNANCE, T. Nordenfelt, London.—25*th May*, 1882.
2498. DOOR FASTENERS, A. M. Clark, London.—A com. from C. Crongeyer and G. Busch.—25*th May*, 1882.
2508. CUTTING SCREW THREADS, J. H. Johnson, London.—A com. from W. D. Forbes.—26*th May*, 1882.
2574. DECORTICATING GRAIN, J. Wetter, London.—A communication from W. Ager.—31*st May*, 1882.
2608. FOLDING SLATES, &c., C. D. Abel, London.—A communication from W. Stuckle.—2*nd June*, 1882.
2617. SEWING MACHINERY, A. Greenwood and J. W. Ramsden, Leeds.—3*rd June*, 1882.
2631. ELASTIC WEDGES, A. E. Séné, Paris.—5*th June*, 1882.
2664. MANUFACTURE of SULPHIDE of SODIUM, G. W. von Nawrocki, Berlin.—A communication from the Verein Chemischer Fabriken.—7*th June*, 1882.
2667. PORTABLE SOLES and HEELS for BOOTS, &c., G. H. Ellis, London.—7*th June*, 1882.
2827. WIRE ROPES, F. C. Guilleaume, Cologne.—15*th June*, 1882.
2884. PREPARING COLOURS with MORDANTS, B. Grénié, London.—19*th June*, 1882.
2979. BALL and SOCKET JOINTS, H. J. Haddan, London. —A com. from O. C. White.—23*rd June*, 1882.
3004. PROTECTING TAP HOLES of CASKS, L. J. Prosser, London.—24*th June*, 1882.
3026. BLOW-PIPE LAMP, J. T. Garratt, London.—27*th June*, 1882.
3435. GAS MOTOR ENGINES, C. D. Abel, London.—A communication from C. Beissel.—19*th July*, 1882.
3666. ELECTRICAL WIRES, &c., P. R. de F. d'Humy, London.—2*nd August*, 1882.
3718. CRUSHING, &c., ORES, W. R. Lake, London.—A communication from R. McCully.—4*th August*, 1882.
3772. THRASHING MACHINES, W, R. Lake, London. – A communication from J. Schleyder.—8*th August*, 1882.
3835. MANUFACTURE of ALUM, &c., P. Spence and F. M. Spence, Manchester.—11*th August*, 1882.
3911. SIMULTANEOUS IGNITION of FUSES, W. Bickford-Smith and G. J. Smith, Tuckingmill.—16*th August*, 1882.
3917. DISINFECTING COMPOUNDS, C. Lowe and J. Gill, Manchester.—16*th August*, 1882.
3971. INSULATING COMPOSITIONS, G. J. Allport, London, and R. Punshon, Brighton.—19*th August*, 1882.
4141. RECIPROCATING PISTONS, H. J. Haddan, London. —A com. from M. V. Schiltz.—30*th August*, 1882.
4155. EVAPORATING LIQUIDS, Baron de Podewils, Munich.—31*st August*, 1882.
4348. WHEELS and AXLES, W. R. Lake, London.—A com. from E. B. Orne.—6*th September*, 1882.

Patents Sealed.

(*List of Letters Patent which passed the Great Seal on the* 15*th September*, 1882.)

1299. DRAUGHTING PATTERNS for LADIES' DRESSES, &c., W. T. Philpott, Colchester.—17*th March*, 1882.
1308. ARTIFICIAL HATCHING, M. Arnold, Acton.—17*th March*, 1882.
1325. DRAIN and SEWER PIPES, C. Slagg, Leeds.—18*th March*, 1882.
1333. CASES, &c., for INK HOLDERS, E. G. Brewer, London.—18*th March*, 1882.
1335. SPRINGS for RAILWAY VEHICLES, A. J. Boult, London.—18*th March*, 1882.
1336. COVERED or INSULATED WIRE, A. J. Boult, London.—18*th March*, 1882.
1349. RAILWAY SIGNALS, J. Livesey, Blackburn, and S. Whitehall and R. Becconsall, Summerseat.—20*th March*, 1882.
1358. CUTTING MORTISE HOLES in WOOD, J. Hall and W. Hall, Nottingham.—21*st March*, 1882.
1359. BRAKES for RAILWAY VEHICLES, H. Ivey, Battersea, and J. H. Cradock, London.—21*st March*, 1882.
1364. WHEELS, J. Taylor, Wigan.—21*st March*, 1882.
1370. SPINNING MACHINERY, J. M. Howson, Drighlington.—21*st March*, 1882.
1412. ELECTRIC LIGHTING, &c., O. E. Woodhouse and F. L. Rawson, London.—23*rd March*, 1882.
1416. BINNACLES, W. R. Williams and C. A. Williams, Newport.—24*th March*, 1882.
1425. VELOCIPEDES, A. Pengelly and R. Day, High bridge.—24*th March*, 1882.
1440. SPREADING MANURE, &c., R. G. Garvie and H. Skinner, Aberdeen.—25*th March*, 1882.
1446. MULES and TWINERS, J. Wain, Manchester.— —25*th March*, 1882.
1487. CUTTING METALS, W. W. Hulse, Manchester.— 28*th March*. 1882.
1520. LOOMS for WEAVING TUFTED PILE FABRICS, J. C. Rouse, Halifax.—29*th March*, 1882.
1547. DRAINING LAND, T. Abbott, Newark-on-Tren and G. S. Moore, Sunderland.—30*th March*, 1882.
1577. COPPER TUBES, S. Walker, Birmingham.—31*st March*, 1882.
1624. DRIVING TUNNELS, &c., C. D. Abell, London.— 4*th April*, 1882.
1649. UNDERGROUND CONDUITS for ELECTRIC WIRES, A. J. Boult, London.—5*th April*, 1882.
1701. ROTARY MOTORS, W. J. Gurd, Sarnia, Canada.— 8*th April*, 1882.
1775. BLEACHING HEMP and FLAX, A. C. Henderson, London.—14*th April*, 1882.
1795. MAKING NUT and BOLT BLANKS, &c., A. M. Clark, London.—14*th April*, 1882.
2196. WINDING COTTON, &c., H. C. Hill and H. H. Brown, Stalybridge.—10*th May*, 1882.
2381. HOT-BLAST STOVES, E. A. Cowper, London.—20*th May*, 1882.
3047. TELEPHONE RECEIVERS, W. Spence, London.— 28*th June*, 1882.
3101. ARC ELECTRIC LAMPS, R. H. Courtenay, London. —30*th June*, 1882.
3194. CONSTRUCTION of RIVER WEIRS, F. Wiswall and W. H. Collier, Manchester.—6*th July*, 1882.
3317. PNEUMATIC RAILWAY BRAKES, J. Imray, London. —12*th July*, 1882.
3411. POWER LOOMS, R. J. Gülcher, London.—18*th July*, 1882.

(*List of Letters Patent which passed the Great Seal on the* 19*th September*, 1882.)

1176. SPOON, T. F. D. Heap and J. Rettie, London.— 10*th March*, 1882.
1340. EXCAVATING TRENCHES, J. W. Wailes, Walsall.— 20*th March*, 1882.
1341. THRUST BEARINGS for SHAFTS, J. Wills, Leicester. —20*th March*, 1882.
1347. GENERATING ELECTRIC CURRENTS, S. E. Phillips, Charlton.—20*th March*, 1882.
1351. BINDING for SCAFFOLDING, J. Rettie, London.— 20*th March*, 1882.
1354. TREATMENT of FLOUR, F. H. F. Engel, Hamburg. —20*th March*, 1882.
1362. PERMANENT WAY of RAILWAYS, &c., A. Riche, Brixton.—21*st March*, 1882.
1366. WORKING TELEPHONIC, &c., APPARATUS, A. E. Dolbear, London.—21*st March*, 1882.
1367. ELECTRIC CIRCUIT CONNECTIONS, A. E. Dolbear, London.—21*st March*, 1882.
1368. ELECTRICAL CABLES, A. E. Dolbear, London.— 21*st March*, 1882.
1378. WATERPROOF CAPES, &c., G. Mandleberg, H. L. Rothband, and S. Mandleberg, Manchester.—22*nd March*, 1882.
1385. ELECTRIC CONTACT-MAKING THERMOMETER, J. Formby, Formby.—22*nd March*, 1882.
1389. FILTERING LIQUIDS, F. A. Bonnefin, London.— 22*nd March*, 1882.
1406. CORKSCREWS, W. J. Holroyde, Manchester.— 23*rd March*, 1882.
1511. BREECH-LOADING SMALL-ARMS, T. W. Webley, Birmingham.—29*th March*, 1882.
1523. LOOMS, R. Hindle and G. Greenwood, Blackburn. —29*th March*, 1882.
1539. PORTABLE STEAM ENGINES, G. R. Mather, Wellingborough.—30*th March*, 1882.
1558. GOVERNORS for STEAM ENGINES, E. Truman, Grantham.—31*st March*, 1882.
1574. STRENGTHENING ELECTRIC CURRENTS, W. R. Lake, London.—31*st March*, 1882.
1602. RING SPINNING FRAMES, A. M. Clark, London.— 1*st April*, 1882.
1641. MEASURING, &c., DEPTHS of LIQUIDS, J. M. Smales, Leavesden, and H. J. Rogers, Watford.—5*th April*, 1882.
1798. BOOTS and SHOES, J. Wetter, New Wandsworth. —15*th April*, 1882.
1863. POCKET FILTER, A. M. Clark, London.—18*th April*, 1882.
2094. PREPARING PRESERVES, V. Manuel, Brixton.—4*th May*, 1882.
2255. LOOPED FABRICS, J. Kiddier and H. Kiddier, Nottingham.—13*th May*, 1882.
2440. ROTARY ENGINES, H. J. Haddan, London.—23*rd May*, 1882.
3008. TELEPHONIC INSTRUMENTS, J. D. Husbands, London.—24*th June*, 1882.

List of Specifications published during the week ending September 16th, 1882.

