THE RIO TINTO MINES.

THE *Rio Tinto*, or Red River, from which the mines take their name, enters the sea on the south coast of Spain, between the mouths of the Guadalquivir and the Guadiana. The mines are near the source of the river, about fifty miles from the town of Huelva, and are connected with it by a 3ft. 6in. gauge railway. Huelva twenty years ago was scarcely more than a fishing village, but it is now one of the most important sea ports of Spain. It is situated between the rivers Tinto and Odiel, eight miles from the sea, and it is the terminus of the Seville and Huelva Railway, and also of the Zafra and Huelva line, which is nearly completed, and when finished will put Huelva into direct communication with Lisbon. The visitor who arrives by sea will disembark at the magnificent pier of the Rio Tinto Company in the river Odiel. A full description of this pier was given in a paper read by Mr. T. Gibson before the Institution of Civil Engineers—vol. liii., page 130. After having inspected the well-arranged foundry and repairing shops, through which we were conducted by the company's resident engineer, Mr. W. Langdon, M.I.C.E., we continued our journey to the mines. The rails are Cammell steel, Vignoles section, 50 lb. to the yard, spiked direct on to the sleepers, as is the custom throughout Spain. The first part of the road presents no features of special interest; but as we approach the mines the scenery becomes wilder—fields of corn give way to hills covered with gum-cystus, and we wind round them by sharp curves and up numerous inclines—some as steep as 1 in 40—crossing and re-crossing the river till we reach the new cementation works at Naya. Shortly afterwards vegetation ceases, and we enter Rio Tinto station. Here the scene baffles description. On the right rise clouds of smoke from heaps of mineral which is being slowly calcined; high above us, on the left, the slag from the blast furnaces pours its long, narrow streams of fire down a tip; thousands of children, both boys and girls, are carrying small wooden trays of mineral to fill wagons, and locomotives seem to be passing in all directions. Our carriage is here detached from the train, and another locomotive takes it up a steep incline to the town. The most important feature of Rio Tinto is the open-cast, of which a model was exhibited at the Inventions Exhibition in 1885. This vast chasm, about 600 yards long by 300 yards wide at the top, and more than 100 yards in depth, has all been excavated since the present company commenced its operations in 1874. The mines were previously worked by the Spanish Government, but not on a very large scale. It is laid out in steps, or *benches*, as they are termed, each one 10 m. below the other. The lode narrows as it deepens, but the ore improves in quality. Borings with the diamond drill have been carried down to a depth of 240ft. below the present lowest workings without reaching the bottom of the lode. In fact, the company has ore in sight for upwards of 100 years at the present rate of output. From the open-cast the lode runs westward for several miles, but, of course, with varying width. Adjoining the open-cast is the Contramina, which is connected with it by tunnels at various levels, and some way beyond that is San Dionisio. To the north of the open-cast is a mountain of red porphyry and ironstone, and at the back of this are further deposits of copper ore known as the North Lode.

At San Dionisio there are three shafts, viz., the Alicia, the San Dionisio main shaft, and the Alfonso, the latter being called after the late King Alfonso in honour of his visit to the mines in 1882. All these shafts have galleries at distances of 10 metres one below the other, the Alicia being already at the seventeenth level, or a depth of 558ft. The galleries are large and well ventilated. Those of each shaft are gradually being connected. The boring is done partly by hand, but chiefly by means of rock drills. Of these two systems are used—McKean's and McCulloch's, otherwise known as the "Cornish rock drill." In both the drill is driven by compressed air, and in both the same rotary and percussive movement is given to the drill which a miner would give when drilling by hand. The blasting is almost entirely done by dynamite, as the object being to get as much ore as possible in pieces of a convenient size for transport, the shattering caused by this explosive is not a disadvantage. There are several tunnels connecting San Dionisio with the open-cast. The lowest one, at the tenth level, is continued to the main line railway station, joining another tunnel from the main lode, so that it is only below this level that the ore has to be raised by winding engines.

The total quantity of ore extracted in 1886 from all the Rio Tinto mines was 1,378,381 tons, which gives an average of 4400 tons per working day. The quality of copper pyrites varies considerably; even in the same lode, and at distances of a few feet, the percentage of copper is very different. It may fall as low as ½ per cent., and it may rise to 20 per cent. In some mines it is even richer. At Rio Tinto the average is rather over 3 per cent. Besides copper, the ore contains sulphur and iron; also traces of gold, silver, lead, arsenic, and other metals.

There is hardly a mine of any importance in the south of Europe which does not show traces of having been worked by the Romans, and Rio Tinto is no exception to this rule. Coins, water-jars, weights, tear-bottles, &c., have been found at various depths at different parts of the mine, and, what is perhaps even more curious and interesting, the remains of two Roman water-wheels were recently discovered in the North Lode. One of these, about 13ft. diameter by 12in. wide, is in a very good state of preservation. It is of wood, with a bronze axle, and it is a remarkable fact that the mixture of metals in this axle was found on analysis to be almost exactly the same as that now used for underground work at Rio Tinto. The acid copper-liquor rapidly destroys all usual descriptions of bronze, brass, or gun-metal which come in contact with it; but a special mixture, containing an unusually large proportion of copper, is found to stand very well. The Romans had evidently discovered this fact, as their ordinary brasses for above-ground work contained about 10 per cent. less copper than that used for this special purpose.

As we stated above, the percentage of copper in the Rio Tinto ores varies considerably. Roughly speaking, they may be divided into three classes—poor, medium, and rich. Each of these classes is again sub-divided in the Rio Tinto classification, but these three divisions will suffice for the present article. The poor ore we may term that which contains less than 2 per cent. of copper, the medium between two and five, and the rich all above 5 per cent. Of these only the medium quality is exported as ore. From 300,000 to 400,000 tons of this are sent annually to Huelva, and thence shipped to Great Britain, France, Germany, and the United States. It may seem strange that with the large production of copper from the Lake Superior and other mines of North America, there should be a large and increasing demand for Rio Tinto ore in the United States. This, however, is because Rio Tinto ore, which usually contains about 50 per cent. of sulphur, is very suitable for the manufacture of sulphuric acid.

A good deal of the poorer ore containing less than 2 per cent. of copper is treated by what is called the wet or cementation process. In this process the ore is first usually piled in conical heaps, carefully constructed with stone flues passing through them. The heaps are then ignited with brushwood, and the heat drives off a large proportion of the sulphur, reducing the sulphide of copper to sulphate. After slowly smouldering for from nine to twelve months, the *teleras*, as these heaps are called in Andalusia, have burnt out. The calcined ore is then removed, shot into long narrow tanks, and washed for some days. The sulphate of copper contained in the liquor flowing from these tanks is conducted to other tanks containing pig iron, and the iron gradually precipitates the copper. The effluent liquor is strongly impregnated with iron, but contains only traces of copper.

The precipitate at first resembles pure copper, which, in fact, it very nearly is; but after a few hours' exposure to the air it oxidises and becomes black. When removed from the tanks it is passed through buddles, or jiggers, to free it from graphite, and from any iron that may have become mixed with it, and it is then dried in kilns, and packed in bags for shipment.

The richer ores, viz., those containing more than 5 per cent. of copper, are destined for the blast furnaces. They are also calcined before they are sent to the furnaces, but much more rapidly than for the cementation process. At Rio Tinto there are twenty blast furnaces. Eight of these are of the ordinary pot type, modifications of which are found in all parts of the world. They are built from stone found on the spot, and held together with iron ties, so as to allow of partial repair without destroying the furnace. There is a separate chimney for each furnace, and the charge is tipped in from the back, through openings in the chimneys. The slag, which chiefly consists of oxide of iron and silica, is drawn off into conical cast iron vessels running on wheels, and is tipped over an incline. It forms excellent railway ballast, but has not yet been utilised for any other purpose. The matte, containing from 35 to 45 per cent. of copper, is run into cast iron moulds, and when cold is broken up and examined before being loaded up for shipment. The greater part of it is sent to the Rio Tinto Company's smelting works at Cwmavon, in South Wales, where it is converted into marketable copper.

The other twelve blast furnaces are more of the type of the German *Pilz-ofen*, but they present several new features. There are only two chimneys, one for each six furnaces, but there is a separate blowing engine for each furnace. No. 5 size of Roots' blowers is used, and a pressure of 1 lb. per square inch, or even less, is found sufficient. These furnaces also differ from the others in having eight tuyeres, and water jackets; and in the matte, as it is formed, being run into a separate receptacle, instead of remaining at the bottom of the furnace. The quality of the matte is similar to that produced by the other furnaces.

The total number of hands employed at Rio Tinto is about 10,000. Of these more than a hundred are English, mostly chiefs of departments, but also chemists, clerks, winders, underground timbermen, &c. The machinery is extensive, and in good condition. It consists of winding engines, air compressors for rock drills, pumps for draining the mines, and for the supply of fresh water, pumps raising 3,000,000 gallons daily for the cementation process, the blowing engines for the blast furnaces to which we have alluded above, and a large quantity of mills, ore-crushing rolls, and other miscellaneous machines. There are sixty locomotives for the mines and works, besides another twenty for the main line between Rio Tinto and Huelva. The workshops, which employ over 1000 men, are well supplied with English drills, planing and slotting machines, &c. All work is done to English dimensions, the draughtsmen, fitters, carpenters, &c., use English rules, and understand inches and sixteenths far better than centimetres and millimetres.

In conclusion, we wish to express thanks to the manager—Mr. James Osborne, M.I.C.E.—and to his staff, for the readiness with which they afforded us every information in their power.

PRESTON DOCKS AND THE RIBBLE.

THERE is, we regret to say, reason to believe that matters are going very unsatisfactorily with Preston Docks and the Ribble improvements. The works were estimated to cost £600,000, and now it is said that they will cost double this amount. The difficulty lies not in making the docks, but in getting access to them from the sea, through a sand bank extending some five miles out. The cost of making a channel through this beach cannot be estimated with any accuracy, and whether it can or cannot be kept open, no one can say. Thus, then, the docks are being made, while it is a matter of pure conjecture whether the ships for which they are intended can get into them. Of course, with sufficient expenditure of money and power, a channel may be made and kept open, because engineers can do almost anything. But the people of Preston want to make a profit, not a loss, out of the docks, and it is clear that no profit can be made if the expenses incurred for construction and maintenance are to be very heavy. It is more than probable that more money will have to be raised, and we venture to suggest that before another sixpence is invested in the undertaking, some highly competent and independent authority be called in to report on the whole.

It is not easy to say who first started it, and it would be worth while to ascertain whether the engineers have had extended experience in work of the kind. If they have, then their opinions must be valuable and the expenditure of additional capital on their advice may be quite justifiable. What is most needed at present is a definite independent statement of facts, and such a statement ought to be forthcoming before another farthing of capital is raised. It may be said that in writing as we do we are damaging the prospects of the undertaking. Nothing is further from our intention. The key of the whole position is the construction of a navigable channel from Lytham to the sea. As for the dredging of the Ribble itself, and the construction of the docks, these present few difficulties. The originators of the scheme should by this time be in a position to show what progress has been made with the formation of the channel. It is absurd to say that this will cause no trouble worth mentioning. We repeat that it must present great difficulties, and before the public invest further sums, or Preston spends more money on the scheme, proper data should be supplied to show that the further expenditure is justifiable. To demand the production of such data is in no wise to damage the chances of the undertaking. When we hear that the estimate must be largely exceeded, we have a right on the part of the public to ask why? The construction of the channel being the weak part of the scheme, we are naturally led to suppose that the additional outlay is needed for it. But it is only too well known that the sums which may be expended dredging channels through sandbanks, and subsequently keeping them open, are limitless. Dredgers have now been at work some time; what have they effected? What will happen to the channel when the winter gales set in? Is there any known instance where docks communicate with the sea through a sandbank left nearly dry at low-water and some five miles wide?

In our impression for May 13th, 1887, will be found a sketch map showing the situation. A reference to this map will make what we have said clear. The figures show buoys on the existing channel, such as it is.

There is some reason to believe that the whole scheme has been based on the circumstance that a deep water channel did years ago exist between Lytham and the sea. There is no such channel now, and the fact that it has been obliterated is a very ominous matter, and bodes no good for an artificial channel. Once more we would urge on the good people of Preston the necessity for having a report from some highly competent and independent engineer before any large addition is made to the capital expenditure.

ABSTRACTS OF CONSULAR AND DIPLOMATIC REPORTS.

Belgium—Trade of Antwerp in 1886.—Business in some branches has been more favourable than during the previous year. Prices in many instances have considerably revived, and navigation has been very active throughout the year. The imports embrace a variety of British goods, those in much demand being agricultural implements, cutlery, and hardware, which, as a rule, command higher prices than the corresponding native products. British coal decreased by 9050 tons, or 7¼ per cent., the greater part of coal imported now coming from Germany. The Belgian portion of the enterprise, known as 'Canal de la Campine," by means of which, when completed, communication with the Rhine district, comprising the important commercial centres of Frankport and Mayence, will be greatly facilitated, is terminated and in operation. The works necessary to complete the undertaking are being carried out in the Dutch and German territory between the Belgian frontier and the Rhine.