20, 6d.; 406, 6d.; 445, 6d.; 505, 10d.; 536, 6d.; 540, 6d.; 614, 6d.; 635, 6d.; 648, 10d.; 657, 4d.; 673, 4d.; 678, 2d.; 687, 6d.; 702, 8d.; 705, 2d.; 706, 2d.; 707, 6d.; 708, 2d.; 709, 2d.; 710, 2d.; 712, 8d.; 713, 6d.; 714, 6d.; 715, 6d.; 716, 4d.; 717, 2d.; 718, 2d.; 719, 2d.; 721, 6d.; 722, 6d.; 728, 6d.; 724, 6d.; 727, 2d.; 728, 2d.; 731, 1s.; 732, 2d.; 534, 6d.; 736, 6d.; 737, 6d.; 738, 8d.; 739, 2d.; 540, 6d.; 742, 2d.; 748, 10d.; 745, 8d.; 747, 2d.; 748, 2d.; 749, 8d.; 750, 6d.; 751, 2d.; 752, 2d.; 753, 6d.; 755, 6d.; 756, 6d.; 757, 2d.; 761, 2d.; 762, 4d.; 763, 4d.; 764, 2d.; 567, 6d.; 768, 1s.; 769, 2d.; 770, 2d.; 771, 6d.; 772, 2d.; 774, 2d.; 777, 4d.; 778, 2d.; 781, 6d.; 782, 8d.; 783, 4d.; 784, 8d.; 788, 8d.; 790, 6d.; 794, 4d.; 795, 4d.; 798, 6d.; 800, 2d.; 801, 2d.; 802, 6d.; 803, 6d.; 804, 2d.; 806, 2d.; 810, 6d.; 811, 6d.; 812, 4d.; 814, 4d.; 815, 6d.; 821, 6d.; 822, 6d.; 823, 6d.; 833, 8d.; 923, 4d.; 924, 6d.; 960, 4d.; 963, 6d.; 970, 4d.; 1027, 6d.; 1064, 4d.; 1249, 6d.; 2813. 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.*

20. STITCHING MACHINES, *J. Day, Stafford.*—3*rd January*, 1882. 6*d.*

This relates to machines chiefly used to stitch the soles to the welts of boots and shoes, and it consists principally in combining with the needle an awl or feeding point to assist the same in feeding the work, so that the needle not having to bear as much strain

as hitherto may be of comparatively small size. The invention further consists in devices for varying the distance of the awl from the needle to suit the length of stitch.

406. SECURING RAILS TO SLEEPERS, &c., *A. M. Clark, London.*—26*th January*, 1882.—(*A communication from T. J. Bush, Kentucky, U.S.*) 6*d.*

This consists in the construction and arrangement of bolts adapted to interlock with one another, and in the method of securing them by intersecting or crossing one another, and causing the bolts to interlock within the sleeper and mutually retain one another, and it consists in forming the bolts with notches or recesses at the point where they cross each other, so that when placed in the holes formed for them in the sleeper, and which cross each other at a suitable angle, the two recessed parts will engage and interlock the bolts.

445. FIRE-GRATES AND STOVES, *J. Jaffrey, Manchester.*—28*th January*, 1882. 6*d.*

This relates to domestic fire-grates for burning anthracite coal or other fuel for the prevention of smoky chimneys or periodical down-draughts, for consuming smoke, and for ventilating rooms by means of a diffusion of heated fresh air and the extraction of vitiated air. The bottom and sides of the grate are of fire-clay, and in the bottom flues are formed to admit highly heated air into a combustion chamber under the bottom. Flues are also formed in the front bars and in the sides, and communicate by side flues with the combustion chamber. A chamber behind the grate heats air which is delivered to the room.

505. DRESSING, TURNING, AND MOULDING STONE, &c., *J. D. Brunton, Westminster.*—1*st February*, 1882. —(*Partly a communication from F. H. J. Trier, Boston, U.S.*) 10*d.*

This consists, First, in the application of circular rotating cutters to the planing, shaping, or turning of stone in such a manner as to cause the edges of the cutters to shave, pare, or slice away, as distinguished from splitting off, the stone to be removed, and it consists in arranging the cutters at a greater or less angle to the plane of motion, the holder of the cutter being adjustable so that the angle of the cutter may be regulated as desired. Two or more cutters inclined to each other may be employed. The invention further relates to apparatus for turning grindstones.

536. GAS OVENS, *D. and W. H. Thompson and W. J. Booer, Leeds.*—3*rd February*, 1882. 6*d.*

This relates to improvements on patents No. 1719, A.D. 1881, and No. 190, A.D. 1882, and consists in adapting the same to bakers' ovens. The oven is formed with flues above, below, at the sides, front, and at the back thereof. The top flues are open alternately at one end to receive atmospheric air or other gas burners, and at the other end alternately lead into the side flues, down which the heated gases pass to transverse parallel flues under the oven, and which all open into a longitudinal flue leading to the back and thence to the chimney.

541. IMPROVED ELECTRIC OR MAGNETIC MOTOR, *T. Morgan, Charing Cross, London.*—3*rd February*, 1882.—(*A communication from J. C. Caff, Singapore, and W. Judd, Penang.*) 6*d.*

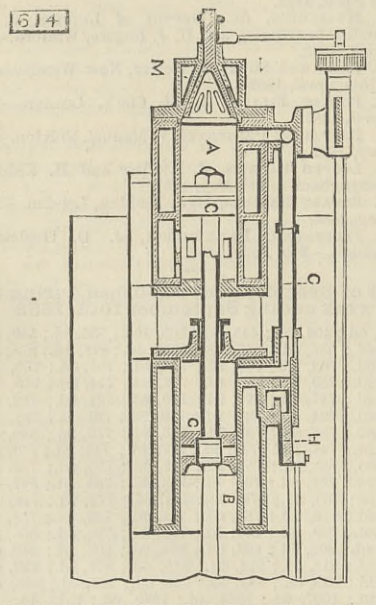
This relates to a motor for reciprocating movements, such as pulling a punkah, &c. The motor consists of two long bars of iron, to which are attached several pole pieces. These bars are wound with wire, so as to produce electro-magnets with several consequent poles of alternate polarity. A sliding piece built up of brass is provided with two electro-magnets, one to slide with its poles near the fixed pole on the bars, and the other so arranged that its poles are not opposite the fixed poles at the same time as those of the first sliding magnet. The sliding piece is also provided with a piston rod. Commutators are provided above the fixed magnets to reverse the current as required.

578. IMPROVEMENTS IN ELECTRIC LAMPS, *B. J. B. Mills, London.*—7*th February*, 1882.—(*A communication from M. M. Thomas, Cincinnatti, Ohio, U.S.*) 6*d.*

This relates to arc lamps of the Achereau and Gaiffe type, in which the electrodes are kept properly apart by direct attachment of one of them to a soft iron core suspended within a coil, whose magnetism is dependent upon the current. The object of the present invention is to render the arc steady. The upper carbon only is movable, and is attached to a core working inside a single coil helix. To procure the proper height of suspension of the core in the coil, the insulating wrapping of the wire is taken off on the two opposite sides of the coil, and two sliding conductors—rollers—are caused to make contact with these exposed portions. These conductors being attached to the upper carbon and rising and sinking with it, carry off the current from their point of contact, and cut out of the magnetic field so much of the coil as extends for the time being beneath them.

614. GAS ENGINES, *W. B. Haigh and J. Nuttall, Oldham.*—8*th February*, 1882. 6*d.*

This consists in forming a gas engine with two cylinders A and B placed in line, and each containing a piston C connected to the same rod. The rear ends of the two cylinders are connected by a passage G



fitted with a valve H worked from the crank shaft. A charge being admitted to one cylinder is thus caused to exert a corresponding force on both pistons at the same time. M is the valve to admit the charge to cylinder A, and over it works an ignition slide.

632. IMPROVED MEANS OF AND APPARATUS FOR SIGNALLING BY ELECTRICITY ON RAILWAYS, *S. C. C. Currie, Strand, London.*—9*th February*, 1882. 1*s.* 2*d.*

This relates to a system of signals, wherein the inventor uses a continuous current, which with a special arrangement of contacts and levers, enables the signals to be worked automatically by the passage of a train; such passage acting through a rod and lever by the deflection of one of the rails to automatically disconnect the signals, the current being restored again by means of a shunt passing through a smaller magnet. The signals, though automatic, are also under the control of the signalman, who can at any time put them to danger.

635. STEAM BOILERS, *W. Arnold, Barnsley.* — 9*th February*, 1882. 6*d.*

The First part relates to means for imparting increased strength and heating surface to the internal flues and fire-boxes of steam boilers, and consists in making the rings or parts of which the same are formed barrel-shaped or in the form of a double cone; and the Second part relates to the apparatus for giving the desired form to such parts or rings, and consists of a suitably formed roll on a long shaft in conjunction with three other rolls having a corresponding configuration and mounted in a strong frame.

648. MUSICAL INSTRUMENTS, *H. J. Haddan, Kensington.*—10*th February*, 1882.—(*A communication from W. F. Abbot, Montreal.*) 10*d.*

This relates more particularly to instruments in which a perforated strip is used as a valve to control the operation of the reeds or other sounding devices, and it consists, First, in the combination with such instruments of a swell box constructed to form a conduit for the passage of air through the reeds to or from the bellows. It further relates to a valve for the bellows capable of being opened from the outside and while the bellows are in operation; and, lastly, to a flexible valve for the bellows made of leather and secured along one edge only.

657. ANVILS, *E. and O. Wright, Dudley.*—10*th February*, 1882. 4*d.*

This consists in making anvils in one solid piece so as to avoid the usual welding or joining of the parts. A piece of iron is by means of dies and swage tools formed to a suitable shape under a steam hammer, that is, with the two ends hollowed out and the part to form the top flattened, the bottom part being formed afterwards. The piece is then reheated, and by means of top and bottom dies it is made to the required shape for an anvil ready for steeling the face in the usual way.

658. SLABS OR PANELS FOR DECORATIVE PURPOSES, *A. McLean, Belvedere-road.*—10*th February*, 1882. 4*d.*

This consists in the manufacture of slabs or panels for decorative purposes from Keene's Parian or similar cement, by the aid of pressure.

659. GAS ENGINES, *E. S. Wastfield, Bath.*—10*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the use, in combination with a hollow or chambered piston, of a peculiar arrangement of slide valve to admit the inflammable mixture, and for admitting a small charge of gas alone immediately before and after the admission of the mixture. Other improvements are described.

661. IMPROVEMENTS IN TELEPHONE EXCHANGE SYSTEMS, &c., *H. H. Eldred, London.*—11*th February*, 1882.—(*A communication from T. B. Doolittle, Bridgeport, Conn., U.S.*) 8*d.*

The object of this invention is to avoid the difficulties consequent on the collection of a large number of lines in one station, by distributing the lines into different groups, each group containing as many as can be conveniently worked by one operator, and each group having its own switch-board and apparatus complete. The different switch-boards belonging to different groups are connected by direct wires. The invention also relates to improvements in switch-boards and apparatus, the object being to procure celerity of working.