Brazil—How to increase British trade—Porto Alegre.—Stress has been laid on the necessity of commercial travellers being sent abroad as an important means of extending trade, and as one reason why Germans have taken away a portion of the foreign trade from English houses. Travellers may be useful in backward places, such as parts of Eastern Europe, or in semi-barbarous localities, but in such a market as this I doubt if they are of any use. It is rare for a traveller from Germany to come here, whilst they are constantly arriving from England, yet the business of the place is principally in the hands of the Germans, though a great part, perhaps more than half, of the manufactured goods imported here is of British origin. The merchants and wholesale dealers who import direct from Europe are intelligent and practical enough to know where the most suitable articles can be got, and have their agents in Europe who go there for them irrespective of country. It has been stated that two-thirds of the South American trade is in the hands of the Germans, who can transfer their connection to Germany. I cannot agree with this, it is the goods that are wanted; if they could be got as well or better from Germany the trade would have long been transferred, for I know cases in which everything that can be done in the way of sending samples of British goods to Germany to be imitated is done. It is not so much British manufacturers that have been driven out of the field as that British merchants have had the foreign trade with their own country wrested from them. I will endeavour to give a reason for this which has hardly been touched upon, but which is very important and of considerable influence on the subject. Hardly any English house takes any trouble to provide itself with successors against the time when the founders or heads have to retire. The employés are looked upon as nothing more, partnerships are seldom given to them, nor held out as a reward for long and steady service. When the principals become more

or less independent of business, there is no one in the concern with sufficient interest to push it properly and compete with younger and more vigorous opponents, especially when these are foreigners. In this way houses are continually dying out, even when there are sons, for these generally prefer to remain in England. There is no advantage personally to the members of English firms in securing successors to their business, but there can be no question as to the great advantage from a national point of view in the German system of keeping the business together. They take care to provide themselves with successors in their clerks, whom they make junior partners as the older ones retire, and so the continuity of the house is carried on with all the advantages of unbroken connection and experience joined to new blood and ideas. The business is kept, if not in the same hands, in the same nationality. It is said that there is a difficulty on the part of English houses in finding suitable successors among their employés, for the British clerk is inferior to his German colleague in commercial education and qualifications, such as a knowledge of foreign languages, &c., and this is probably one of the reasons why the British merchant has to give way to his more linguistically gifted competitor. New houses of English nationality are being constantly established in different places, but even in this case new British firms are generally at a disadvantage compared with new German firms. A young German house can get far more assistance and facilities in the way of credit, &c., in Germany than a young English firm can get in England. There is more backing up of one's countrymen and clannishness amongst the Germans than amongst the English, and even in England more facilities are given, or are more readily given, to foreign than to English houses. As long as these matters remain as they are, there is nothing very surprising in English merchants being replaced by Germans, by which British manufacturers and trade generally must suffer in the long run. Amongst other suggestions made for the furtherance of British trade is one that show-rooms should be established in connection with all the principal Consulates. To have a complete range of samples of every manufacturer's goods in all branches of trade would require enormous premises and be impracticable, but the idea to some extent is good, and could, perhaps, be carried out in part with advantage. "As a trading Consular officer I should be glad to take charge of and exhibit, by means of my own firm, any samples suitable to this market which manufacturers may wish to send."[1] Workmen were brought from England for an earthenware factory here, but in many instances gave a great deal of trouble, which was one cause of the factory proving unsuccessful and having to stop. "In connection with this matter, I wish to say that the experience I have had of British workmen who come here is very unsatisfactory. They are generally given to drink, unsteady, exacting, overbearing, and a great contrast to foreigners. In the few undertakings here originally commenced under British auspices and with British workpeople, such as coal-mines, gasworks, &c., which are now in other hands, the British are generally got rid of and their places filled by Germans, Italians, and others, who are found more reliable and steady. British contractors prefer foreign to such British labourers as are to be met with here. The British steamers engaged in the coasting trade between here and Rio de Janeiro prefer a foreign to a British crew, the latter giving far more annoyance and trouble." These remarks are suggested by an experience extending over a considerable number of years, and it is a depressing and unpleasant fact to an Englishman to find his fellow-countrymen compare so unfavourably with other nationalities.

Brazil—Rio Grande do Sul.—The Germans are continually making great efforts to completely control the trade of this district, with results not very gratifying to the well-wishers of British commerce. In the last six months of 1885, British imports exceeded those of Germany by 11½ per cent., and at the end of 1886 the imports from the two countries were almost equal, and it is very probable that such British goods as hold their own are being gradually squeezed out. This is not to be wondered at, there being only three British importing houses in the town, and nearly all the remainder are controlled by Germans, who live and thrive upon smaller profits, and there is always someone in the house being trained to carry it on when the principals retire, a good custom rarely observed by British houses abroad, and the absence of which may account for the decay of many old houses, and the brief efforts of the units into which they split up. In this province a very large proportion of the purchasing class is either of German descent or nationality, and purchases from their own countrymen rather than from the foreigner. The bulk of the British imports may therefore be considered as goods which cannot yet be produced in and exported from Germany as cheaply as from England. The feeling widely prevails that what is of British manufacture is good, but the selling power primarily lies in cheapness; and a familiarly-coloured box, a fraudulent trade-mark, or a well-known label, will generally induce the purchaser to believe that he is buying cheaper the article which previously answered his purpose. Through the knowledge gained by customers, complaints, experience, and reduced sales, one wholesale dealer has given up importing German goods, and again ordered largely from England. The question of supplying inferior goods to compete with German requires careful attention; but the risk of making a present profit at the risk of a loss of reputation for good workmanship, which may easily affect more persons than the actual manufacturer, should never be lost sight of, especially as a revival of trade generally would probably first be felt by those who had consistently produced the best work. As regards improving British trade, it is difficult to suggest any means that have not been frequently pointed out. The British commercial traveller is conspicuous by his absence, and the expansive power of British trade is therefore still seriously crippled. Lately this Consulate has been deluged with circulars and letters from home manufacturers. The information asked for is given as far as is possible, but the mass of illustrated catalogues, price lists, printed matter, trade newspapers, &c., is not and cannot be put to proper use. It is useless to retain them in the Consulate, for they would never be seen by the proper persons. During the eleven years I have been in the service I have only once had a merchant apply to me for information concerning a branch of British trade. The papers are distributed among importers, but once out of the Consulate they remain where they are sent, for merchants abroad are no more inclined to further their competitors' business than at home. It is also very difficult for a Consular officer to act fairly in such matters, for in bringing the manufacturer at home and the merchant abroad in direct communication, he is generally damaging the trade of a third person, who has hitherto acted as the middleman through whom the purchases have been made. A distinction is thus created which may impair the Consul's influence for good in other ways. Were there a local institution for the furtherance and protection of British trade, all communications regarding private as distinguished from general trade questions might with advantage to all parties be referred to it. A private firm with a small staff of good local travellers, who would undertake to keep a sample room and act as local agents for a number of different trades, would answer a useful purpose, and might be made remunerative, and such a firm would not be difficult to find. The facilities now within the reach of everybody for importing direct from any European port, instead of through Liverpool and London, has done much to decrease the business of the old commission importing houses, and have caused trade to settle down upon a broader and firmer basis of direct demand and supply. In this light the above suggestion may look like an attempt to bolster up a decaying trade and interfere with natural laws; but the method is honest, which is more than can be said of all the influences adversely affecting British trade in Rio Grande.

Chili — Study of market requirements. — Merchants here generally complain that English manufacturers do not study the changes in the requirements of the market in the same manner as their continental competitors; and the consequence is, that whilst articles of regular consumption, which seldom change in character, are imported chiefly from England, articles which require manipulation to prepare—as well as good taste—and which constantly change in design or make, are imported from continental houses. As the market requires constant change in the character of its merchandise, it has given the continental houses the opportunity of competing successfully with English goods.[2]

France—Trade of La Rochelle in 1886.—The depression of trade in this district has greatly increased in 1886. Imports have decreased by 221,000 tons, or 47·5 per cent. under 1885; and exports by 18,000 tons, or over 78 per cent. The trade with Great Britain has not only held its own, but shows an increase of exports both in value and volume; a fact worth noting, because hitherto that trade has shared in the fluctuations of trade generally. British shipping has increased by 5000 tons, or over 15 per cent. This increase is not exceptional, and indicates that the carrying trade is falling more and more into English hands. French vessels are unable to go on working at present rates of freight, and merchants here who have hitherto employed French ships in the foreign trade are substituting English vessels for them, being unwilling to pay the dearer rates which their own countrymen must charge if they are to go on working at all. If our merchant navy is able to hold on while those of other countries are giving up, in spite of the great advantages they have over us in freedom from restrictions as to lading, lower wages to seamen, and shipping bounties—which handicap us so unfavourably—our position must be a very strong one, and will become more so in the future when this depression shall pass by, because these disadvantages are compelling our shipowners to adopt every appliance and means for working economically, while foreigners are depending upon bounties and protection, which has not done much for them so far, and must in the end leave them more helpless than they were before. The works at the new port of La Pallice have made considerable progress, upwards of £80,000 having been spent on it during the past year. It is expected to be complete in 1889, and being easier of access at all tides, will entirely supersede the present port. Since I called attention to the necessity of employing commercial travellers if English houses wish to do business in France, I have received letters from manufacturers, who send prices and samples of their goods, and beg me to bring them under the notice of buyers. I have much pleasure in doing so, but can only repeat it is useless here, as no one cares to look at patterns unless there is some one on the spot to sell the goods to him. They will not be at the trouble of procuring them from England, and the choice is between sending out agents who can speak to the customers, or not doing any business at all. As to having museums of samples attached to the Consulates, they would not be any use unless the Consular officer were to take orders for and sell the goods. For other reasons also the scheme would be very objectionable. There is a great amount of suffering from depression of trade at present in France, which has led to a strong feeling against the importation and importers of foreign goods, even when French traders. Consuls, by mixing themselves with the sale of foreign goods, would incur an amount of ill-will that would impair their power of making themselves useful in other ways. Many tradesmen sell foreign goods quietly, without saying where they come from, and will continue to do so if they can make money by it, so long as they do not make themselves obnoxious. They ought to have the opportunity of buying their goods without calling attention that they are doing so, or trouble to themselves; this will be best attained by following the usual mode of doing business in this country—sending round private agents who understand the business, and avoiding the appearance of official interference as much as possible.

France—Trade of Nantes in 1886.—Nantes, from its position on the Loire, its industries, manufactures, and port, is one of the most important commercial towns of France. I cannot report any marked improvement in the general state of commercial affairs during 1886. British shipping decreased twelve in number and 5043 in tonnage. Little inducement is offered to vessels to call at this port, the larger vessels going to St. Nazaire, which is increasing in importance. Some think that the lateral ship canal between these ports now constructing will not be profitable. The Chamber of Commerce is of opinion that when completed the canal will vastly increase the importance of Nantes as a port. In imports there is a slight decrease, principally in coal, machinery, and metals. Exports are slightly increased in cast iron, hardware, machinery, and rails. The depression of trade and the reduction of the import duty in agricultural implements for the relief of the farming classes have greatly affected this industry, the local workshops being unable to compete with British and German manufacturers. No noticeable recovery has taken place in the metal trade, which in former years showed great activity, owing to large orders for public works. The most practical way of giving an impetus to British trade abroad is the employment of commercial travellers. A competent man speaking well the language of the country in which he is called upon to act might represent several firms in different branches of British industry. An earlier report states that there is a field here open to English manufacturers if they make their goods more generally known, and, above all, dispose of them direct to the purchaser, without passing through the houses of the Paris middle-man.[3] The absence of travellers here may be due to the disinclination of our manufacturers to open numerous small accounts, owing to the difficulty in recovering cheques, and so they prefer to deal with wholesale houses of responsibility.

At a special meeting of the Manchester Chamber of Commerce on Tuesday, it was unanimously resolved to have a Lancashire annexe in the Melbourne Exhibition next year.

[1] Mr. Ambrose Archer, Vice-Consul, Porto Alegre, Brazil.

[2] For kind of goods see Engineer 4th March, 1886, p. 170.

[3] For full details see Trade Reports, Part V., 1886, p. 638-9.

PETROLEUM FUEL.

Mr. F. V. Urquhart, whose system for burning petroleum is almost universally adopted by the railways in Russia using that kind of fuel, and who is most probably the most competent authority on the subject, has recently published the results of working with coal and petroleum residuum on the Grazi-Tsaritsin Railway, where petroleum residuum has been the sole fuel used since 1st October, 1884. The comparison is accurate, complete, and comprehensive, and is the result of a year's use of each article. The comparison of the results appeared in our "Abstracts of Consular and Diplomatic Reports," on page 168. The details are as follows:—

GRIAZI-TSARITSIN RAILWAY.

Expenditure of Coal in 1882 *and Petroleum Residuum in* 1885, *inclusive of Kindling Wood, on two Types of Engines.*

EIGHT-WHEELED ENGINES.

With Coal in 1882.

Month.	Average number in train.	Aggregate distance run by locomotives.	Aggregate distance of unproductive run of locomotives.	Aggregate distance run by freight cars.	Average consumption of fuel and cost per mile.	
					Coals.	Cost.
		miles.	miles.	miles.	lbs.	d.
January ..	33·82	41,296	7,003	1,294,696	98·83	14·76
February ..	34·21	37,444	5,770	1,082,924	86·91	12·66
March	33·41	20,881	1,956	632,410	87·44	12·99
April	38·14	24,293	3,329	850,147	73·01	10·60
May	41·24	31,145	4,757	1,170,956	70·62	10·36
June	40·53	37,520	4,907	1,321,835	73·04	10·73
July	43·64	29,749	5,802	1,045,201	71·74	10·55
August ..	39·99	38,751	6,028	1,308,734	71·28	10·01
September..	39·54	56,586	9,298	1,866,171	76·26	10·75
October ..	35·13	71,041	11,891	2,081,474	77·06	11·04
November ..	36·56	70,466	12,648	2,114,172	92·54	13·49
December ..	34·00	52,763	7,166	1,416,010	99·82	14·42
Total and average for year	37·51	511,935	80,555	16,184,730	81·43	11·50

With Petroleum Residuum in 1885.

Month.	Average number in train.	Aggregate distance run by locomotives.	Aggregate distance of unproductive run of locomotives.	Aggregate distance run by freight cars.	Average consumption of fuel and cost per mile.	
					Petroleum residuum.	Cost.
		miles.	miles.	miles.	lbs.	d.
January ..	37·72	83,636	16,066	2,549,230	48·30	6·71
February ..	37·15	55,222	10,449	1,663,813	49·98	5·36
March	30·95	38,742	3,247	1,405,162	52·79	8·82
April	41·03	60,477	9,809	2,079,544	42·68	6·95
May	40·81	87,805	13,489	3,033,003	41·00	6·32
June	41·68	75,175	11,029	2,673,988	41·84	5·47
July	38·80	63,901	8,160	2,120,526	38·19	5·46
August ..	40·32	74,272	10,796	2,560,034	41·50	6·02
September..	39·76	82,415	13,241	2,654,637	41·22	5·88
October ..	37·61	101,253	15,468	3,226,698	47·74	6·77
November ..	36·24	82,346	16,434	2,388,761	42·95	7·48
December ..	34·85	63,468	9,482	1,881,136	54·19	8·60
Total and average for year	38·08	868,712	137,670	28,565,555	45·83	6·50

SIX-WHEELED ENGINES.

With Coal in 1882.

Month.	Average number in train.	Aggregate distance run by locomotives.	Aggregate distance of unproductive run of locomotives.	Aggregate distance run by freight cars.	Average consumption of fuel and cost per mile.	
					Coals.	Cost.
		miles.	miles.	miles.	lbs.	d.
January ..	21·32	78,244	36,032	897,826	62·60	9·35
February ..	27·47	43,160	23,008	560,152	55·15	9·90
March	26·52	27,742	15,337	329,249	52·73	7·66
April	28·59	57,514	22,497	1,004,129	53·84	7·78
May	31·90	111,181	40,974	2,241,273	56·58	8·08
June	30·74	147,720	48,638	3,043,384	57·46	8·46
July	28·39	145,232	51,826	2,652,482	48·69	7·13
August ..	27·04	152,659	52,697	2,703,475	49·88	6·92
September..	28·93	143,000	50,112	2,693,239	55·49	7·71
October ..	23·30	163,442	53,837	3,101,778	62·29	8·26
November ..	21·60	159,669	43,640	2,508,388	63·88	9·15
December ..	20·04	112,118	36,081	1,517,773	68·37	9·72
Total and average for year	26·32	1,341,681	474,679	23,253,148	57·25	7·80

With Petroleum Residuum in 1885.

Month.	Average number in train.	Aggregate distance run by locomotives.	Aggregate distance of unproductive run of locomotives.	Aggregate distance run by freight cars.	Average consumption of fuel and cost per mile.	
					Petroleum residuum.	Cost.
		miles.	miles.	miles.	lbs.	d.
January ..	22·14	114,192	46,052	1,509,005	34·43	4·77
February ..	22·01	89,648	37,513	1,148,056	34·09	4·84
March	22·58	88,950	33,721	1,097,442	28·98	4·82
April	25·33	141,584	46,654	2,354,348	31·73	5·16
May	28·49	179,872	65,985	3,246,003	29·88	4·59
June	28·35	144,669	55,347	2,533,104	29·93	4·28
July	24·77	131,341	48,001	2,064,742	27·57	3·71
August ..	28·27	128,559	46,677	2,315,544	28·75	4·17
September..	31·89	130,846	46,088	2,703,087	32·07	4·55
October ..	28·04	125,523	38,266	2,448,912	35·55	5·09
November ..	21·41	119,788	36,258	2,451,573	35·74	5·21
December ..	22·15	92,361	34,171	1,287,893	38·13	5·74
Total and average for year	25·45	1,487,333	534,733	25,159,709	32·23	4·50

A New Transvaal Industry.—A Transvaal paper calls attention to a new industry which is being started in the Republic, and which may possibly be the beginning of an outburst of manufacturing enterprise there, consequent on the impulse given to the country by the gold discoveries. Some years ago a concession for the establishment of a tannery was obtained, and was subsequently transferred to a company started in Holland—the South African Leather Preparation Company—with a provisional capital of 250,000 guilders, which may be increased to 500,000 guilders. Some eight months ago the company sent out an expert to look into the state of affairs, and the result has been that steps have been taken to establish a factory. This building is now completed. "It is unnecessary to point out," says the Transvaal authority, "the great usefulness of such an establishment, as everybody knows how many hides are annually exported from the Transvaal and how much leather is again imported. Until now South African hides have obtained low prices on the European markets, for the reason that they have not been properly prepared."

RAILWAY MATTERS.

THE Peoria and Pekin Union Railroad runs from Peoria to Pekin, a distance of fourteen miles. That is the main line. Being a belt road, caring for cars of several roads running into Peoria, and transferring the cars from one road to another, it has many miles of side tracks—over 100. This accounts for the road having more miles of side track than it has in its main line.

TWO successive Conferences have taken place at Domo Dossola and Lausanne between the delegates of the Swiss cantons and those of Italy to examine the tracings of the project of a tunnel through the Simplon. Italy would agree to it providing that the entry to the southern portion of the tunnel be situated on Italian territory, which is generally admitted. It is probable that the French Government will not participate financially in the enterprise.

PARLOUR cars are being built by the Wason Manufacturing Company for the State Railroad of Chili. The exterior of the cars is painted cream colour, with designs in gilt and colours, high colouring and polish being appreciated in South America. The interior is finished in mahogany, and the designs for the carving and the silken hangings were made expressly for this order. The windows are 4ft. wide, and as everybody smokes, a match case is placed between each pair of windows. The cars cost 12,000 dols. each.

THE Baltimore and Ohio Road is to build a transfer elevator on a new plan, to be located in its South Chicago yards. It will be 20ft. wide, 40ft. high, and 100ft. long. By means of shovels operated by a 50-horse power engine, the grain is to be unloaded from a car on one track and elevated into hopper scales, where it is weighed and immediately run by self-loading spouts into a car on the other track. It is expected that eight men—foreman, engineer, weighmaster, and five labourers—can transfer and weigh 100 cars in ten hours. It is estimated that the cost of transfer will be only about 18c. per car.

IN the last sixteen years the railroads of the United States have increased in mileage yearly at the following rates:—

	Miles.		Miles.		Miles.
1887 ..	3214	1881 ..	3459	1875 ..	613
1886 ..	2655	1880 ..	2853	1874 ..	962
1885 ..	1472	1879 ..	1746	1873 ..	2028
1884 ..	2104	1878 ..	1049	1872 ..	3962
1883 ..	3078	1877 ..	1013	— ..	—
1882 ..	5984	1876 ..	1273	— ..	—

This statement covers main track only, second or other additional tracks and sidings not being counted.

DR. W. H. SAUNDERS, a physician appointed to make examinations of locomotive engineers and other railroad *employés* under the new State law, which went into effect August 1st, abandoned his work. He was arrested on a writ of mandamus, which requires him to complete his tests as to colour blindness. His reason for abandoning the work is said to be trouble with railroad men, who dislike the new law. All railroad men who operate in Alabama are incensed, and call it an outrageous law, many refusing to submit to examination. More than 20,000 are affected by the law, and it is estimated that 3000 will be forced to give up their places.

IN the United States it has been proposed to heat street cars by raising the temperature of wires by an electrical current. Baron Gostkowski, General Manager of Austrian Railways, has calculated the power necessary to heat a railway car in this way, and his results for an ordinary German car holding forty two persons show that 20-H.P. are necessary to heat it, while it requires only 8-H.P. to haul it at the rate of twenty-two miles per hour. Proceeding in the same way with an ordinary street railway car seating twenty persons, we find that to keep the temperature of the interior of the car 30 deg. Fah. above that of the exterior requires an expenditure of about 3-H.P. So heating street railway cars in this way is rather visionary.

THE Montreal *Star* says editorially about Russia's trans-Siberian line:—This line will shorten the time occupied in travelling to Japan from Western Europe to about eighteen days, and will open up to trade a part of Siberia said to be fertile, but previously unsettled. It will in many respects be an undertaking similar to the Canadian Pacific. The principal difference will be that the work will be a purely Government one. The Russian Government appears in earnest about this undertaking, and some English journals are urging the British Government to discuss some scheme for a short route to the Pacific through India and Burmah. The advantages of the Euphrates Valley route are being discussed, and the Government urged to employ speedily its own means for effecting analogous abridgments of time and space.

IN driving a tram-car by storage batteries, it has been found that seventy to eighty cells are needed, weighing 41 lb. per cell, when in running order. Assuming the weight of the loaded car to be 1500 lb., a battery of seventy cells would be about 20 per cent. or one of eighty cells about 25 per cent. of the entire weight of the car loaded; and this, it must be borne in mind, does not include the motor and driving machinery, which would add anywhere from one-third to 50 per cent. to the weight of the 1½ ton batteries. A seventy cell battery on ordinary traffic, or eighty cell battery on very hard traffic, is capable of running continuously 4½ hours, but it is found advisable to change the batteries about once in three hours. As one set of cells is being charged when another is being discharged, two sets of cells are required. It need not take more than three minutes to make a change of batteries. The loss of power in standing is practically nothing.

A CORRESPONDENT of the American *Railroad Gazette*, speaking of old injectors, which will not work because they have become worn, says: "In looking the matter up, I found that the injector would admit of the steam ram being turned on pretty nearly full before it would fly off. This led me to believe that the steam ram, the thread on it, and other parts had become so worn that there was too much steam and water admitted for the overflow, and consequently, when it got up to a certain pressure, the overflow not being sufficiently large, a reaction must take place. With this idea in view I took one of our injectors that would not work with over 60 lb. steam pressure under any circumstances, and took the overflow out and increased it from ¼in. to ⅜in., and started the injector to work at 125 lb. pressure. We have continued to do the same with the other old injectors that would not work, and it overcomes the difficulty in each case where the injector fails to go to work with a high pressure."

MR. B. C. FAUROT, president of the Lima Street Railway Motor and Power Company, writes to General Stiles, of the Van Depoele Company as follows:—"My contract with the Van Depoele people was that they were to guarantee the power—sixteen hours being a day's work, and the cars running eighty miles per day, and carrying forty passengers each trip—should not cost over 2 dols. per car per day, and that I was to have a trial of six months before final settlement was made or required. I have operated these cars about forty days, and have so thoroughly satisfied myself of the worth of the system that I have settled and paid the company in full. I find from actual trial, with new track and cars and everything close and tight, making the cars require more power than they do to-day, and very much more than they will three months hence, that the actual figures for cost for power alone shows less than 1 dol. per day per car for a run of seventeen hours, and does not exceed 3 dols. per car for the entire expense. I have no hesitation in saying to the public that it is a grand success, and that too much cannot be said in its favour. Anyone doubting the truthfulness of this report will do well to visit Lima, and investigate for themselves."

NOTES AND MEMORANDA.

TO restore faded ink on parchment, &c., the Bodleian Library, at Oxford, has long employed hydrosulphide of ammonia, a solution of which is spread in a thin layer over the writing, by means of a camel's hair pencil.

A REMEDY for burns, proposed by M. Dubois (*Jour. de Med. de Nantes*), consists in allowing the contents of a syphon of seltzer water to flow slowly over the affected parts. It quiets the pain almost instantly, and the writer believes it hastens the final cure. He ascribes the good effects to the carbonic acid gas and to the local lowering of the temperature.

TO make ice at home, says *La Science en Famille*, "take a cylindrical earthen vessel and pour 3⅓ oz. of commercial sulphuric acid, and 1⅜ oz. of water into it, and then add 1 oz. of powdered sulphate of soda. In the centre of this mixture place a smaller vessel containing the water to be frozen; then cover the vessel, and, if possible, revolve the whole with a gentle motion. In a few minutes, the water in the small vessel will be converted into ice. The same mixture can be used a second or third time for making a block of ice. The operation should, if possible, be performed in a cool place, in a cellar, for example.

THE *Journal des Applications Electriques* says that eleven different colours may be communicated to well cleaned copper, and eight to nickel-plated objects, by means of the following bath:—Acetate of lead, 300 grains; hyposulphite of soda, 600 grains; water, 1 quart. After the salts are dissolved, the solution is heated to ebullition, and the metal is afterward immersed therein. At first, a gray colour is obtained, and this, on the immersions being continued, passes to violet, and successively to maroon, red, &c., and finally to blue, which is the last colour. As the substances that enter into the composition of the solution cost very little, the process is a cheap one. It is especially applicable in the manufacture of buttons.