662. TAPS AND VALVES, *G. Heidman and Y. Hoffmann, Germany.*—11*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to valves in which the body is divided into inlet and outlet channels by a partition in which is an opening controlled by the valve proper, and it consists of a screw action to actuate the valve, which has a vertical motion.

663. SLIDING WINDOWS, *J. F. Williams, Liverpool.*—11*th February*, 1882.—(*Not proceeded with.*) 2*d.*

The top of the window or sash is fitted with hooks or fastenings, which take into openings formed in the side frames.

664. ELASTIC FABRIC, *T. H. Harrison, Derby.*—11*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in the manufacture of a fabric woven with an elastic shoot in place of elastic warps, whereby lateral instead of longitudinal elasticity is obtained.

666. BRICKS, TILES, &c., *H. J. Haddan, Kensington.*—11*th February*, 1882.—(*A communication from F. Cancalon, France.*—(*Not proceeded with.*) 2*d.*

The object is to make the clay homogeneous without the application of much water, and it consists in pressing the clay through a perforated plate so as to divide it into threads, which are then compressed into a compact mass and moulded to the desired form.

667. PURIFYING AND DISCOLOURING SACCHARINE LIQUIDS, *H. J. Haddan, Kensington.*—11*th February*, 1882.—(*A communication from H. Tietz, Brunswick.*) —(*Not proceeded with.*) 2*d.*

This consists in purifying and discolouring saccharine liquids by means of binoxyde of hydrogen.

668. SET-SQUARES OR PLUMB RULES, *G. W. von Nawrocki, Berlin.*—11*th February*, 1882.—(*A communication from T. Redlich, Berlin.*)—(*Not proceeded with.*) 2*d.*

This consists of a pendulum to the lower portion of which a pointer is pivotted, and consists of a two-armed vertical lever, the short upper arm having a vertical slot into which projects a pin fixed to the casing of the pendulum, while the pivotted end of the lower and longer arm is visible through an opening in the casing, and remains opposite a fixed mark when the pendulum is exactly vertical.

669. DISTILLATION AND PURIFICATION OF ALCOHOL, *P. Claes, Brussels.*—11*th February*, 1882. 6*d.*

The alcoholic vapours as they escape from the boiler pass through a couple of condensers, where the impurities are eliminated and returned to the boiler to be again subjected to heat, whereby all the alcohol they hold in suspension is driven off. The vapours are then subjected to washing by steam previously to passing to the distillatory column.

670. SHIRTS, *G. Tighe, London.*—11*th February*, 1882. 6*d.*

This consists in securing straps to the front and back of the shirt so that it may be attached to and support the trousers without the use of braces.

671. COMBINED DOOR MAT AND SCRAPER, *J. S. Willway, Bristol.*—11*th February*, 1882.—(*Not proceeded with.*) 2*d.*

A series of parallel bars are arranged on edge and connected together at suitable distances apart by intermediate tubular distance pieces through which rods are passed.

674. STARTING OR INCREASING THE COMBUSTION OF FRESHLY LIGHTED FIRES IN FURNACES, *A. J. Boult, London.*—11*th February*, 1882.—(*A communication from J. Hahn, Germany.*)—(*Not proceeded with.*) 2*d.*

A blast nozzle connected by a flexible pipe to a suitable blower is placed between the bars and injects a mass of easily ignitable material, such as dirty waste saturated with oil, or a cake of tar and coal dust, into the grate.

675. RAISING AND LOWERING HEAVY WEIGHTS, *J. C. Mewburn, London.*—11*th February*, 1882.—(*A communication from A. Ballier, France.*)—(*Not proceeded with.*) 2*d.*

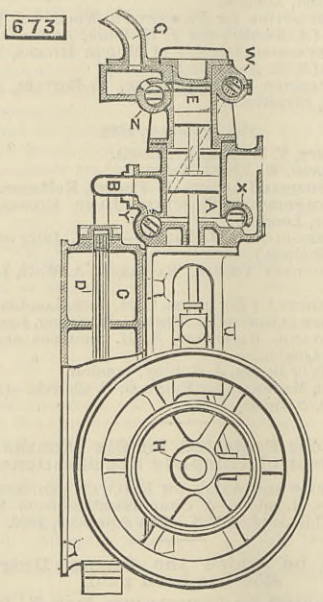
This relates to apparatus for raising and lowering heavy packages on to or from coaches or other vehicles.

677. IMPROVEMENTS IN INTERLOCKING ELECTRIC AND OTHER SIGNALLING APPARATUS FOR RAILWAY AND OTHER TRAFFIC, *W. E. Langdon, Derby.*—11*th February*, 1882. 10*d.*

The objects of this invention are to provide a system of signals by which it shall be, First, impossible to place a starting signal to "all clear," until the electric signal has been so placed; also Secondly, impossible to release an electric "line blocked" signal until the train for which the signal was set has passed out of the section; and Thirdly, impossible to release the block signal for or to give the "all clear" signal to the section out of which the train has passed until it has been signalled forward to the next section in advance and until the "line blocked" signal for that section has been received. To accomplish these ends the inventor applies to the commutator portion of an ordinary electric block instrument a locking arrangement, by preference mechanical, and an electrical releasing arrangement. In connection with the metals he places a commutator actuated by the train, and in connection with the signal lever governing the outdoor signals controlling the road, under a block catch arrangement controlling the movement of such lever; and in order to better ensure the movement of the signals and facing points, he applies to the signal, where such is required, an automatic igniter, which by means of electrical appliances is brought into action when the light is extinguished, and to the facing points an improved electrical contact and circuit arrangement to indicate the position of the points.

673. AIR REFRIGERATING APPARATUS, *T. B. Lightfoot, London.*—11*th February*, 1882. 4*d.*

This relates to a machine for refrigerating by compressing and cooling air and then expanding it. A is the air compressing pump taking in air at X and discharging at Y, and which passes by pipe B to space C in the foundation, in which water circulates through



pipes D. Behind pump A is the expansion cylinder E which receives air from space C through valve W, and discharges it when expanded through valve Z, the air passing by pipe G to the place where it is to be employed. The valves X Y, W, and Z are all worked from excentrics on the shaft H driven by a suitable motor.

678. GAS ENGINES, *W. Watson, Leeds.*—11*th February*, 1882.—(*Void.*) 2*d.*

This relates, First, to the means for supplying and mixing the air and gas to gas engines; Secondly, the vapours arising from the combustion of the gases are condensed, and the water conveyed into the cylinder and used for lubricating purposes; Thirdly, to the use of a tube with a piston to explode the mixed gases; and, Fourthly, in the use of a balanced ball float to regulate the supply of air and gas.

679. HORSESHOES, *J. Gavett, London.*—11*th February*, 1882.—(*A*)*communication from J. Kuerman, St. Louis, U.S.*)—(*Not proceeded with.*) 2*d.*

This consists in forming a continuous calk all round the underside of the shoe.

680. SLIDE VALVES FOR STEAM MACHINERY, *D. Ashton, Sheffield.*—11*th February*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to reduce the pressure of the slide valve against its facings, and it consists in the use of a small cylinder and piston connected with the valve, and fixed so that the piston can be acted upon by the steam, and exert a counteracting force on the slide valve, in proportion to the difference of the surface area of the piston to that of the valve.

681. HINGES FOR DOORS, *J. W. Pitt, Liversedge.*—11*th February*, 1882.—(*Not proceeded with.*) 2*d.*

The wings of the hinge are of ordinary construction; but a recess is formed in the joint of the hinge, and in it a coiled flat spring is mounted on the spindle of the hinge.

682. INTRODUCING ANTI-INCRUSTATION MATERIAL INTO STEAM BOILERS, *J. Trotter, Rawtenstall, Lancashire.* —11*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This consists of a chamber to hold such material, and connected with the feed pump, so that a part of the feed-water is caused to pass through such chamber before passing into the boiler.

683. BALL OR ROLLER BEARINGS FOR VELOCIPEDES, *A. Burdess, Coventry.*—11*th February*, 1882. 4*d.*

This consists in the use of two circular series of balls, one in contact with the axle, and each ball of the second is placed between two balls of the first series, the whole being enclosed in a suitable casing.

684. SUSPENDING WALL PAPER IN RACKS TO DRY, &c., *A. M. Clark, London.*—11*th February*, 1882.—(*A communication from H. Staib, New York.*)—(*Not proceeded with.*) 4*d.*

This relates to mechanism for taking the web of paper as it comes from the printing machine, and carrying it to racks, where it is suspended to dry in loops on sticks placed at intervals, and also to the construction of the racks.

685. RAISING WATER, *A. M. Clark, London.*—11*th February*, 1882.—(*A communication from J. Decondun, Paris.*)—(*Not proceeded with.*) 4*d.*

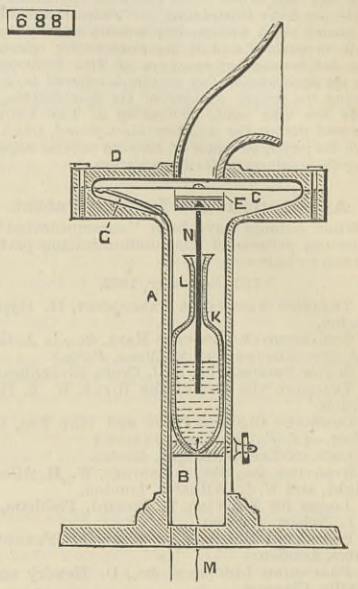
A measured quantity of water is delivered automatically and intermittently to a vaporiser, and the steam generated is conducted to a receiver, and, acting on the surface of the water therein, raises it to the desired position. As the steam becomes condensed in the receiver a vacuum is formed and water is drawn up into it from the source.

686. IMPROVEMENTS IN TELEPHONE CALL OR SIGNALLING APPARATUS, *A. M. Clark, London.*—11*th February*, 1882.—(*A communication from G. M. Hopkins, Brooklyn, New York.*) 6*d.*

This relates to a simple call for telephone lines, belonging to the class of signalling apparatus employing magneto or induction currents in connection with polarised bell magnets. A Siemens magneto-electric machine is used to generate the current, and the inventor claims certain improvements in the bell hammer and magnets.