PESIER'S natrometer was first introduced in 1846 for the valuation of potash in the residues obtained from the calcination of beetroot molasses, and it was soon abandoned for the better method of determining potash by platinum chloride. Herr E. Pfeiffer (*Chem. Zeit.*) states that in the hands of a careful analyst, the natrometer gives with little trouble results well agreeing with those obtained by the platinum method. The apparatus consists of a hydrometer, the scale of which is based on the fact that the density of a potassium sulphate solution increases proportionately with the amount of solid matter in solution. If the solution contains sodium sulphate, the density rises considerably, potassium sulphate being more soluble in the presence of sodium sulphate.

THE current number of *L'Astronomie* contains a description of a new observatory belonging to M. Camille Flammarion, which has just been completed. An admirer of M. Flammarion had presented him some five years ago with a little chateau and park situated on the road from Paris to Fontainebleau of historic name and interest. The house, which was built in 1730, possessed walls so thick and solid as to serve as a perfectly stable base for the equatorial and dome with which M. Flammarion has surmounted it. The dome is 5 m. in interior diameter, and covers an equatorial by Bardou of 0·24 m. aperture and 3·75 m. focal length, with clockwork by Bréguet, furnished with a Villarceau governor. Two smaller telescopes—one by Secretan of 108 mm. aperture, the other by Foucault of 160 mm., stand on the adjoining terrace. The observatory, the co-ordinates of which are East longitude from Paris 0h. 0m. 8s., N. latitude 48° 41′ 36″, commands an uninterrupted horizon, and an atmosphere noticeably purer than that of Paris.

IN the manufacture of glucose with nitric acid, the originators of this process, A. Seyberlich and A. Trampedach, use nitric acid for the saccharification of starchy or amylaceous matter. To eliminate, then, the nitric acid from the solution of glucose thus obtained, water saturated with sulphurous acid is added in such quantity that the syrup smells of this gas. The mixture, heated rapidly, brings about the decomposition of the nitric acid. At the expense of the oxygen contained in this acid, the sulphurous acid is rapidly converted into sulphuric acid, and nitric oxide is evolved. The reaction is so perfect that no trace of nitric acid can be found with Schönbein's reagent. On heating to boiling, the excess of sulphurous acid is expelled from the saccharine solution. This last operation must be conducted rapidly, and with an abundant supply of steam, so that the saccharine solution shall not remain long in contact with the sulphuric acid formed, as otherwise the sugar would be liable to decomposition. The solution of glucose obtained is neutralised with carbonate of lime, and made alkaline with alkaline carbonates, evaporated and crystallised.

THE Division of Mining Statistics and Technology, under the direction of the United States Geological Survey, has issued a return showing the production of coal throughout the States in the year 1886. The total production of all kinds of coal, exclusive of that consumed at the mines and known as colliery consumption, was 107,682,209 short tons, valued at 147,112,755 dols. at the mines. This may be divided into Pennsylvania anthracite, 36,696,475 short tons, valued at 71,558,126 dols.; all other coals, including bituminous, brown coal, lignite, and small lots of anthracite produced in Arkansas and Colorado, 70,985,734 short tons, valued at 75,554,629 dols. The colliery consumption at the different mines varied from nothing to 8 per cent. of the total product, being greatest at special Pennsylvania anthracite mines, and lowest at the bituminous mines, where the bed is nearly horizontal and where no steam power or ventilating furnaces are employed. Including colliery consumption, the total production of all coal in the United States was 112,743,403 short tons, valued as follows:—Anthracite, 76,119,120 dols.; bituminous, 78,481,056 dols.—total value 154,600,176 dols. The total production shows a net gain of 1,783,881 short tons compared with 1885, but a loss in spot value of 4,419,420 dols. Pennsylvania raises more than half of the whole coal product, but Illinois and Ohio are advancing, the former producing in 1886, 9,246,435 tons; the latter, 8,435,211 tons. Iowa and West Virginia come next, with a production respectively of about 4,000,000 tons per annum.

DR. CHOQUET, in a work recently published in Paris, gives the following figures as to the theatres burnt since 1750; the average of theatres burned is forty-eight per annum:—The most calamitous of these disasters was that at Cape d'Istria, in 1794, when 1090 persons were killed; that in St. Petersburg in 1836, which resulted in the loss of 800 lives; the fire in Canton in 1845, which had 1670 victims; that of Brooklyn in 1876, with 283 victims; that of Shanghai in 1871, with 120 victims; that of Tientsin in 1872, with 600 victims; and lastly, that of Vienna, which had 450 victims. February 5th, 1876—Robinson's Opera House, Cincinnati; false alarm of fire; 11 killed and 30 injured. April 25, 1876—Theatre des Arts, Rouen; 8 killed and 12 injured. October 30th, 1876—Chinese Theatre, San Francisco; 19 killed, others injured—small fire. November 13th, 1876—Circus Theatre, Madrid; 2 killed. December 5th, 1876—Mrs. Conway's Theatre, Brooklyn, U.S.A.; 283 known to have perished. October 11th, 1878—Colosseum, Liverpool; 37 killed and several injured; false alarm. January 1st, 1881—Cronstadt Theatre; 8 burned. March 23rd, 1881—Opera House, Nice; about 150 supposed to have perished. December 8th, 1881—Ring Theatre, Vienna; about 794 lives lost. January 7th, 1883—Buff Theatre, Moscow; about 300 lives lost. June 24th, 1883—Temporary Theatre, Dervio, Italy; about 50 lives lost. August 20th, 1883—Theatre Govi Sumuki, Japan; 75 killed, over 100 seriously hurt. November 1st, 1884—Star Theatre, Glasgow; false alarm of fire; 14 killed, others injured. July 28th, 1886—Tinnivelly, India; about 100 natives killed. January 18th, 1887—Hebrew Dramatic Club, London; false alarm of fire; 17 persons crushed to death. 25th May, 1887—Paris Opera Comique, in which 200 lives were lost.

MISCELLANEA.

MESSRS. HAYWARD TYLER AND CO.'s only office for steam pumps will in future be at 84 and 85, Whitecross-street, E.C.

ELECTRICAL machinery will be the chief feature in the next fair of the American Institute, in New York City. The principal manufacturers of electrical appliances in the States have promised to take almost half of the space in the Third Avenue building. No prizes will be offered.

MESSRS. RUSTON, PROCTOR and Co. have obtained this month the following first prizes for the best portable engine and thrashing machine at the recent competitive trials of the principal English and foreign makers held at the following towns, viz.:—Charkow, Russia, gold medal; Viborg, Finland, silver medal; and Toulouse, France, gold medal.

THE completion of the Russian ironclad Tchesmé is likely to be delayed, owing to the recent rapid silting at the entrance of the dry dock at Sebastopol. The shoal at the mouth is so large that extensive dredging will be required to fit it for the reception of large vessels. A commission has been sent from St. Petersburg to inquire into the matter.

TWO sister turret ships are about to be laid down in Cronstadt for the Black Sea. Their displacement will be 8000 tons. For protection of the centre of the ship and machinery steel armour 20in. thick will be used, decreasing to 10in. towards the extremities. The breastwork and turret armour will be 16in. They will be armed with two 12in. guns in each turret, and will carry in addition four 9in. guns, eight Gatlings, and a torpedo apparatus.

THE water supply of Bradford is causing considerable anxiety to the inhabitants, and it has been found necessary to prepare a scheme for an additional supply. Three sites for a new reservoir have been suggested, one of which, in the Masham district, commends itself to the townspeople. The cost will be about a million and a-quarter sterling. The Town Council on Tuesday authorised parliamentary proceedings in favour of the Masham scheme.

UNLESS a minimum sum of £10,000 is guaranteed by the 15th proximo there is but little probability of further arrangements being made for holding the proposed industrial exhibition in North Staffordshire. Should the finance committee be successful in securing this guarantee, it is probable that the exhibition will be held on land at Fenton Manor, adjoining the North Staffordshire Railway. The cost of this land will be £1700. The Earl of Granville has signified his willingness to become president of the exhibition.

IT is stated that the company which has secured the concession from the Nicaraguan Government for the construction of the Nicaragua Canal intends to put in the field ten parties of engineers by December 1st. Mr. Menocal is reported to have said that the preparatory work done would probably take one or two years, and that after that is done the canal can be completed within six years, at a cost of from 60 to 75 million dollars. It is the intention to make the canal 120ft. wide on the bottom, with not less than 28ft. of water.

A MEETING of the North Staffordshire Mining Institute was held at Stoke-on-Trent, on Monday, Mr. James Lucas presiding. In a discussion on papers which had been read by him, Mr. A. R. Sawyer, Government inspector, said that the water cartridge was perfectly safe if properly used. Its safety, however, depended upon the manner in which it was manipulated and used, and one of the staunchest advocates of the water cartridge had written that nothing but practical experience and careful attention could make any water cartridge safe.

BIDS for three overhead travelling cranes were opened at the U.S. Navy Department on September 10th. The Secretary of the Navy has directed that 75,000 dols. be expended for the purchase of tools and plant for the New York Navy Yard, and a like sum for the purchase of tools and plant for the Norfolk Navy Yard. This action is taken under the Act for the increase of the Navy, passed at the first session of the 49th Congress, which provided for the expenditure of 150,000 dols., under the direction of the Secretary of the Navy, for improving the plant of such Navy-yards as he might select.

NEW ORLEANS has commenced the erection of a new tower system which is to conduct all telegraph, telephone, and electric light wires high above the roofs of the houses. As the soil is such as to forbid the underground system, water being found 3ft. below the surface almost everywhere, this aërial system is to be thoroughly tested. The plan includes an iron tower, or braced and guyed post, planted at each street corner and about 150ft. high. From the tops of these towers will extend two steel cables ⅜in. diameter, and just below these two or three other cables 1in. diameter. Between these sets of cables will be fastened upright cross-arms of wood and iron, and on these the wires will be strung. A stand-pipe with nozzles at intervals will run up each tower for the use of the fire department.

AS anticipated, the proposal of the Bolton employers to submit the wages question in the engineering trades of that town to open arbitration has met with only an indifferent reception on the part of the men on strike. It is true that the proposal has been accepted conditionally by a majority of votes at a meeting of the men called to consider the matter. But a large number of the men left the meeting before the vote was taken, and those who voted for its acceptance represent only a small minority of the men on strike. It is very questionable whether the proposal will come to anything after all, as there will almost certainly be conditions on either side to be settled before arbitration can be entered upon, which neither the men on their side nor the employers on the other will agree to accept, and it seems more than probable the proposal in its present form will fall through.

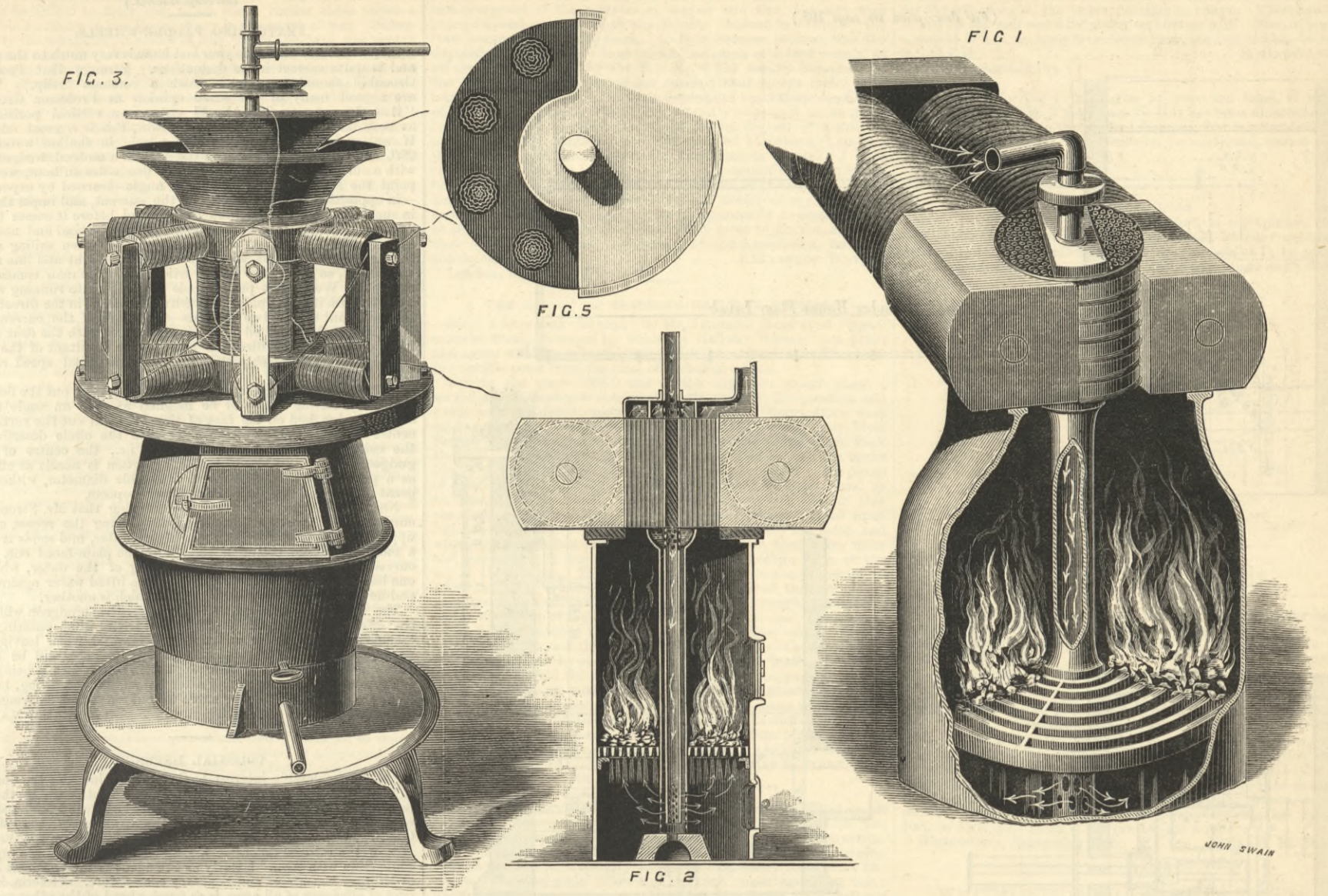
THE experiment of the New York Board of Health, this week, in ridding the streets from the foul smells emanating from upturned and gas-permeated earth, is interesting to other sections. Gas-makers claim that there is a loss of about 20 per cent. due to leakage at the joints in the distribution system. This escaping gas is confined below the surface in great part by the close modern street pavement and thoroughly saturates the soil. Excavating in this material of course releases this foul-smelling compound, and while it is claimed that this gas is not absolutely injurious to health, opinions differ on this head and complaints are frequent. The Health Department now neutralises this bad smell in the dirt by a solution of bromine scattered over the piles with sprinkling cans. The effect is almost instantaneous, and in the worst cases a double dose wholly removed the offensive smell.