688. IMPROVEMENTS IN THE METHOD OF TRANSMITTING OR REPRODUCING AND REPEATING SOUNDS BY ELECTRICITY, &c., *A. M. Clark, London.*—11*th February*, 1882.—(*A communication from G. M. Hopkins, Brooklyn, New York.*) 8*d.*

The first part of this invention consists in a contact surface attached to a vibratory diaphragm and a float-supported electrode pressed against the contact surface by column of liquid. In the figure, E is a disc of carbon attached to the centre of the diaphragm C—metal or mica. If of metal, the diaphragm may be made part of the circuit by means of spring G. A glass bottle K is supported at any convenient height within A, as shown. A platinum wire B enters K and is connected to wire M. K is partly filled with mercury in contact with B, and which buoys up float-rod N carrying on its upper end a carbon disc U. The float-rod is a conductor. This carbon disc is pressed by N into light contact with carbon disc E attached to C. Another part of the invention consists in two sets of electrodes insulated from each other and vibrated



alternately in opposite directions, one set being placed in the primary telephonic circuit, and the other in the secondary, the object being to interrupt the secondary circuit so as to break up the effects of induction and render the induction currents and earth currents available in transmitting. Other improvements are described.

690. FASTENING RAILS TO SLEEPERS BY CLAMPING LEVERS, *G. Schwartzkopff, Berlin.*—13*th February*, 1882. 6*d.*

This relates to improvements on patent No. 613, A.D. 1879, and consists in the adaptation of the clamping levers therein described for fastening rails to sleepers, to various kinds of rails and sleepers.

691. FIRE-BARS AND FURNACES, *S. Barlow, Castleton.* —13*th February*, 1882. 6*d.*

This consists, First, in making fire-bars in the form of a spear-head in cross section, having the upper extremities on which the fire is laid sharply pointed like a chisel edge, and elongated below. These bars can be arranged in a curvilinear form, so that the fire is deeper on each side of the box in internally-fired boilers.

692. WINDING OR HAULING APPARATUS, *H. J. Haddan, Kensington.*—13*th February*, 1882.—(*A communication from A. Lausies, Bordeaux.*)—(*Not proceeded with.*) 2*d.*

This relates to apparatus for hauling long ropes, and has for its object to dispense with the necessity of holding the rope tight by hand, so as to produce friction on the drum and prevent it slipping back, and it consists of two parallel discs mounted on the horizontal shaft of the windlass and kept at the required distance by bolts, in combination with a system of movable wedges arranged radially in grooves on the inner face of the discs.

693. ROLLER MILLS, *J. Qualter, Barnsley.*—13*th February*, 1882. 6*d.*

A pair of smooth rollers are mounted in a case, one being driven by a pulley and strap, and the other by friction therefrom. Below each roller are placed one or more smaller rolls carried on the ends of pivotted levers, adjustable as to pressure by sliding weights or springs. The material to be reduced passes first between the main rollers, and then between the smaller ones.

694. FIRE-BOXES, *R. H. Brandon, Paris.*—13*th February*, 1882.—(*A communication from P. A. Nepilly, Germany.*)—(*Not proceeded with.*) 2*d.*

This consists in the application of a fire screen over the grate so as to prevent the light fuel or dust being carried away into the flues by the draught of air.

696. TREATING METALS AND ALLOYS, *A. M. Clark London.*—13*th February*, 1882.—(*A communication from L. Clémandot, Paris.*) 4*d.*

This consists, First, in subjecting metals and metallic compounds or alloys, when heated, to powerful compression, and letting them cool under pressure, so as to effect a tempering by compression; and Secondly, in effecting the magnetisation of steel during the operation of compression as described.

697. HORSESHOES, *G. Collier, Newcastle, and W. Armes, Norwich.*—13*th February*, 1882. 9*d.*

This consists of a double shoe, the upper one attached to the hoof, and the under or wearing shoe fastened to the bottom of the upper one. The upper shoe is in two parts, hinged together and secured to the hoof by a cross-bar and a suitable screw or spring.

698. TRANSPORTING PASSENGERS AND MERCHANDISE OVER RIVERS, &c., *P. Everitt, London, and E. Burrell, jun., Thetford.*—13*th February*, 1882.—(*Not proceeded with.*) 2*d.*

The vessel is adapted to receive a train of carriages from railways, and is covered in, so that waves may break right over it. It is propelled by means of a rope connected with the opposite shores, and is wound on to or unwound from drums actuated by powerful steam engines.

699. LOOMS FOR WEAVING, *J. Hollingworth, Dobcross, Yorkshire.*—13*th February*, 1882. 10*d.*

This relates, First, to mechanism for actuating the shuttle-boxes and supporting them between the changes; Secondly, to improvements in the jacquard apparatus, and consists in operating the jack hooks by two horizontal levers mounted on studs placed at a short distance from each other, so that when nearest together the levers are about parallel, but form a gradually increasing angle as they are separated; Thirdly, to means for causing the catch lever to engage with the studs on the box lever; and, Fourthly, to the arrangement of levers and springs to lift the healds in plain looms.

701. ADJUSTABLE FIRE-SCREEN MOUNT, *H. J. Davis, London.*—13*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to a fire-screen mount which can readily be attached to the bars of the fire-grate.

702. BLOWING, EXHAUSTING, HEATING, &c., AIR, GAS, AND FLUIDS, *H. Wilson, Stockton-on-Tees.*—13*th February*, 1882. 8*d.*

This relates, First, to the application of direct action to the propulsion of the blowing apparatus described in patent No. 4305, A.D. 1879, and consists in the application of a steam cylinder with one central and two or more annular spaces, in which a solid and two or more ring pistons work, which are connected directly to the rods actuating the blower plungers; Secondly, to the form and arrangement of the various cooling and heating media to be used in conjunction with the blower, one of which consists of a tube of cast metal, between which and a covering of bright tin the air is driven; and Thirdly, to the fires to heat the air or liquids operated upon, and also its application for heating and drying purposes.

705. MATCH-BOXES, *J. Darling, Glasgow.*—14*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in forming a perforated chamber at one end of the match-box, so that the match when lighted may be held therein, so as to prevent its being blown out.

706. FASTENING OF NECKTIES, &c., *F. H. Valpy, London.*—14*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in inserting a buckle in the body of the necktie, and forming eyelet holes in the band, one of which, when the band is passed through the buckle, receives the tongue thereof, and so secures the necktie in position.

707. ROLLING PAMPHLET COVERS, *W. P. Thompson, Liverpool.*—14*th February*, 1882.—(*A communication from E. L. Miller and W. H. Rohrer, Washington, U.S.*) 6*d.*

This relates to an improved tool or implement for pressing and folding and pasting covers upon book edges, pamphlets, &c.; and it consists of two rollers arranged at right angles to each other in a frame to be manipulated by hand; one roller being vertical and the other horizontal, so that when the instrument is in use one roller will bear on the rear and the other on the upper edge of the book, and when moved to and fro will press the cover firmly to the book.

708. SIGNALLING ON RAILWAYS, *W. C. Dredge and W. J. Cordner, Westminster.*—14*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates more particularly to fog signals, and consists in fitting a lantern, signal, or whistle to any part of the train and causing it to be operated by a contact piece placed between the rails and under the control of the signalman.

709. HORSESHOES, *J. Camp, Lowestoft.*—14*th February*, 1882.—(*Void.*) 2*d.*

This consists in forming the shoes in two halves hinged together and provided with side clips to grip the outside of the hoof, while the rear ends of the two halves are secured together by means of a transverse screw, whereby the use of nails to secure the shoe in position is obviated.

710. CONTROLLING THE MOTIVE POWER OF ENGINES, *J. McCammon, Belfast.*—14*th February*, 1882.—(*Not proceeded with.*) 2*d.*

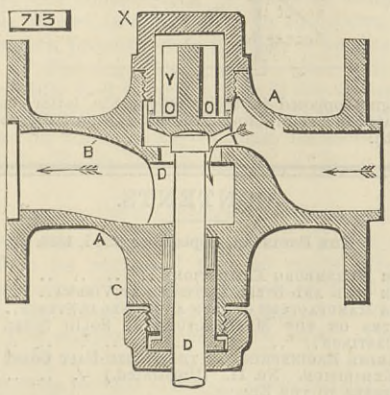
This relates to a mode of applying momentum, or momentum combined with centrifugal force, to the regulation of the speed of motive power engines, and it consists in the use of a brake, which, by its centrifugal action, is brought to bear on a disc connected by differential gear with the cut-off excentric, which is thus shifted on its shaft.

712. REPEATING MECHANISM AND CARTRIDGE MAGAZINES FOR BREECH-LOADING FIRE-ARMS, *G. E. Vaughan, London.*—14*th February*, 1882.—(*A communication from J. Werndl, Austria.*) 8*d.*

This relates to improvements in the detachable repeating mechanism for breech-loading fire-arms described in patent No. 3878, A.D. 1878, and it consists, First, in a peculiarly constructed cartridge magazine, combined with a pressing spring and plate, adapted to receive a given number of cartridges; Secondly, in an arrangement to feed the cartridges regularly from the magazine to the breech; and Thirdly, in arranging the repeating mechanism so that it may be made to slide along the breech in a line parallel with the longitudinal axis of the gun, so that the mechanism makes with the sliding bolt the same forward and backward movements.

713. VALVE COCK, *W. R. Lake, London.*—14*th February*, 1882.—(*A communication from A. Benoist, Paris.*) 6*d.*

The valve to govern the passage of the fluid is not attached to the rod which operates it. The body A of the cock has two necks B and C, one containing a stuffing-box through which the operating rod D passes, and the other a hollow plug X in which is arranged



the valve Y, the seat D of which is formed in the body of the cock, and which is kept closed by the pressure of the water. The operating rod forces the valve from its seat when required to be opened, and when the pressure is removed the valve closes. Small holes O allow the fluid to pass under the valve so as to facilitate its moving.

714. LAMP WICK, *W. R. Lake, London.*—14*th February*, 1882.—(*A communication from G. Beck, Texas, U.S.*) 6*d.*

This consists in forming a non-combustible lamp-wick of one or more layers of mineral wood enclosed in a textile material, and the whole sewed together by a series of parallel longitudinal stitches.

715. VENETIAN BLINDS, *R. M. Chevalier, Westbourne-grove.*—14*th February*, 1882. 6*d.*

The laths are formed of thin wood cut off by a knife set at an angle of about 45 deg., the wood having been previously hardened by treatment with a glutinous matter composed of glue and shellac dissolved and brought to the consistency of paint or varnish. The head lath of the blind consists of a roller suspended upon pivots at each end, and supported in bearings, which allow it to be revolved by means of a cord wound thereon, and the tapes supporting the laths are thus caused to wind on to or unwind from the roller. A curved tilting lath is mounted over the roller, and serves to tilt the laths as required.