THE plough manufacturers of the West, embracing nearly all the principal plough manufacturers of the country, have held a meeting at the Grand Pacific Hotel, Chicago, at which they succeeded in effecting an organisation to be known as the Western Plough Manufacturers' Association. Mr. H. T. Noble, of Dixon, Ill., was elected president, and A. R. Bryant, of Moline, Ill., was chosen secretary. It is reported that a scale of prices was agreed upon, and each member required to give bond to keep to the fixed rate, the bond having a sliding scale penalty which increases with the fall of prices. A commissioner will be appointed to see that prices are maintained at the rates agreed upon by the association. It is stated that one large Western plough manufacturer refused to join the association and be held by its regulations, but his action is interpreted to mean a lack of faith in the success of the project and not hostility to the purpose sought to be accomplished.

COMPOUND ENGINES FOR THE INDIAN STATE RAILWAYS.—DETAILS.

(*For description see page* 198.)

EDISON'S PYROMAGNETIC DYNAMO.



THE PYROMAGNETIC DYNAMO.[1]

By THOMAS A. EDISON.

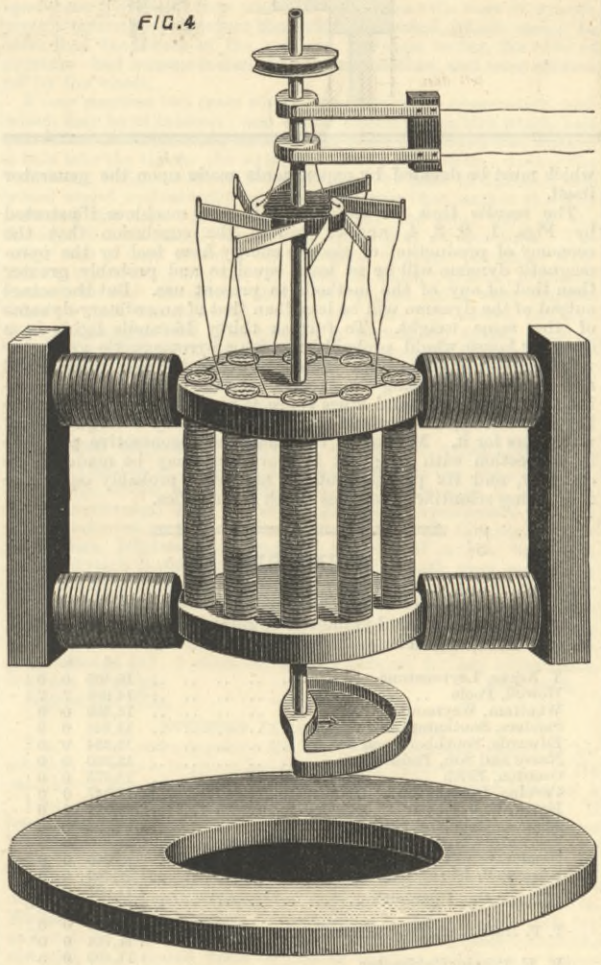
THE production of electricity directly from coal is a problem which has occupied the closest attention of the ablest inventors for many years. Could the enormous energy latent in coal be made to appear as electric energy by means of a simple transforming apparatus which accomplishes its results with reasonable economy, it will be conceded probably that the mechanical methods of the entire world would be revolutionised thereby, and that another of those grand steps of progress would be taken of which the nineteenth century so justly boasts.

The simple production of a potential difference by means of heat is as old as Seebeck and Melloni. The science of thermo-electricity thus originated has been developed by Becquerel, by Peltier, by Thomson, and by Tait, and the thermo-batteries of Clamond and of Noe have found many important practical uses. The results already attained in these generators have stimulated research marvellously, and many investigators have believed that in this direction lay the philosopher's stone. Our fellow member, Moses G. Farmer, worked long and assiduously in this field, producing, it is believed, the most satisfactory results as regards economy which have ever been obtained. But even these results were not very encouraging. He never succeeded in converting one per cent. of the energy of the coal into electric energy. Quite recently, Lord Rayleigh has discussed, with his well-known ability, the law of efficiency of the thermo battery from the standpoint of the second law of thermo-dynamics; and he concludes that for a copper-iron couple, working between the extreme limits of temperature possible for these metals, a conversion of not more than one three-hundredth part of the coal energy can be hoped for. While therefore as a heat engine the thermo cell appears to follow precisely the law of Carnot, and hence may have a theoretical maximum efficiency equal to that of the reversible engine of this eminent philosopher, yet in practice its efficiency falls very far below this theoretical maximum.

It therefore follows that if the result hoped for is to be attained at all, it must obviously be looked for in some other direction than in that of the thermo cell. In considering the matter, another line of investigation suggested itself to me, the results of which I have the honour now to submit to my fellow members of the physical section. It has long been known that the magnetism of the magnetic metals, and especially of iron, cobalt, and nickel, is markedly affected by heat. According to Becquerel, nickel loses its power of being magnetised at 400 deg., iron at a cherry red heat, and cobalt at a white heat. Since, whenever a magnetic field varies in strength in the vicinity of a conductor a current is generated in that conductor, it occurred to me that by placing an iron core in a magnetic circuit and by varying the magnetisability of that core, by varying its temperature, it would be possible to generate a current in a coil of wire surrounding this core. This idea constitutes the essential feature of the new generator, which therefore I have called a pyromagnetic generator of electricity.

The principle of utilising the variation of magnetisability by heat as the basis of electric machines, though clearly applicable to generators, was first applied to the construction of a simple form of heat engine, which I have called a pyromagnetic motor. A description of this motor will help us to understand the generator subsequently constructed.

Suppose a permanent magnet, having a bundle of small tubes made of thin iron placed between its poles, and capable of rotation about an axis perpendicular to the plane of the magnet, after the fashion of an armature. Suppose, further, that by suitable means, such as a blast or a draught, hot air can be made to pass through these tubes so as to raise them to redness. Suppose that by a flat screen symmetrically placed across the face of this bundle of tubes, and covering one-half of them, access of the heated air to the tubes beneath it is prevented. Then it follows that if this screen be so adjusted that its ends are equidistant from the two legs of the magnet, the bundle of tubes will not rotate about the axis, since the cooler and magnetic portions of the tube bundle—*i.e.*, those beneath the screen—will be equidistant from the poles, and will be equally attracted on the two sides. But if the screen be turned about the axis of rotation so that one of its ends is nearer one of the poles and the other nearer the other, then rotation of the bundle will ensue, since the portion under the screen, which is cooler and therefore magnetisable, is continually more strongly attracted than the other and heated portion. This device acts,



DETAIL OF FIG. 3.

therefore, as a pyromagnetic motor, the heat now passing through the tubes in such a way as to produce a dissymetry in the lines of force of the iron field, the rotation being due to the effort to make these symmetrical. The guard plate in this case has an action analogous to that of the commutator in an ordinary armature. The first experimental motor constructed on this principle was heated by means of two small Bunsen burners, arranged with an air blast, and it developed about 700 foot-pounds per minute. A second and larger motor is now about finished, which will weigh about 1500 lb., and is expected to develope about 3-horse power. In both these machines electro-magnets are used in place of permanent magnets, the current to energise them being derived from an external source. In the latter machine, the air for the combustion is first forced through the tubes to aid in cooling them, and then goes into the furnace at a high temperature.

The earliest experiments in the direction of the pyromagnetic production of electricity were made with a very simple apparatus, consisting of a charged electro-magnet, having a tube of thin iron passing through its cores near their outer ends, a coil of wire being wound round this tube, and including an ordinary sounder delicately adjusted, in its circuit. The tube beneath the coil was covered with asbestos paper. After heating the tube to redness by a gas blast directed into it at one end, a jet of cold air was suddenly substituted for the flame: the sounder at once closed, showing that the change in the magnetisability of the iron had varied the distribution of the lines of force within the coil, and thus had produced a current of electricity in this closed circuit.

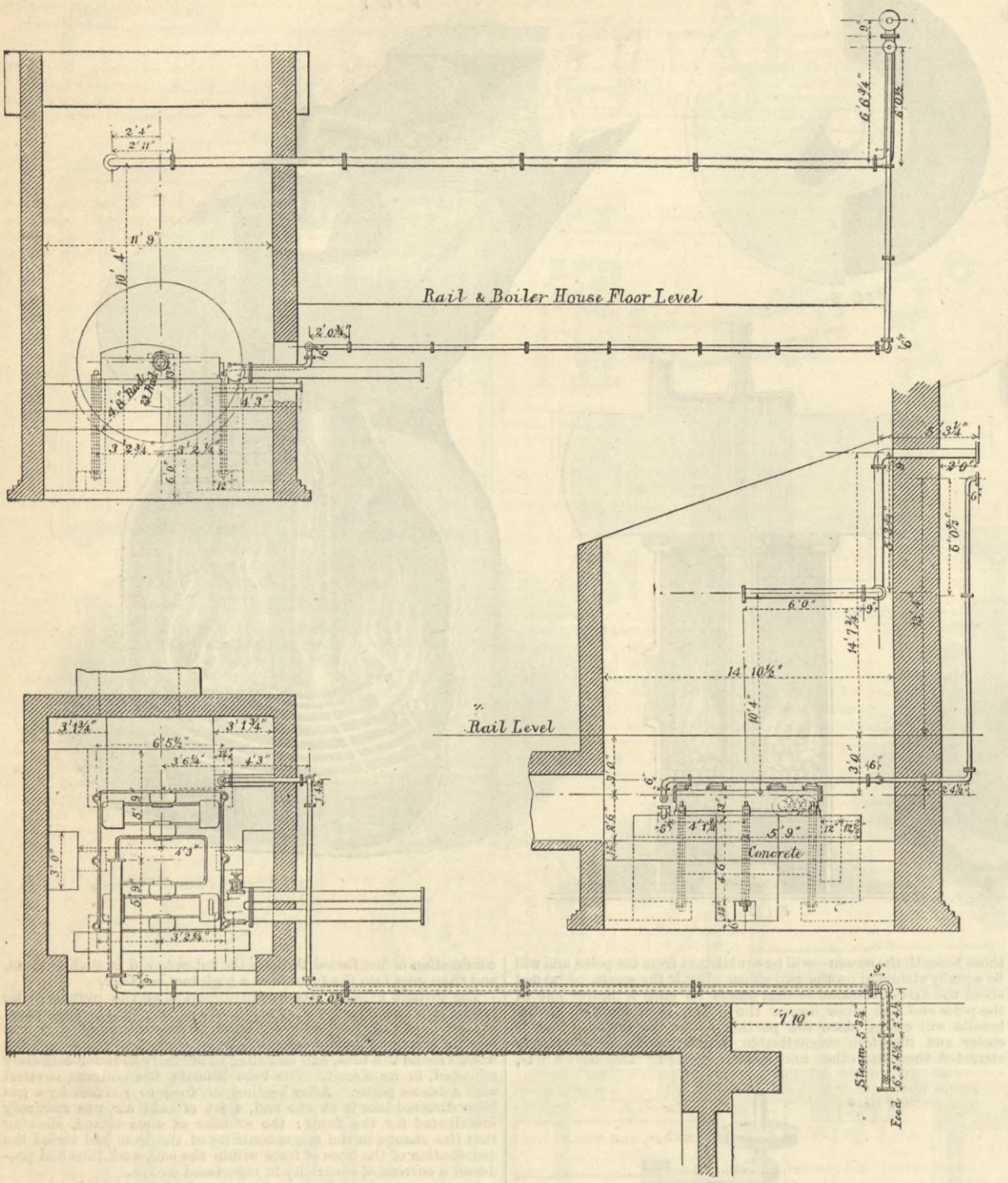
The construction of a machine of sufficient size to demonstrate the feasibility of producing continuous currents on the large scale in this way was at once begun, and has only just been completed. The new machine, Figs. 3, 4, and 5, consists of eight distinct elements, each the equivalent of the device already mentioned, consisting of the two legs of an electro-magnet somewhat far apart—12in. actually—having at one end the ordinary yoke, and at the other a roll of corrugated sheet iron, 0·005in. thick, called an interstitial armature, this armature having a coil of wire wound upon it, and separated from direct contact by means of asbestos paper. The eight elements are arranged radially about a common centre, and are equidistant, the eight interstitial armatures passing, in fact, through the iron discs which constitute the common pole pieces of all the electro-magnets. The coils wound upon the interstitial armatures are connected directly in series, the whole forming a closed circuit. Through the centre of these discs a vertical hollow shaft passes, carrying at its lower end a semi-circular plate of fire-clay called a guard plate, which, when the shaft is turned, revolves close to the lower ends of the sheet iron armatures, and screens off half of them from the access of heat from below. The shaft carries a cylinder of insulating material, having metallic contact pieces let into it on opposite sides, the line joining them being parallel to the straight edge of the guard plate. Upon this cylinder eight springs press, Fig. 4, each of these springs being connected to the wire of the closed circuit above mentioned midway between the coils. The length of the metallic segment is so proportioned that the following spring touches it just as the preceding one leaves it. The springs themselves are so adjusted that each of them comes into contact with its metallic segment just as the preceding coil of the pair to which it is connected is uncovered by the rotation of the guard plate. Upon the same shaft, and above the cylinder just mentioned, a pair of metallic rings are placed, insulated from the shaft, to each of which one of the metallic segments is connected. Brushes pressing upon these rings take off the current produced by the generator.