716. PURIFICATION OF COAL-GAS, *T. E. Jones, Tottenham.*—14*th February*, 1882. 4*d.*

This consists in purifying gas supplied for illuminating purposes by causing it to filter through chromic acid, which for convenience may be intimately intermingled with some fibrous material such as cotton wool. The apparatus employed is constructed so that the chromic acid and wool may be readily renewed.

717. PRESERVING MILK, *J. H. Bibo, Horsham.*—14*th February*, 1882.—(*A communication from E. Scherff, near Berlin.*)—(*Not proceeded with.*) 2*d.*

The milk is placed in bottles, the necks of which are then closed by corks and the bottles heated in a closed cistern containing water at somewhat over 100 deg. Cent., after which the bottles are allowed to cool, and the stopper coated with paraffine and a capsule of tin foil.

718. CAUSING NAPS TO ADHERE TO HAT BODIES, *E. K. Dutton, Manchester.*—14*th February*, 1882.—(*A communication from G. Atherton, Stockport, at present at Newark, U.S.*) 2*d.*

The hat body is placed over the napping bat, which is mounted or a forming cone, the hat body and the bat being then rubbed or pressed and vibrated upon the cone until the combination or adhesion is effected, the process being aided by the application of heat.

719. PROPELLING AND STEERING SHIPS, *J. Cooke, Richmond, Yorkshire.*—14*th February*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to construct apparatus, by means of which water may be ejected with force astern a vessel in a number of small streams, so as to increase the superficial area of the stream and the extent of the surface in contact with the water into which it is ejected, and it consists in the use either of a screw or of a centrifugal pump, with suitable means for dividing the current delivered into a number of streams and directing them as required.

720. OVENS, *C. D. Abel, London.*—14*th February*, 1882.—(*A communication from W. Lorenz, Vienna.*) 10*d.*

This relates to an improved construction of baking ovens for continuous working, whereby, First, a very equable and constant temperature of about 500 deg. Fah. is maintained by the employment of a large mass of brickwork which, in taking up the heat from longitudinal and transverse heating flues formed therein, serves as a magazine for a considerable quantity of heat, which is only slightly affected by variations in the amount of heat supplied thereto or absorbed therefrom during the baking; and, Secondly, the baking or cooking operation is effected in the presence of steam produced in a steam generating apparatus.

721. HUMANE TRAP FOR CATCHING AND KILLING VERMIN, *W. Burgess, Malvern Wells.*—14*th February*, 1882. 6*d.*

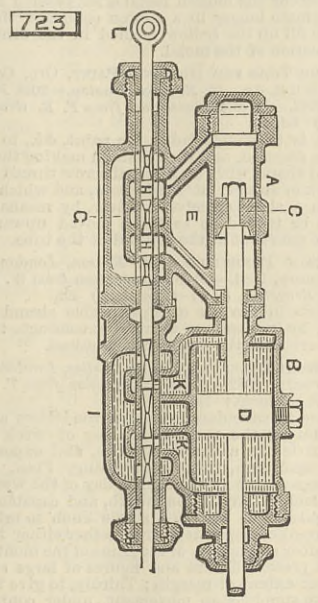
This trap is to catch and kill rabbits and vermin, but which cannot catch foxes, pheasants, and poultry or injure the fingers of the person setting it, and it consists of a tunnel-like structure open at both ends and fixed on a board, a suitable frame or jaw being pivotted to the base, and actuated by a spring released by the weight of the animal on the board, so as to cause the frame to work through a slot in the tunnel and kill the animal passing through it.

722. COMBINED NIGHT COMMODE AND CUPBOARD, *J. W. Randall, Chatham.*—14*th February*, 1882. 6*d.*

This consists of a box or cupboard, the upper part of which is of convenient height to sit on, and the top part forms a commode fitted with the usual pan, while the lower part forms a cupboard to receive one or more chamber utensils.

723. REGULATING OR GOVERNING THE SPEED OF STEAM ENGINES, &c., *G. B. Goodfellow and R. Matthews, Hyde, Chester.*—15*th February*, 1882. 6*d.*

The object is to make governors more sensitive and capable of governing with variable loads and variable steam or other pressures, and it consists in the application of two cylinders A and B to any governor of the pendulum or other known form, such cylinders being fitted with pistons C and D, preferably coupled to the same rod, which is connected to the throttle valve or cut-off rod. Cylinder A has a valve chest G, in which works a valve H which is actuated to give



fluid pressure to either side of piston C, while the other is in communication with the exhaust passage E. The cylinder B is filled with liquid and has a valve chest I in which works valve K, preferably in one piece with valve H, the end, L, of which is connected to the governor. When the governor is in its correct position the piston D will be locked by the valve K closing communication between the two sides of the piston; but when the governor moves slide H the piston C is actuated, and liquid passes from one side of piston D to the other.

724. GLASS GOBLETS, *T. G. Webb, Miles Platting, Lancashire.*—15*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the manufacture of goblets of flint glass by a combination of pressing or moulding and blowing processes, and it consists in pressing the stem and blowing the bowl, the two being then placed together at a bright red heat and thus united.

725. FEEDING MECHANISM FOR SAWING MACHINES, *R. B. Pope, Dumbarton, N.B.*—15*th February*, 1882. 6*d.*

This relates to machines with reciprocating saws, and has for its object to provide an arrangement of parts which may be adapted for double feeding to suit the saws when cutting in both directions of their motion, or for single feeding to suit the saws when cutting in one direction only.

727. VERTICAL STEAM BOILERS, *A. Verey, Dover.*—15*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This consists of a vertical cylinder having its two opposite sides flattened for a portion of its height to form tube plates to receive horizontal or slightly inclined fire tubes. One side is arranged with fire-brick linings or water spaces, so that in conjunction with the shell it forms the fire-box; and to the other side a smoke-box is attached.

728. INDELIBLE INK, *Dr. W. Reissig, Munich.*—15*th February*, 1882.—(*Not proceeded with.*) 2*d.*

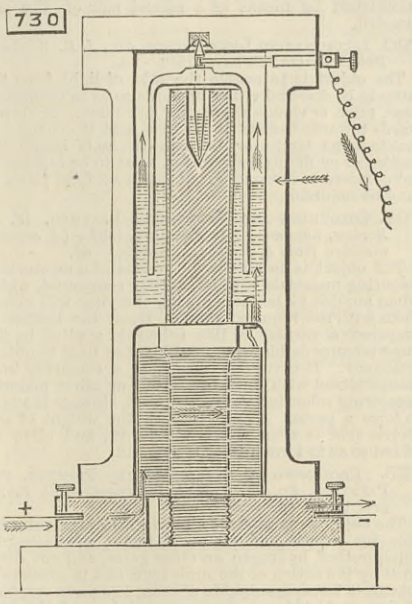
This consists in the addition to printers' ink of peroxides and protoxides of iron, and metallic iron in a fine state of division, so as to render the same indelible.

731. WHITE LEAD, &c., *E. V. Gardner, Oxford-street.*—15*th February*, 1882. 1*s.*

This consists, First, in preparing lead by submitting it to the action of acetic acid and acetate or nitrate of lead and water, or to a mixture of the same; Secondly, in granulating or spongifying lead by dropping the molten metal on to a slab arranged in a tank; Thirdly, in the arrangement of electro-negatives to lead, such as carbon, platinum, and so on, in connection with the lead to be converted into white lead, so that they shall be in electrical relationship to each other; Fourthly, in the employment of ozonised materials (such materials being ozonised before entering the chamber or within the chamber by electrical discharges), either alone or in combination with the electro-negatives above referred to; Fifthly, in producing carbonic acid gas by the oxidation of paraffine or other like carbonaceous substances; Sixthly, in the construction and arrangement of a "saturating evaporator," for purifying carbonic acid obtained as described; and Seventhly, in the employment of the mixed vapours of acetic and nitric acids and water, alone or mixed with air or oxygen or carbonic acid, in ordinary condition or with ozonised materials.

730. IMPROVEMENTS IN APPARATUS FOR MEASURING AND REGISTERING ELECTRIC CURRENTS, *C. A. Faure, Strand, London.*—15*th February*, 1882. 6*d.*

The principle of the invention is that a conductor conveying a current tends to rotate round a magnet. The apparatus is illustrated in the accompanying figure. A cylindrical electro-magnet is mounted vertically within a vessel containing mercury. A conductor in form like the flier of a spinning machine is pivotted on the top of the magnet core, and its arms dip down into the mercury. The current to be



measured circulates through the magnet and the moving conductor, and as the force required to move any object through a liquid is proportional to the square of the speed, it follows that the number of rotations of the conductor will be proportional to the current to be measured. The registering part of the apparatus may be independent of the above, and consists of an electro-magnet and armature similar to that of an electric bell, and arranged with a train of wheels. Each pulsation of the armature registers permanently.

732. SULPHATE OF ALUMINA, *W. Gentles, Widnes.*—15*th February*, 1882. 2*d.*

This consists, First, in the manufacture of sulphate of alumina, the purification of same from iron by converting the iron salt into chloride of iron, and extracting it by mechanical means; and Secondly, in the purification of crude sulphate of alumina from salts of iron by decomposition with chlorate of lime containing chloride of calcium.

733. SPINNING AND DOUBLING MACHINERY, *C. H. Maxted, Galgate, Lancashire.*—15*th February*, 1882. 4*d.*

The object is to secure economy of construction and working and great efficiency, particularly at high speeds, and it consists in fixing on the upper or stationary rail of the spinning frame a number of tubular studs, each fitted with a driving pulley, from which a light frame is carried up in the shape of an inverted U and has at its centre at top an eye or hook and an inclined slit at each side. The upper part is grooved. Through the stud passes a rod fixed to the movable rail, and on it the bobbin is placed, the thread passing from the feed roller over a guide rail, through the eye at top of U frame, down the groove through the side slot and to the bobbin.