The entire machine now described is placed upon the top of any suitable furnace fed by a blast, so that the products of combustion are forced up through those interstitial armatures which are not covered by the guard plate, and raise them to a high temperature. The field magnets when charged magnetise of course only those interstitial armatures which are cold, *i.e.*, those beneath the guard plate. On rotating this plate the interstitial armatures are successively uncovered on the one side and covered on the other; so that continually during the motion four of the eight armatures are losing heat and the other four are gaining heat. But those which are losing heat are gaining magnetism, and *vice versa*. Hence, while currents are generated in all the armature coils, since in all the magnetism is varying, the current in the coils beneath the guard plate will be in one direction, while that in the coil exposed to the fire will be in the other. Moreover, whenever an armature passes out from under the guard plate, its condition at once changes; from losing heat and gaining magnetism, it begins to gain heat and lose magnetism. Hence, at this instant the current in the coil is reversed; and consequently the line connecting this coil with the one opposite to it constitutes the neutral line or line of commutation, precisely as in the ordinary dynamo. Indeed, the action of the interstitial armature coils of the pyromagnetic dynamo resembles strongly that of the ordinary armature coils of the Gramme ring, not only in the manner of connect-

[1] Abstract of paper read before the American Association for the Advancement of Science, New York, August, 1887.

INSTALLATION OF ENGINE FOR THE INDIAN STATE RAILWAYS.

(*For description see page* 198.)



ing them together, but also in their functions; the change of direction in the current as the magnetism of the field changes sign, in the latter case corresponding closely to the change of current in the former case, due to the direction of the temperature change. But it will be observed that while in the Gramme ring the loops between the armature coils are connected to commutator segments equal in number to that of the coils, upon which commutator two brushes press, in the pyromagnetic dynamo the loops between the armature coils are connected to an equal number of brushes (in this case eight), while the commutator segments are only two in number. So that the functions of the commutator and the brushes in this generator are in a certain sense reversed as compared with the ordinary dynamo.

The potential difference developed by this dynamo will obviously depend (1) upon the number of turns of wire on the armature coils, (2) upon the temperature difference in working, (3) upon the rate of temperature variation, and (4) upon the proximity of the maximum point of effect. No advantage will be gained, of course, by raising the temperature of the interstitial armature above the point at which its magnetisability is practically zero, nor will it be advantageous, on the other hand, to cool it below the point where its magnetism is practically a maximum. The points of temperature, therefore, between which, for any given magnetic metal, it is most desirable to work, can be easily determined by an inspection of the curve showing the relations between heat and magnetism for this particular metal. Thus the points of temperature at which the magnetisability is practically zero, as above stated, are a white heat for cobalt, a bright red for iron, and 400 deg. for nickel. On the other hand, while at ordinary temperatures iron has a maximum intensity of magnetisation represented by 1390, its intensity at 220 deg. is 1360, and hence no commercial advantage is gained by cooling the iron below this temperature. Nickel, however, whose maximum of intensity of magnetisation at ordinary temperatures is 800, has an intensity of only 380 at 220 deg. Hence, while this metal requires a lower maximum temperature, it also requires a lower minimum one, but it may be worked with much less heat. The rate of the temperature variation is determined by the rapidity with which the guard plate revolves, and this in its turn is dependent upon the rapidity with which the interstitial armature can be cooled and heated. That it may take up and lose heat readily, the sheet iron of which it is made is very thin—only 0·005in. thick, even when its durability is increased by enamelling or nickeling—it is corrugated and rolled up so as to expose a large surface—about 60 square feet for the eight armatures—and hot and cold air are alternately forced through the armature. Experiments already made show that the guard plate can probably be made to revolve 120 times a minute. Since the potential difference is proportional to number of lines of force cut per second, it is evident that by doubling the speed of rotation twice as many lines of force would flow across the generating coils per second, and the output of energy would be quadrupled. Exactly what thickness of metal is the most suitable for the purpose, what the relative volume occupied by metal and by air space in the intestitial armature should be, what is the best diameter for the armature, or even the best metal, what the best limits of temperature, and what the best speed of rotation to produce the maximum potential difference—all these are questions which must be decided by experiments made upon the generator itself.

The results thus far obtained with the machines illustrated by Figs. 1, 2, 3, 4, and 5, lead to the conclusion that the economy of production of electric energy from fuel by the pyromagnetic dynamo will be at least equal to and probably greater than that of any of the methods in present use. But the actual output of the dynamo will be less than that of an ordinary dynamo of the same weight. To furnish thirty 16-candle lights in a dwelling house would probably require a pyromagnetic generator weighing two or three tons. Since, however, the new dynamo will not interfere with using the excess of energy of the coal for warming the house itself, and since there is no attendance required to keep it running, there would seem to be already a large field of usefulness for it. Moreover, by using the regenerative principle in connection with it, great improvement may be made in its capacity, and its practical utility may very probably equal the interesting scientific principles which it embodies.

TENDERS.

LYMINGTON SEWERAGE.

List of tenders for Lymington sewerage; Mr. James Lemon, M. Inst. C.E., engineer:—

	£	s.	d.
T Neave, Leytonstone	16,565	0	0
Howell, Poole	14,995	7	7
Whettam, Weymouth	13,350	0	0
Sanders, Southampton	13,346	0	0
Edwards, Southborne-on-Sea	13,334	0	0
Neave and Son, Paddington	13,300	0	0
Osenton, Erith	13,175	0	0
Perkins, Lymington	13,047	0	0
Harrison, Brighton	13,000	0	0
Adams, Kingsland-road	12,998	0	0
Frere and Co., London	12,966	0	0
Meader, Cowes	12,560	0	0
Kingswell, Isle of Wight	12,400	0	0
Hill and Co., Plymouth	11,997	0	0
	11 9 9	10	0*
T. P. Hall, Southsea (accepted)	11,952	0	0
	11,752	0	0*
W. H. Dearle, Chichester	11,490	0	0
	11,380	0	0*

* Amended tenders to postpone the commencement of the outfall works until March, 1888.

A Mica Mine.—A mica mining company, with the stock owned largely in Fall River and in New Bedford, Mass., has recently been organised for the purpose of mining mica in Dorchester, N.H., and the work of blasting was commenced on August 1st with three men. Five blasts were made, which yielded about 1000 lb. of mica free from rock. The waste in fitting mica for the market is estimated at about 90 per cent., but as the wholesale price is from 25c. to 6 dols. per lb., according to size and quality, the profits of a good mine must be enormous. A large force is soon to be put upon the mine.

LETTERS TO THE EDITOR.

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

FEATHERING PADDLE-WHEELS.

Sir,—"M. E.'s" letter in your last issue is very much to the point, and is quite correct in its deductions. Strange that Professor Greenhill should have made such a common "slip." There are a good many of the same opinion as Professor Greenhill "that the entering float should enter in a vertical position, so as to enter the water edgeways." Now, this is a great mistake. If we try to take soundings with a pole in shallow water, say 20ft. or 25ft. deep, standing on the deck of a moored dredger, and with a current setting at, say, four or five miles an hour, we must point the sounding-rod at a certain angle—learned by experience—in opposition to the direction of the current, and impel the rod in such direction so as to take the ground before it comes to the vertical. We can then allow it to fall to the vertical and note the figure. The sounder on board a man-of-war, when sailing slowly through shallow waters, slings his sounding weight and line a long way ahead, so as to have them vertical when the man comes over the spot. We cannot push a pole vertically into running water; we must push it at an angle, and such angle will be in the direction of the resultant of the two motions—the speed of the current and the speed of the impelled pole. Is is the same with the float entering the water. Such direction must be the resultant of the horizontal speed of the ship and the circumferential speed of the point of such float.

"The good old rule, the simple plan," of setting out the floats so that the entering float will be inclined at such an angle that a straight edge laid on the face of the float will cut the vertical of centre of shaft at a point coinciding with the circle described by the centre of pressure of the floats, *i.e.*, the centre of float gudgeons, gives a paddle-wheel whose action is nearly as efficient as a propeller as a radial wheel of double diameter, without its great weight and disadvantage in other respects.

Now, I should say it is not in the entering that Mr. Stroudley's curved floats have the advantage, but during the recess, as the upper concave edge reacts on the lifting water, and sends it aft in a more horizontal direction than does the plain-faced one. The curved floats prevent the great uplifting of the water, which is one loss of power, and the striking of the lifted water against the paddle beam, and after cleading, &c., which is another.

The lowering of the centre of the excentric gudgeon will have the effect of causing the floats to be vertical when entering and "hooked" below water and nearly horizontal when leaving the water level, when a tremendous quantity of water will be lifted. Such an arrangement will be fraught with loss from not being able to exert effort on water at and after immediately entering, hooked to the water below, causing extra weight on wheel bearings and lifting the water as aforesaid. R. Hartland.

Cork, September 7th.

COLONIAL DEFENCE.

Sir,—Considerable interest having been evinced in the question as to how far the Australasian armaments contribute to the protection of their own commerce and coasts, supplementing, and consequently strengthening the naval squadrons of the Mother Country, I have endeavoured in the following sketch to give some idea of the colonial defensive arrangements, derived from my own connection with them—latterly as President of the Southern Board of Military Examiners and honorary commodore. Victoria, in respect of efficiency of all arms, is as much ahead of the other colonies as she appears to be in the prosperous condition of her inhabitants. Her fleet consists of the Cerberus, monitor, mounting four muzzle-loading guns, each of 18 tons weight, two or three torpedo boats of about 125ft. long, which cost £9000 apiece, and a few small vessels. The whole of these have been brought into capital order by Captain Thomas, R.N., who commands the squadron.

The land forces, under Colonel Disney, are likewise thoroughly efficient, and to strengthen the land defence of Melbourne, its port and entrances, breech-loading ordnance of 9·2 and 8in. calibre, of the newest pattern, have recently been mounted in gun pits upon disappearing carriages of the Moncrieff type.

The Victorians are not, however, satisfied unless the whole of their armament is of the most improved pattern, and are therefore desirous of exchanging for breech-loaders the present guns of the Cerberus, which was the first vessel of her class, and was specially constructed and armed for the defence of Victoria's principal port, Melbourne.

The desired exchange to more powerful breech-loading ordnance I had no hesitation in stating could be easily effected, having been previously officially informed that my patent carriages and the turret arrangements carried out by me some years since, and upon which the Cerberus 18-ton guns were mounted, continued to work very satisfactorily.

The land forces of New South Wales have already well proved their value, side by side with the troops of the United Kingdom; and the fine bodies of Volunteers possessed by all the colonies, and the spirit with which they are animated, compare most favourably with any Volunteer or Regular troops in Europe or America. The New Zealand Volunteers showed their "grit"—to use a Yankee word—when left alone in the Maori War, and again more recently at Parihaka they evinced similar determination, when by the promptness of their mustering, ready armed for the threatened conflict, they put a final end to Maori risings.

The war vessels of Australasia—with the exception of those of Victoria—are of little power, but they are valuable as training ships and for keeping up the maritime spirit and enterprise which is so essential for the development of these colonies.

The recent decision of the London Conference that the colonies share between them the cost of augmenting the imperial fleet protecting their coasts of commerce, is doubtless wise as well as just; but in addition to this proposed increase of mobile force, Australasia possesses ports which afford a secure base for naval operations, and which, with abundance of coal and provisions and a sufficient population of our own blood to protect them, must largely augment the effective power of any naval force in these waters.

The United Kingdom possesses, in fact, in these long undervalued colonies the means of docking, repairing, and refitting, as well as re-manning her war-vessels, and of thus enabling them soon after an engagement to sally forth as well prepared for battle as when they left the shores of Britain.