734. LOOMS FOR WEAVING, *W. H. Hacking and E. Grube, Bury.*—15*th February*, 1882. 6*d.*

This relates, First, to the shedding motion, the object being to obtain the same result as with a Woodcroft's sectional tappet, and at the same time to dispense with the sections and substitute a pattern surface consisting of lags and pegs, bowls, cards of paper or other materials, and it consists in the use for each heald to be operated on of two compound tappet levers connected by a link, which carry internal movable tappets or switches acted upon by the pattern surface, and arranged so that oscillating bars may pass over or under the tappets and raise or depress the treadles; and Secondly, to apparatus for stopping the loom when the weft fails or is broken, and it consists in fitting in the shuttle a hinged fork, under which the weft passes, and which is released by the breakage or failing of the weft. Part of the side of the shuttle is movable, so that when the fork is released such part moves inwards and the swell enters the side of the shuttle, which, not being lifted, stops the loom.

736. PROPELLING TORPEDOES, *J. H. Johnson, London.*—15*th February*, 1882.—(*A communication from W. F., A. H., M. M., and W. A. Johnston, New York.*) 6*d.*

The main object is to impart to the fluid used as a motor for torpedoes (which usually is a liquefiable gas, compressed to the extent of liquefaction), the heat needed to maintain it at such a temperature as will cause it to exert the best effect as a motor fluid, and it consists in leading a compressed liquefiable combustion supporting gas, such as nitrous oxide gas, through a combustion chamber containing ignited carbon or other fuel with the products of combustion from which it unites and forms a highly heated gaseous motor fluid.

737. FURNACES, *J. H. Johnson, London.*—15*th February*, 1882.—(*A communication from E. J. Mallett, jun., New York.*) 6*d.*

The object is to promote the combustion of fuel, so that all the fuel, gaseous as well as solid, is consumed and utilised to produce heat, and it consists in the use of a fan which draws air through the furnace instead of forcing it into the same. Between the furnace and the fan a "water-contact condenser" is inserted, through which the air passes, and is cooled before reaching the fan.

738. RECEPTACLES FOR AERATED WATER BOTTLES, &c., *J. Ferguson, Ashton Keynes, Wilts.*—15*th February*, 1882. 8*d.*

This relates to a case to hold bottles so that they are locked therein and cannot be removed, but may be emptied of their contents by suitable apparatus, and it consists in placing the bottles in holders of sheet metal, which are forced together so as to grip the bottles. A tube attached to a suitable lever handle is forced into the neck of the bottle, and removes the stopper, allowing the contents to flow from the bottle.

739. ORNAMENTATION OF METALS, *G. Bower, St. Neots.*—15*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in coating iron or steel which has been subjected to the action of steam, air, oxygen, or carbonic acid at an elevated temperature, and covered by this means with a protective film consisting of magnetic oxide of iron with a layer of some other metal, which is deposited thereon by the action of an electric current.

742. REVOLVING SHOW STANDS FOR SHOP WINDOWS, &c., *W. J. Lloyd, Harborne.*—15*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to means for controlling the speed of revolving show stands, so as to cause them to revolve slowly, and thus render the frequent winding up of the spring mechanism unnecessary.

743. UTILISATION OF SEWAGE, &c., FOR IRRIGATING LAND, *G. H. Gerson, Berlin.*—15*th February*, 1882. 10*d.*

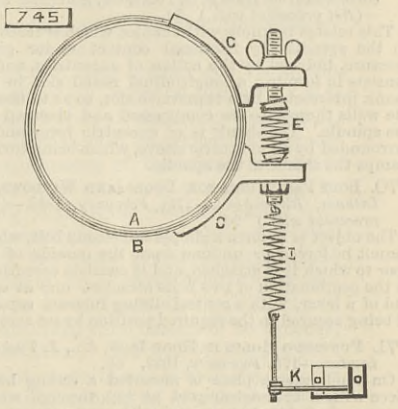
A field to be sown in spring is manured in winter for which purpose, after the ploughing, a number of ridges are formed in it at intervals by a special plough, and other cross ridges are formed so as to produce a network of square basins, to which the sewage is delivered by means of a set of conducting pipes resting on forks or trestles, and connected by pliable tubes to each other and to an underground main containing the sewage.

744. BARRELS AND STAPLES OF SOCKET BOLTS, *W. Randle, Birmingham.*—15*th February*, 1882. 6*d.*

This relates, First, to forming the barrels and staples and the plates of socket bolts from cylindrical tubing by a drawing process; and, Secondly, to the tools to be used in producing the same.

745. REGULATING THE SPEED OF WARP BEAMS IN LOOMS, *H. H. Lake, London.*—15*th February*, 1882.—(*A communication from Tassigny, Frères, and Co., Paris,*) 8*d.*

Round the warp beam A is placed a hoop B formed of one or more turns of metal covered with india-



rubber or other material to give the necessary pressure on the warp beam. To the heop are attached angle pieces C with a spring E between them, adjustable by means of nuts. To the bottom angle piece is attached a spring I, also adjustable by the screwed rod K.

747. REVOLVING CUTTER, *A. H. Pear, Exeter.*—16*th February*, 1882.—(*Not proceeded with.*) 2*d.*

A rotary cutter consisting of a disc of sheet metal with a knife edge is mounted in a forked arm fitted with a handle, and used for cutting textile fabrics or other materials.

748. WIRE TRAMWAYS, *J. Brown, London.*—16*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in forming the carrier to which the load is attached with a pair of pincers or pinchers under the saddle, and so arranged as to grip the wire and prevent the carriage slipping backwards on the wire when in an inclined position.

750. TRANSMITTING MOTION, *W. Spence, London.*—16*th February*, 1882.—(*A communication from J. Coirarrd, Paris.*) 6*d.*

This invention is principally applicable to mowing and reaping machines, and it consists of a wheel toothed on its two side faces, the top of the tooth on one face corresponding to the centre of the space on the other face. Two spring contact pieces mounted in the forked ends of a lever are alternately engaged with the toothed wheel, and receive as the wheel revolves a reciprocating motion which can be transmitted to the mechanism as required.

751. MOTOR POWER MECHANISM, *J. B. Howie, Glasgow.*—16*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to the use of a set of coiled springs and gearing fitted within a box to be attached to the sewing or other machine to be driven by the uncoiling of such spring, and in combination therewith of a brake arrangement to regulate the power to be given out by the springs, and thereby controlling the speed of the machine.

752. GAS GOVERNORS, &c., *G. E. Webster, Nottingham.*—16*th February*, 1882.—(*Not proceeded with.*) 2*d.*

In the service pipe a partition is fixed having a valve in its centre attached to a hollow spindle fixed on an inverted cup floating in an annular trough containing mercury.

753. TRAVELLING BUILDING FOR A CIRCUS, *C. H. Keith, Bradford.*—16*th February*, 1882. 6*d.*

This relates to the construction of a travelling building forming a circus, which, when not in use, may be separated into sections forming vehicles, which can be taken from place to place by horses or other means.

754. HOOKS FOR FASTENING STEAM, GAS, AND WATER PIPING, &c., *M. Benson, London.*—16*th February*, 1882.—(*A communication from J. N. Doremus, Paterson, New Jersey, U.S.*) 6*d.*

This relates to machines for manufacturing such hooks, and it consists in the construction of pinching devices and the rolls, and in the details of construction and combination of the several parts of the machine.

755. SANITARY APPLIANCES, *R. Weaver, Clapham-road.*—16*th February*, 1882. 6*d.*

The pan is constructed in any suitable manner, and round the bottom outside is fitted the trap and bend, made of metal and of a special form, the end of the bend being attached to the soil pipe. The peculiar form of the bend ensures a portion of the flush being retained in the pan between the trap and the dip of the pan. Several modifications are described.

757. DYEING COTTON YARNS AND THREADS, *G. W. von Nawrocki, Berlin.*—16*th February*, 1882.—(*A communication from G. Fagenburg, jun., Sweden.*)—(*Not proceeded with.*) 2*d.*

This relates to dyeing cotton in the loose state in a closed vessel in which a partial vacuum is maintained, and which contains the dye and the cotton maintained at a lower temperature than hitherto.

762. MAKING UP STRAW, &c., INTO SHEAVES, *G. Kearsley and E. Whitworth, Ripon.*—16*th February*, 1882.—(*Not proceeded with.*) 4*d.*

The apparatus can be used either in connection with harvesting machines or with separate sheaf-binding machines, and also in connection with thrashing machinery, and it consists in placing on an ordinary harvesting machine a shaft extending over the binding table, and carrying curved arms, which divide the cut crop into bundles of uniform size. The invention further relates to the means for delivering the sheaf when bound, and for retaining and cutting the binding material.

763. NUTS FOR SCREW BOLTS, *R. Harrington, Wolverhampton.*—16*th February*, 1882. 4*d.*

The lock nut can be formed by rolling or coiling a strip of spring steel of suitable shape with a spiral or convoluted form, one edge of the strip being V-shaped, so as to form the thread when coiled.

764. OBTAINING MOTIVE POWER, *H. H. Fanshawe, East Dulwich, and C. J. Griffith, Islington.*—16*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This relates to means for obtaining motive power to drive machinery continuously by means of weights or springs, which are periodically rewound without the intervention of manual power.

767. CANS FOR PRESERVED PROVISIONS, &c., *J. S. Gates, London.*—16*th February*, 1882.—(*A communication from H. K. and F. B. Thurber and Co., New York.*) 6*d.*

This relates to means for ensuring the uniformity of

size of provision cans, and it consists of a bracket mounted on a table and having a jaw or gripper at each end to embrace the ends of the block, on which the body of the can is held while being soldered. The bracket has a joint capable of being actuated by a strap and treadle, so as to open and close the two ends of the gauging appliance.

768. RAILS, CHAIRS, SLEEPERS, AND FASTENINGS FOR RAILWAYS AND TRAMWAYS, *H. T. Grainger, Camberwell.*—17*th February*, 1882.

The object is to prevent railway wheels mounting the rails, thus preventing accidents, and also to improve the permanent way of tramways and facilitate crossing the rails. The railway rail is rolled of an oblong form with grooves in the vertical walls, and it is suspended from the top end of a chair having a projection to enter one groove in the rail whilst the opposite grooves receive a similar projection formed on a piece passing under the rail and secured by nut and key to the former piece. The specification describes several modifications and the application to tramway lines.

769. ATTACHING DOOR KNOBS TO SPINDLES, *T. A. Weston, Stamford, U.S.*—17*th February*, 1882.—(*A communication from B. H. Lockwood, Stamford U.S.*)—(*Not proceeded with.*) 2*d.*

This relates to knobs with shanks, which are secured to the spindles by frictional contact under great pressure, induced by the action of excentrics, and it consists in forming a longitudinal radial slot in the shank intersected by a transverse slot, so as to enable the walls thereof to be compressed and clamped on the spindle. The shank is of excentric form and is surrounded by an excentric sleeve, which being turned clamps the shank to the spindle.