The embodiment of a Royal Naval Volunteer force, embracing the sea-faring people of Australasia, would not only be a great step towards federation, but would have an excellent effect in developing the slumbering patriotism as well as the commercial spirit of the people; and the advantage of such a force would lie, not only in its cheapness, but in its being always ready, and not requiring the men composing it to be called away from their homes and occupations for drill, &c., as is the case with land volunteers. In New Zealand not long since the naval volunteers mustered with alacrity, willingly giving up their holidays, to man the vessels required for the sham attack upon Camaru, which was to be defended by a large body of their military brethren remaining in ambush outside the city. The announcement of the proposed attack seemed to stir up the Norse instincts of the people, and the directors of the Union Company's fine steam fleet of about thirty or more vessels willingly lent those at hand free of cost, and generously assisted the Harbour Boards of Dunedin and Camaru to provide the guns, powder, and boats needed for the sham bombardment and sack of the city. Mines were laid down at the entrance to the harbour of Camaru and fired as the boats advanced, and a grand field day with all arms ensued, the result of the attack being a more strongly expressed feeling that New Zealand was essentially a maritime colony, and needed naval organisation for its defence. A deputation consisting, amongst others, of Generals Fulton and Irvine, of the Imperial Service, and the Hon. Captain

Frazer, of the Legislative Assembly, represented to the Ministry the importance of encouraging the development of the colonial marine, and recommended that some of the largest of the New Zealand Union Company's steamers trading throughout Australasia should be armed with light quick-firing guns, and that the crews should be drilled to their use, which would render these vessels a valuable auxiliary to the Royal Navy in the event of war. Subsequently the managing director of the Union Company was waited upon and readily consented, as a commencement and for full trial of the plan, that two of the company's best steamers should be armed, provided the New Zealand Government bore the expense. Thus the matter stood when I left the colony, but it cannot be a matter of indifference to the Mother Country that the fine body of seamen available for the naval defence of New Zealand and the other colonies, and which would furnish seamen for our squadrons, should not be encouraged and utilised, so as to add to the strength of her Majesty's widely extended empire.

ROBT. A. E. SCOTT, Rear-Admiral (retd.).

September 10th.

ELECTRO-DEPOSITION OF ALLOYS.

SIR,—Having lately obtained successful deposits of alloys from acid solutions of mixed metals—which has hitherto been considered practically impossible by other investigators—and having made known the results of my experiments in this direction.[1] I was somewhat surprised to find that the Electrolysis Committee of the British Association, at its meeting on Saturday last, made no reference whatever to these results, although there were many present who were specially interested in the subject, and must have known that I had published a series of papers in which I explained the nature of the electrolytes I had used in my experiments and the methods I adopted to obtain deposits of alloys from acid solutions of mixed metals. Indeed, I went farther than this, for I endeavoured to prove, and I believe my results have proved beyond question, that the accepted theories of electrolysis, so far as they relate to the deposition of alloys, are unstable and opposed by the results I have obtained. According to the law of Berzelius, "out of a solution of mixed metals the least elecro-positive metal is deposited first." That this law does not apply to cyanide solutions of mixed metals is well known, for electro-brassing and electro-bronzing are common arts, while many years ago I described a method of depositing German silver—now also a common art—besides which various alloys of gold, silver, and copper are frequently obtained from cyanide solutions. Berzelius' law, however, has ever been held paramount, so far as acid or neutral solutions of mixed metals are concerned, and even so recently as in June last, Professor S. P. Thompson in a paper read before the Royal Society on the "Electro-deposition of Alloys and on the Electro-motive Forces of Metals in Cyanide Solutions," stated, 'It is well known that the electro-desposition of such alloys as brass, bronze, and German silver is not practicable from mixed solutions of the sulphates or chlorides of the constituent metals." On reading this statement I called to mind some experiments made several years ago, with a view to obtain deposits of alloys without employing cyanide of potassium, and I resolved to determine, if possible, whether or not the deposition of alloys could be obtained from neutral or faintly acid solutions of mixed metals, and if you will permit me I will explain the course I adopted—with, I am pleased to affirm, perfect success. In the first instance I prepared an electrolyte composed of a moderately strong solution of the acetates of copper and zinc, the latter salt being in excess. The current was obtained from five small cells of a zinc-copper battery, arranged in series. This battery had been more or less at work for many weeks, and was virtually exhausted. Even with the weak current thus obtained I soon discovered that my electrolyte was too concentrated, so I gradually reduced its strength with water until—using the judgment of experience for my guide—I found that the character of the deposit approached what I was seeking, the evidence of an alloy, that is brass. By regulating the anode surface I soon obtained what I desired, a deposit of brass of a good yellow colour. Having thus established the fact that both metals—zinc and copper—would deposit simultaneously, in the form of a reguline alloy, upon a surface of steel, I determined to try if I could obtain a similar result upon steel-plate by placing it in contact with a strip of zinc, and in this I was equally and immediately successful, for in a few seconds the steel-plate became coated with brass of very good colour. It next occurred to me to ascertain whether the two metals—zinc and copper—would deposit upon zinc by simple immersion. A clean strip of zinc was dipped into the same solution, and this became promptly and freely coated with brass. I may here state that these deposits were remarkably adherent, and withstood the pressure of a steel burnisher without in the least degree blistering or stripping from the underlying surface, either of steel or zinc. My next trial was with the citrates of copper and zinc, from the mixed solutions of which I obtained deposits of brass by the direct current on steel; also on steel by contact with zinc, and by simple immersion. I then arranged my little battery in multiple arc, and obtained equally good results to those obtained when it was arranged in series, but was obliged to immerse a larger anode surface. The tartrates of copper and zinc and the phospates of copper and zinc also yielded deposits of brass upon a steel surface by the three methods before referred to. Being so far successful, I next determined to try whether mixed solutions of the sulphates, chlorides, &c., of copper and zinc could be made—I use the term advisedly—to yield deposits of alloys, and in attacking these salts I must confess that I had some misgivings. I, however, resolved to try what a very weak solution of the mixed metals would do, for I felt sure that there was little or no use in trying strong solutions. To be brief, when I had succeeded in reducing the strength of my solutions sufficiently to obtain deposits of brass from both the sulphates and chlorides of copper, was thus enabled to refute Professor S. P. Thompson's statement, based upon the general belief that alloys cannot be deposited from mixed solutions of these salts. With the nitrates, however, I was less successful, but with certain modifications that have occurred to me, I hope yet to obtain deposits of alloys from mixed solutions of these salts.

Knowing that cyanide depositing solutions, prepared by what is termed the battery process, invariably yield most excellent results, I determined to apply the same system to form an electrolyte for depositing brass from an acid solution. To do this I made a mixture composed of about one part of acetic acid to three parts of water; in this I immersed a brass anode and a carbon caltrode connected to the small battery before referred to. In about a quarter of an hour a slight coating—apparently of copper only—appeared on the surface of the carbon; a steel plate was then substituted for this, which at once received a film of brass, of a good yellow colour. The deposit from this solution was far more adherent than any deposit of brass I have ever met with from cyanide solutions. Having thus deposited brass from solutions prepared in various ways, I next resolved to try if other alloys were to be obtained from acid solutions. In using this term I do so to contra-distinguish the electrolytes I employed from ordinary cyanide solutions, or those prepared from pyrophosphates, &c. I now prepared a series of solutions from the undernamed salts, from each of which I obtained deposits of the respective metals, in the form of an alloy, on steel, by the direct current; on steel by contact with zinc, and on zinc by simple immersion. By this latter method, however, it was necessary in some cases to keep the strip of zinc in brisk motion in the solution, in order to induce both metals to deposit simultaneously. The mixed solutions referred to were:—Sulphates of copper and nickel; chlorides of copper and tin; chlorides of copper and cobalt; chlorides of copper and antimony; sulphates of copper and iron; chlorides of copper and platinum, &c. Finding that the deposition of electro-positive and electro-negative conjointly in the form of negative alloys was neither dependent upon quantity of current, nor on a high E.M.F., I made the following experiments:—I took two pieces of thin wire, one steel and the other zinc, and tied them together with fine copper wire, allowing the steel wire to project about three-quarters of an inch beyond the zinc wire. The couple thus arranged was fixed in a cork, and their ends immersed in a solution composed of the acetates of copper and zinc, the zinc wire being allowed only to touch the liquid. Almost immediately the steel became coated with brass. It thus became evident that the deposition of an alloy—from an acid solution of mixed metals, at all events—is effected by the E.M.F. of the metals immersed in the liquid and the immeasurable current that passes under such conditions, and is not in the least dependent upon those conditions of the electric current which are generally supposed to be absolutely necessary to effect the simultaneous deposit of metals of opposite electric relation. As I have stated elsewhere, I am in a position to repeat before others the experiments to which I have called your attention, and, this being so, I cannot understand how or why it is that the members of the Electrolysis Committee of the British Association should have taken no notice of my published communications, more especially as it is generally understood that at these annual gatherings scientific men meet to discuss, not only their own performances, as members of the Association, but also the doings of others.

ALEXANDER WATT.

London, September 13th.

[1] *Electrical Review*, August 26th, September 2nd, and 9th.

THE EFFECT OF SKIDDING RAILWAY WHEELS.

SIR,—I have read the paper by Mr. Jeremiah Head upon "Specimens of Steel Produced by Skidding Railway Wheels"—p. 218—and agree with the conclusion at which he arrives, that the pieces in question come from the tires of skidding wheels.

During the years 1868-9 one of the engineers under whom I served my pupilage gave considerable attention to the question, and I still have the details recorded at the time. Observations were made upon the Bagworth and Lickey inclines, also near West Bridge Station, Leicester, and upon the Cromford and High Peak Railway. The rails were of iron, the tires of steel, and the brake blocks of wood, having holes filled with resin and sand. The pieces of metal picked up where the wheels were skidded were found by an analyst to be "steel," consequently it appeared certain that they had come from the tires. It was also observed that upon inclines where the speed throughout was practically the same, and where the wheels had been skidded or spragged, that many more and large pieces of steel were found near the bottom than at the top of the inclines. This would seem to point to a conclusion that a tire heated by friction was more easily destroyed than when cool as it would be near the top of an incline. I brought these facts under the notice of the advocates of the Wilkin and Clark chain brake when attending trials on the Metropolitan and at Bromsgrove 1869-1870, and they at once replied that "all the destruction would be avoided by adopting their continuous brake, which did not require to skid the wheels for any ordinary stoppages.

The fact that an unskidded wheel gives the greatest stopping power and yet does not produce the steel scale seems to prove that it is not the total friction which the brake blocks exert upon a tire which causes the damage, but the concentration of friction and consequent heat produced upon one portion of a skidded tire.

27, Belvoir-street, Leicester, CLEMENT E. STRETTON.
September 12th.

SIR,—The information supplied by Mr. Jeremiah Head in his paper read before the British Association, a copy of which you print in your issue of 9th inst., is interesting as well as instructive. I have often observed the effect of skidded wheels when rubbing along a rail at a high velocity—in most cases only for a short distance. The steel scale illustrated in your paper resembles many which I have often picked up. It was on the Baden State Railway that this subject came to my notice; this railway used for its tires, on coaches fitted with brakes, a very mild steel indeed, whereas the rails were of a harder material. I have noticed wheels just as the train has come to rest, which have been skidded, these had a flat place where the piece had been rubbed off, the wound itself having a colour resembling the scale. This confirms Mr. Head's first conclusion, viz., that the tires suffer most. From what I have seen I am of opinion that in the case of worn rails it is from the rails that the scales are rubbed off more than from the tires, for the specimens I obtained from near the well-worn rails were of a much more longitudinal structure than that illustrated, which seems to infer that the fibres of the rail—or, perhaps better, the rows of crystals—had become loosened from one another, and were rubbed off by the wheel.

I may mention two cases which came under my observation, and which may be of interest; one was a goods wagon tire which had run down the Semmering incline—the head of the rail had worked a hole into the tire to the extent of about 1½in. deep; during the run down, which would be little less than an hour in duration, the wheel would undoubtedly have become very hot, and in this way softened the tire. It seems likely that the most part of the damage was sustained during the latter part of the time. The other was a case where a four-wheeled coupled passenger locomotive was, during a speed of about 50 kilos. per hour, suddenly braked to such an extent that the coupled axles were stopped from turning, the engine slid along for some 100 metres, the tires were so damaged that they had to be turned up again. This all tends to confirm what Mr. Head has so well put forward, and to substantiate the conclusions which he has drawn at the end of his paper.

JOHN PLACE.

34, Highgate-road, N.W., Sept. 11th.

THE RELATIVE STRENGTH OF SCREW THREADS.

SIR,—Can any of your numerous readers give me some information on the above subject, which I cannot meet with in any published mechanical work? Certain practical experiments which I have conducted go to show that screw bolts with threads of finer pitch than Whitworth's standard—in case of a ⅞in. bolt with eleven threads instead of nine to 1in.—fitted with nuts containing the same number of threads as in ordinary nuts, but of the finer pitch, are at least as strong as bolts and nuts screwed to Whitworth's standard pitch and gauge. What is the theory on this point, and does it coincide with the result of the practical experiment alluded to? I shall be greatly obliged for any information that can be given.

INQUIRER.

September 10th.

STRESSES IN A CAMP STOOL.