770. BOLT FASTENINGS FOR DOORS AND WINDOWS, *E. Latham, Birkenhead.*—17*th February*, 1882.—(*Not proceeded with.*) 2*d.*

The object is to form a simple and strong bolt, which cannot be forced or undone from the outside of the door to which it is attached, and it consists essentially in the combination of two bolts attached one at each end of a lever, with a central sliding fulcrum capable of being secured in the required position by set screws.

771. PUNCHING HOLES IN HOOP IRON, &c., *J. Tushaw, London.*—17*th February*, 1882. 6*d.*

On a hollow sole plate is mounted a strong headpiece with a cylindrical part at top, through which passes a shaft fitted at one end with gearing to actuate the punching apparatus, while its other end is cam-shaped and works in a rest in a sliding block carrying the punching tool and working in guides. To ensure self-feeding the gearing of the main shaft actuates a pair of rollers, between which the metal passes and is gripped. Modifications are described for machines for punching and setting saws.

772. LOCK-UP STANDS FOR BOTTLES, &c., *J. Ridge, Sheffield.*—17*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in applying fall bars capable of moving in the frame of the stand, so as to be brought over the tops of the stoppers of the bottles, in which position they can be locked.

776. MARINE ENGINES, *G. A. P. H. Duncan, Westminster Bridge-road.*—17*th February*, 1882. 6*d.*

This relates to an arrangement of compound marine engines and of their connecting channels and valves so that the working power can be varied over a wide range without materially interfering with the regularity of the action, and it consists in arranging four cylinders in a row, the first and last being large, and provided with condensers and air pumps to work as condensing engines, whilst the second and third are considerably smaller, and adapted to work at high pressure without condensation. All the pistons are connected to cranks on one shaft, those for the first, second, and third being preferably at an angle of about 120 deg. to one another, and that for the fourth opposite the first. The steam and discharge channels have valves, which can be set so as to work the engines in several ways.

777. RECOVERING THE TIN CONTAINED IN OR UPON WASTE METALS, &c., *C. D. Abel, London.*—17*th February*, 1882.—(*A communication from Dr. H. A. Schulte, Dusseldorf.*) 4*d.*

This relates to recovering tin from waste metals or alloys, and consists in the preparation of a lye composed of hydrate of soda or hydrate of potash and water, which is heated to boiling point and mixed with lead oxide of any composition, in which lye the metals to be treated are allowed to remain until it is perfectly saturated with tin, that is, until all the caustic soda or potash in the liquid is converted into stannate of soda or potash. A mixture of the hydrates of soda and potash might also be employed.

778. FISH JOINTS FOR RAILWAY RAILS, *F. C. Winby, Westminster.*—17*th February*, 1882.—(*Not proceeded with.*) 2*d.*

This consists in forming both the fish-plates and the ends of the rails with a series of alternate grooves and projections, which will interlock.

781. INDICATING DOOR FASTENINGS, *A. Ashwell, West Dulwich.*—17*th February*, 1882. 6*d.*

This relates to means for indicating when a bath-room, water-closet, or other place, is occupied, and according to one arrangement the sliding bolt to fasten the door is formed with teeth on one edge, gearing with a pinion, the spindle of which carries a disc with the word "engaged" written thereon, and which, when the bolt is shot, is exhibited through an opening in the door.

782. WINDING YARNS OR THREADS OF COTTON, &c., *W. T. Stubbs and J. Corrigan, Manchester.*—17*th February*, 1882. 8*d.*

This relates to "winding frames," and consists, First, in an arrangement for arresting the motion of the bobbin when one or more of the yarns become broken. The yarns on their way to the cop or bobbin pass through eyes carried in a frame mounted on a bracket attached to the frame of the machine, and which also supports an oscillating plate with slots to receive projections which keep the eyes in the working position. Under the eyes is an arm to which an oscillating motion is imparted, and which can pass under the oscillating plate, one end of which receives a catch formed on a handle sliding through a bracket also carried by the frame, and jointed to a weighted lever turning on a rod, the other end of the lever projecting beneath a sliding rod having a plate or brake at its upper end, which when raised lifts the bobbin out of contact with the drum by which it is rotated. The Second part relates to winding yarns from one set of bobbins or spools on to another where the spools are of different diameters, and it consists in arrangements to maintain an uniform tension on each of the yarns as they are wound on the bobbin.

783. FOUNTAIN INK HOLDERS, &c., *F. F. Benvenuti, Swansea.*—17*th February*, 1882. 4*d.*

This consists in the combination of a hollow ink holder, a rod with a piston at its upper end, and an ink feeder having a conical aperture in the centre, with a ruling pen or point having a conical valve, and also an ink protector or regulator.

784. MOWING AND REAPING MACHINES, *W. R. Lake, London.*—17*th February*, 1882.—(*A communication from C. W. Levalley, Minnesota, U.S.*) 8*d.*

This consists chiefly in the arrangement in connection with a centrally pivotted cutter bar frame of a draught chain, whereby a lifting force is exerted upon the cutter bar and its attached parts at the same time that the machine is drawn ahead, and also to the construction and arrangement of the several parts of the machine, whereby they are strengthened and made adjustable to render the machine more easy of operation without adding to its weight.

786. VENTILATORS AND COWLS, *J. M. Lamb, Finchley-road.*—18*th February*, 1882. 6*d.*

This consists in having the wind vanes fixed on and between one or more cones, rising one above the other in the form of a Venetian blind, and revolving by the action of the wind over a fixed cone.

788. HOOPS FOR SECURING PICKS, &c., TO SHAFTS, *T. Brown, Sheffield.*—18*th February*, 1882. 8*d.*

This relates to means to making split hoops and causing the two meeting ends to interlock by forming a dovetail projection on one end to enter a corresponding recess in the other, and it consists, First, in stamping out hoops from strips of sheet steel so that there is little or no waste; and Secondly, in placing the blank thus obtained between a pair of dies, and acting on it so as to bend it round a mandril, after which the operation is finished by means of a second pair of dies and mandril.

790. ILLUMINATING LIGHTHOUSES, &c., *J. R. Wigham, Dublin.*—18*th February*, 1882. 6*d.*

The object is to enable the rays of light from the lamp to be directed either upwards so as to illuminate haze, mist, or clouds above the lighthouse, or downwards towards the sea at its base, and it consists in making the lamps or burners movable inside the lenticular or dioptric apparatus, so as to be capable of being raised or lowered out of the usual focal plane as may be required.

794. COLOURING AND VARNISHING LEATHER, *W. A. Barlow, London.*—18*th February*, 1882.—(*A communication from E. Fernbach, Nancy.*) 4*d.*

The object is to obtain, by means of a mixture of colouring materials with oil, a fatty compound, which when applied to leathers during currying will colour them with the required shade. Upon the leather so prepared a varnish of like colour is applied in the same manner as blacking, and brushes used to obtain brilliancy. This varnish consists of a colouring substance mixed with dextrine, gum, or other material possessing colouring properties, and vinegar is added to form a paste. About one-fifth the weight of sulphuric acid is then slowly stirred in, and olive oil added so as to form a fatty compound.

795. PRODUCING A FIXED WHITE PIGMENT FOR PAINTING, &c., *H. Knight, Liverpool.*—18*th February*, 1882. 4*d.*

The object is to produce a pure white pigment suitable for painting in oil or in water, unaffected by sulphuretted hydrogen or other gases, and not darkened by the action of the sun's rays, and it consists in mixing 0·75 parts sulphide of soda, 2·00 parts sulphate of zinc or chloride of zinc, or a mixture of the two, and 3·50 parts chloride of strontia.

798. RECOVERING OF SODA USED IN MAKING WOOD PULP STUFF, &c., *H. C. F. Störmer, Paris.*—18*th February*, 1882. 6*d.*

A furnace directly heats a boiler, into which is poured the lye wash containing the soda to be recovered, and two other boilers are in communication therewith, but are not directly heated. Steam pipes connect the boilers so that the steam given off may pass from the first to the second boiler, and then to the third. Tubes are provided between the boilers for the passage successively of the lye wash from one to the other more and more concentrated. The lye wash returns through another tube in a very concentrated state to the furnace, where it ignites and heats the first boiler.

800. CANDLESTICKS, *J. H. Johnson, London.*—18*th February*, 1882.—(*A communication from J. Engelson, Naples.*)—(*Not proceeded with.*) 2*d.*

The object is to enable candles to be readily inserted and withdrawn from the candlestick, and any size to be firmly held, and it consists in forming the holder with a box-like upper part with a flat bottom, to receive a casing containing jaws forming a funnel above and a tubular socket beneath, being pressed towards each other by springs.

801. MAKING WOODEN PACKING CASES, *W. Crooks, York.*—18*th February*, 1882.—(*Not proceeded with.*) 2*d.*

A cross bar slides to and fro in guides and carries a number of horizontal punches, which at each forward movement pass under hoppers containing nails, which are allowed to fall one by one, and the punches force them along guides into the side of the packing case.

802. REFRIGERATOR FOR USE IN BREWERIES, DISTILLERIES, &c., *W. Morton and P. Robinson, Burton-on-Trent.*—18*th February*, 1882. 6*d.*

This relates to a tubular refrigerator presenting a large and effective cooling surface, easily cleaned and repaired, and although formed of thin metal, possessing great strength and durability, and it consists in the use of copper or other suitable metal drawn tubes flat at top and having a rib along the whole length of one edge at bottom, and which serves to guide or turn off the liquid being cooled, and also to impart strength to the tube. The tubes are, further, flat on one side so that two may be soldered side by side. A series of them are mounted with their flat tops horizontally one above another in a frame, leaving a small space between each to allow a current of air to pass through. The liquor to be cooled passes over the outsides of the tubes and water passes through them.

803. EXTINGUISHING FIRES, *J. K. J. Foster, Bolton.*—18*th February*, 1882. 6*d.*

This relates to a new method and apparatus for extinguishing fires, and consists in depriving air of its oxygen, and vitiating it with the carbonic acid gas and other products of combustion by passing it through a fire or otherwise rendering it unable to support combustion, such as saturating it with steam or impregnating it with gases or vapours which will have the desired effect, and forcing or drawing the air so treated into, through, or over the burning structure. A fan is used to force the air through the furnace of the boiler which supplies steam to drive the engine for actuating the fan, and then into the burning structure.

804. PRESERVATIVE ANTI-FOULING COMPOSITIONS FOR SHIPS' BOTTOMS, &c., *W. C. A. Holtzapfel.*—18*th February*, 1882. 2*d.*

The composition consists of 3 parts bitter aloes, 3 camphor, 5 gum copal, 3 pitch, 15 resin, 5 linseed oil, 28 methylated finish or spirit, 28 colouring matter, and 10 oxide of mercury.

806. STEAM BOILERS AND HEATERS, *J. Rapieff.*—20*th February*, 1882.—(*Not proceeded with.*) 2*d.*

To facilitate the circulation of liquids in boilers and heaters, inner partitions of suitable shape and made of any suitable material are employed. In tubular boilers the tubes are suitably arranged to effect the same purpose.

810. VENTILATING VALVE FOR PREVENTING THE BURSTING OF WATER PIPES DURING FROST, *A. St. C. Buxton and F. O. Ross, Hammersmith.*—20*th February*, 1882. 6*d.*

This consists of a ventilating valve applied to the end of the supply pipe for the house service within the cistern. When the valve closes the pipe the latter may be emptied, air entering it by a pipe extending from the valve casing above the level of the water in the cistern. Modifications are described.

812. SOLID LYE COMPOSITION FOR WASHING AND BLEACHING LINEN, *W. H. Beck, London.*—20*th February*, 1882.—(*A communication from C. M. Lévy and G. Alexandre, Paris.*) 4*d.*

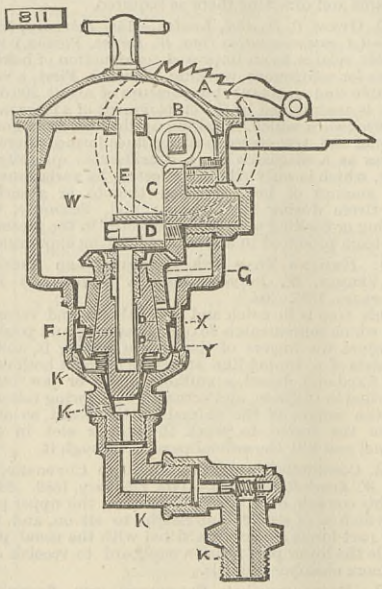
This relates to improvements on patent No. 1899, A.D. 1878, and it consists in the combination of carbonate of soda, silicate of soda, or silicate of potass, colophony or resin, liquid fucus with a soda base, and oleic acid or oleine.

814. COLOURING MATTER FOR DYEING AND PRINTING, *C. D. Abel, London.*—20*th February*, 1882.—(*A communication from Dr. E. Jacobsen, Berlin.*) 4*d.*

This consists, First, in the manufacture of red or violet colouring matters by the action of benzo-trichloride, its higher chlorinated compounds, or certain corresponding bromides or chloro-bromides on chinoline or its homologues or mixtures of the same, with or without the addition of metallic salts or oxides causing condensation; Secondly, the manufacture of colouring matters from pyridine and its homologues by the action of the re-agents above named; and Thirdly, the use for dyeing and printing of colouring matters produced from chinoline and pyridine, as described.

811. LUBRICATORS, *J. Lumb, Elland, Yorkshire.*—20*th February*, 1882. 6*d.*

This relates to ensure supply and discharge of lubricant to cylinders of steam engines and bearings of axles or shafts. The ratchet wheel A is operated in the ordinary manner, and on its shaft is a worm B gearing with wheel C, which is also formed with bevel teeth to gear with wheel G. On the face of



wheel C is a pin D, taking into a slot formed in plunger E, working in the inverted taper plug F, caused to revolve by means of wheel G, so as to admit lubricant from reservoir W to the interior of the tapered plug through the hole X. The plunger in descending forces the lubricant through outlet Y to the passage K.

822. CASTING INGOTS OF STEEL, *J. D. Ellis, near Rotherham, Yorkshire.*—20*th February*, 1882. 6*d.*

This consists in applying to the mould a feeder composed of fire-clay or other suitable non-conducting material, whereby the molten metal after passing the feeder will remain longer in a molten condition than usual, and so fill up the hollow formed in the centre by the contraction of the metal.

823. CASE OR TUBE FOR HOLDING PAINT, OIL, CONDENSED MILK, &c., *W. R. Lake, London.*—20*th February*, 1882.—(*A communication from F. R. Grout, Chicago.*) 6*d.*

The object is to enable tubes for paint, &c., to be refilled when emptied, and it consists in making them cylindrical in shape with an internal screw thread to receive a cork or stopper at the bottom, and which is formed with a slot to receive a driver, by means of which it can be turned so as to be moved upwards and force the paint out at the top end of the tube.

825. FOUNTAIN PENHOLDERS, *M. Benson, London.*—21*st February*, 1882.—(*A communication from W. W. Stewart, Brooklyn, U.S.*)—(*Complete.*) 6*d.*

This consists in the use of a permeable strand or cord, which, by its capillary attraction, conducts ink from the reservoir to the pen as it is required.

833. PERPETUAL CALENDARS, *P. M. Justice, London.*—21*st February*, 1882.—(*A communication from T. H. Hovendon, Ontario.*) 8*d.*

This relates to calendars in which the letters and figures indicating the month and day of week or month are carried on a moving surface, and exposed to view at apertures, the objects being, First, to provide an apparatus to indicate the day of the week, the month, and the day of the month, and capable of being manipulated at will by a single knob to bring into proper position separately or together either the name or number of the day, or the name of the month; Secondly, to present letters and figures of large size with a proper extent of margin; Thirdly, to give the parts positive step-by-step movement, under control of the operator, with yielding stops between the steps; Fourthly, to provide simple mechanism not liable to get out of order; Fifthly, to arrange a fixed yearly calendar or series of yearly calendars in connection with the words and figures indicating days and months; and Sixthly, to produce en effective and practical calendar within reasonable limits as to cost.

845. SADDLES FOR BICYCLES, *E. Edwards, Birmingham.*—21*st February*, 1882. 6*d.*

The object is to give the saddle greater elasticity, and it consists in making the foundation plate extend along the middle of the saddle only leaving the parts of the seat called the bellies without internal metallic support, such parts being supported by springs attached to the underside of the seat.

889. WATER-CLOSETS, *J. C. Mewburn, London.*—23*rd February*, 1882.—(*A communication from J. E. Boyle, Brooklyn, and H. Huber, New York.*) 6*d.*

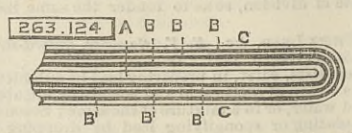
This relates to improvements in water-closets in which the descent of the flushing water is made to syphon the bowl, and it consists in means whereby the vacuum in the flushing chamber is broken after the bowl has been syphoned, and before all the water has escaped from the flushing chamber, whereby the flushing water is caused to fill the bowl.

SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

263,124. SECONDARY BATTERY, *Nicolas De Kabath, Paris, France.*—*Filed January 6th*, 1882.

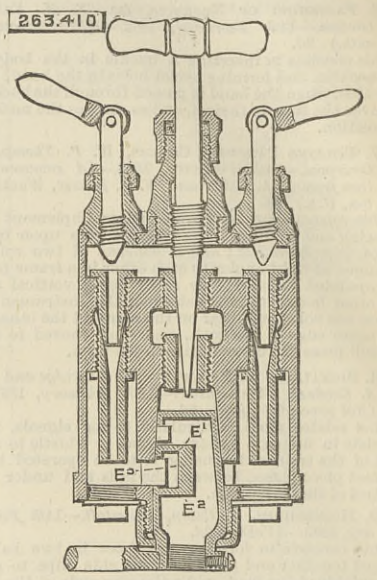
Claim.—(1) A compound electrode for secondary batteries, formed of very thin sheets of lead having a coating of sulphate of lead placed upon a thicker one, and wrapped in artificial parchment, said sheets being either smooth or plaited, as and for the purposes set forth. (2) A compound electrode for secondary batteries, formed of a series of alternately straight and plaited strips A and B having a coating of sulphate of lead held in a bunch by means of a thicker strip C and



india-rubber or other rings D, and wrapped in artificial parchment, as and for the purposes set forth. (3) In a secondary battery, the combination, with a leaden box internally lined with thin sheets of prepared lead, of the electrodes formed substantially as herein shown and described, and arranged in the said box, wrapped together, either in a transverse or parallel direction, with artificial parchment, as set forth.

263,410. INJECTOR, *Lovren E. Hogue, Sandy Lake, Pa.*—*Filed February 1st*, 1882.

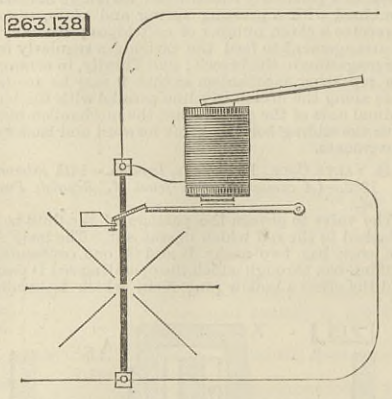
Claim.—(1) In an injector, the combination of a cylindrical shell provided with steam and water passages, a lifting tube and forcing tubes, and a conical spindle in the axis of said shell at one end and a three-way cock at the other end, substantially as and for the purposes described. (2) In an injector, the combination of a shell provided with steam and water passages and a steam-chamber at one end with a partition A^1 provided with forcing tubes, a water-chamber G on one side of said partition, and an air-chamber H provided with openings substantially as and for the purposes set forth. (3) In an injector, the combination of a shell provided with steam and



water passages, two forcing tubes controlled by independent spindles, a lifting tube spindle entering the nozzles A and A^1 between the forcing tubes, and a three-way cock, substantially as and for the purposes described. (4) In an injector, the combination of a lifting tube and forcing tubes controlled by independent spindles with a cock provided with transverse partitions E^1 and E^2 and longitudinal angular guide E^3, substantially as and for the purpose described. (5) In an injector, the combination of a lifting tube and forcing tubes controlled by independent spindles with a cock provided with three openings in the same transverse plane, substantially as and for the purpose set forth.

263,138. ELECTRIC ARC LIGHT, *Thomas A. Edison, Menlo Park, N.J.*—*Filed November 28th*, 1881.

Claim.—In regulating mechanism for arc lamps, the combination of a permanent magnet and an electro-



magnet opposed in their action, the latter being located in a shunt around the arc, substantially as set forth.

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THE ENGINEER, September 22nd, 1882.