SIR,—Your correspondent Mr. Batey is altogether astray in his solution as above, as given in his letter of September 2nd—(1) He calculated the transverse stress of a leg on the assumption of a "beam fixed at one end and loaded at the other." Wrong. If he places a board on his camp stool and sits on it, he will see his mistake at a glance. (2) That the stress on the end of leg acts at right angles. Wrong. The leg must be treated as an inclined beam. (3) In common with your other correspondents, that the depth of the beam should be reduced as $1\frac{1}{4} - \frac{1}{4}$ hole = 1in. Wrong. The beam must be treated as a little girder with top and bottom members. Would your correspondents calculate the strength of a trussed beam by adding the top and bottom booms together, and calling the sum of their depths the depth of the girder? If we allow Mr. Batey to calculate the strength as (1), he must make his calculation as thus:— $\frac{K\ B\ D^2}{L}$ cosine angle of rake of leg with horizontal line = (taking angle = 45 deg.) breaking strain on leg. We have $\frac{19 \times \cdot5 \times 1 \times 1}{12 \times \cdot707} = 1{\cdot}12$ cwt., or 127·64 lb., for one leg.

R. HARTLAND.

Cork, September 7th.

A PROBLEM IN STRAINS.

SIR,—If your sceptical correspondents "T. E. N.," Batey, and Co. will just drive a strong nail into an upright post, &c., and on such nail hang a correct "Salter's" balance, and from the hook hang a weight = 5 lb., then, of course, 5 lb.—neglecting the weight of the balance—hangs from the nail. Now let them drive another strong nail into the post so as to lean against the concave or top edge of hook. Now remove the 5 lb. weight, and the lower nail does duty for the 5 lb. weight, the index pointing as before. There are 5 lb. acting on top nail and 5 lb. acting on bottom nail. Now, if we put a weight of 1 lb. to hang from lower hook, the top nail has to carry it. Q.E.D.

R. HARTLAND.

Cork, September 7th.

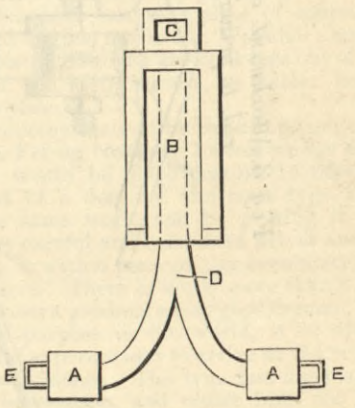
SIR,—On referring to my letter in your last issue, it will be observed that in Fig. 3 the centre tie bolt has been unintentionally omitted; the bolt is in the original diagram, and is a necessary part of the girder. Should the discussion be continued, please insert this correction, and oblige.

C. S.

Manchester, September 12th.

FURNACE BOILERS.

SIR,—I beg to hand you sketch as what, in my opinion, would be a good arrangement of the flues as wished by your correspondent. (1) It will be better to build the flues, as at D, to prevent the two fires coming in contact so abruptly as in to-day's sketch.



(2) Dampers in the position would not last; it would be far better to make the furnace, ashpits, and fire holes E tight when not in use. (3) One flue would be better, as far as the boiler is concerned, than two.

F. BOTTING.

6, Baker-street, London, W., September 8th.

SIR,—In answer to a correspondent in last week's ENGINEER—viz., "F. B., Birmingham"—relative to his sketch of furnace boilers, there is very little practically to hinder it from working. As a furnace builder, I would suggest that at the junction of his furnace flues he should build a mid-feather about 2ft. to 2ft. 6in. long. As there is a tendency to drawing air around the dampers, the mid-feather would give each furnace a better chance, whether working one or both. I would also suggest raising his chimney 10ft. or 15ft., as I think it full low for the work.

Wednesbury, September 13th. FURNACE BUILDER.

WHITWORTH SCHOLARSHIPS FOR 1887.

THE results of the examinations for Sir Joseph Whitworth's Scholarships in Mechanical Engineering Science have just been sent to the successful candidates, and we have again to intimate the more than usual success of Glasgow students. This year twenty-five scholarships have been awarded, one of £200, eight of £150, and sixteen of £100. On the whole, with the exception of Glasgow, these scholarships are pretty well distributed throughout the United Kingdom. Six scholarships have been taken by Glasgow men, and of these, the first five, of a value of £150 each, fall to students trained at the College of Science and Arts, Bath-street. The following is the complete list of successful candidates:—

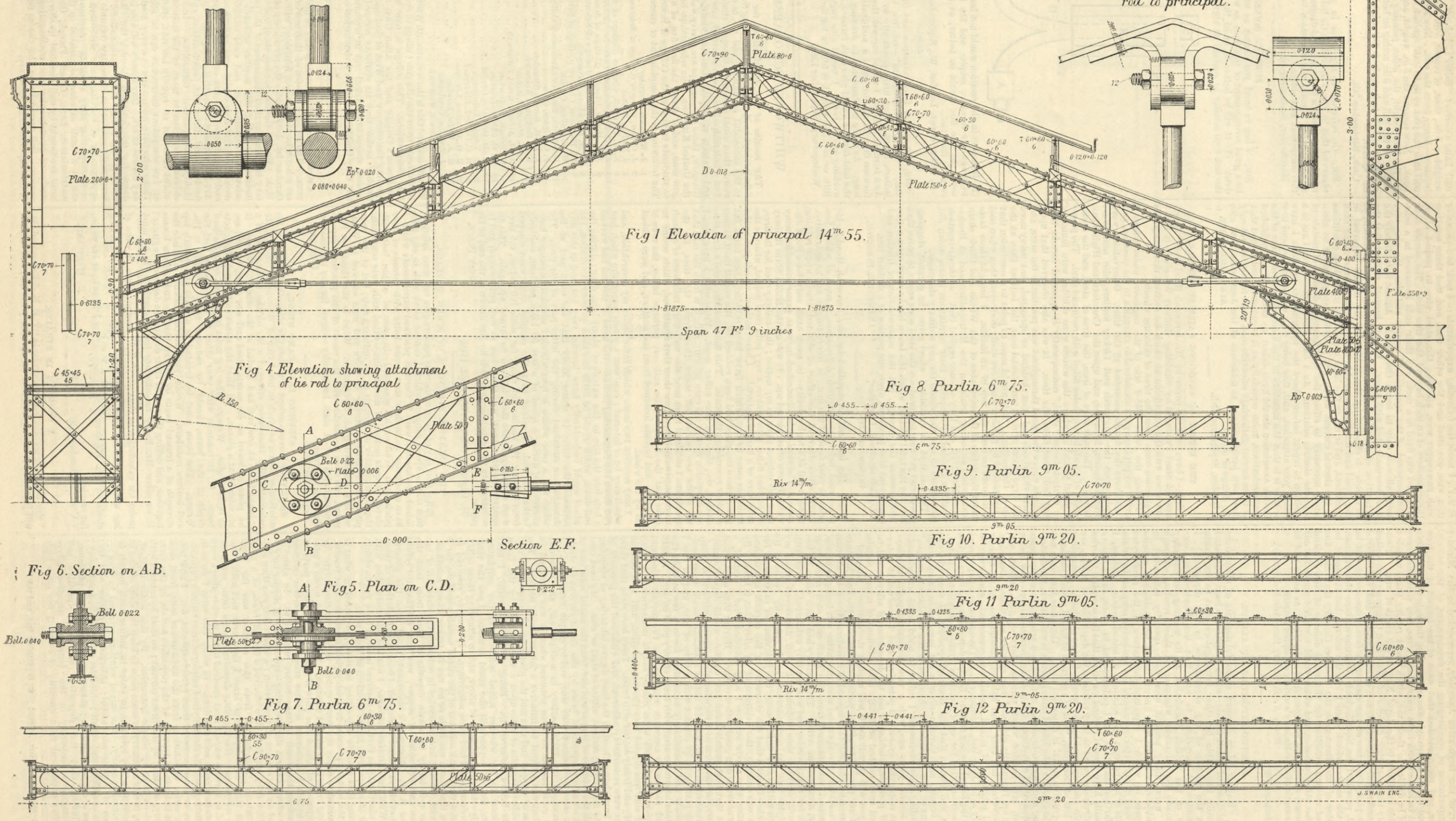
1	J. Whitaker, Burnley	£200
2	J. Calder, Glasgow (College of Science and Arts)	150
3	J. Smith, Belfast	150
4	N. K. Turnbull, Glasgow (College of Science and Arts)	150
5	J. C. Talbot, Southampton	150
6	A. F. Horne, Glasgow (College of Science and Arts)	150
7	E. J. Duff, Glasgow (College of Science and Arts)	150
8	R. N. Blackburn, Liverpool	150
9	W. Thomson, Glasgow (College of Science and Arts)	150
10	W. F. Pullen, Cardiff	100
11	E. Griffith, Glasgow (Anderson's College)	100
12	F. C. Tipler, Crewe	100
13	T. H. M. Bonell, Swindon	100
14	R. J. Redding, Woolwich	100
	A. W. Sisson, Lincoln	100
16	A. H. Abbott, Great Yarmouth	100
17	G. Hough, Wolverton	100
18	H. G. Christ, London	100
19	H. D. Griffiths, Cardiff	100
20	D. Young, Edinburgh	100
21	B. C. Oxford, Liverpool	100
22	B. H. Crookes, Liverpool	100
23	G. J. Wells, London	100
24	J. Eustice, Camborne	100
25	A. H. Bratt, Woolwich	100

We understand this is the seventeenth Whitworth scholarship gained by students from the Glasgow College of Science and Arts at the last four competitions. This college is now being amalgamated with Anderson's College and the Allan Glen School, the combination forming the Glasgow and West of Scotland Technical College. We further notice that its students secured the first places in the honour stages in electrical and in mechanical engineering at the last City Guilds of London technological examinations.

CHARTERHOUSE SCIENCE AND ART SCHOOLS AND LITERARY INSTITUTE.—The weekly session of this, one of the largest science and art schools in the United Kingdom, will commence on Saturday, October 1st, 1887, under the presidency of the Rev. Henry Swann, M.A. During the late session about 950 students, mostly elementary teachers, availed themselves of the privileges afforded by this institution, and of this number upwards of 650 presented themselves for examination, and were successful in obtaining a large number of first-class certificates, and also a goodly number of first and second-class honours certificates awarded by the Science and Art Department of South Kensington. Of eight students prepared for the Lond. B.Sc. (Int.) examination, only one failed; the others highly distinguished themselves. Instruction of a practical character is given in most of the sciences at a very nominal fee; whilst in art, at an equally low rate, students under the direction of five competent instructors can be advanced in their studies. Those who have leisure can at a very moderate charge attend the day classes in art. Day classes will also be held to prepare candidates for matriculation (Lond.), the clerical, medical (including dental), legal, and other examinations. Students who aim at becoming proficient in chemistry (organic and inorganic), have the opportunity of working in a well-fitted laboratory, capable of accommodating sixty students. Aspirants of University honours can at a small expense be assisted in their studies. Classes for matriculation, Latin, Greek, French, German, music, and shorthand are taught by well qualified teachers. Opportunities for the study of photography and watchmaking will be continued this session. Full particulars of the classes may be obtained from Mr. C. Smith, organising secretary.

PARIS INTERNATIONAL EXHIBITION.—SIDE GALLERIES OF FINE ARTS COURT.

(For description see page 227.)



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M. S. (Belford).—*The Pelton wheel is only suitable for very high falls. A high breast wheel will be far more efficient for moderate falls.*

C. J. L.—*The meetings of the International Railway Congress will be held in the Theatre La Scala, Milan, from the* 17*th to the* 24*th of this month.*

A. Z. (South Lowestoft).—(1) *Fill the boiler completely full of water by degrees, boiling it all the time under atmospheric pressure to get the air out of it, and shut down the safety valves and all cocks of every kind when the water has cooled down to about* 200 *deg. or so—and leave it full for the winter—there will be no corrosion. Paint with good red lead or oxide of iron the inside of the furnace and all surfaces liable to rust; or empty the boiler completely, light a fire of shavings to dry it perfectly, and then put in a small basket containing quicklime, and close up the manhole and all cocks and stop valves, so as to prevent air getting in.* (2) *A tube condenser alongside the keel outside will probably answer your purpose much better than a more complex arrangement.*

HAND POWER MILLS.

(To the Editor of The Engineer.)

SIR,—Can any of your readers oblige us with the name of the manufacturers of hand power mills for treating Mandioca or Cassada root; also of large condensers for producing fresh water from salt? E. J. B.
London, September 13th.

HINGED DAVITS.

(To the Editor of The Engineer.)

SIR,—Can you or any of your readers give me any information as to whether hinged davits for small boats are in use? If so, what patent, and where made, &c.? W. K.
Glasgow, September 13th.

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THE ENGINEER.

SEPTEMBER 16, 1887.

COMPOUND LOCOMOTIVES IN FRANCE.

M. MALLET, the apostle of the compound locomotive on the Continent, has, it is well known, experienced considerable difficulty in getting any of the principal lines of railway to adopt his system. On the line from Bayonne to Biarritz his engines have been working satisfactorily for about a dozen years, and his example has at last succeeded in inducing the engineers of the Chemin de Fer du Nord to give the system a trial. The engine tested in certain respects resembles that of Mr. Webb. It is carried on six wheels, four of which are drivers 7ft. in diameter. These wheels are not coupled. The leading driving wheel axle, instead of having one crank as in Mr. Webb's engine, has two cranks driven by two high-pressure inside cylinders, 13in. in diameter. The trailing wheels are driven by two low-pressure cylinders, 18in. diameter, fixed to the frames outside between the driving axles. The stroke of all the pistons is the same—24in. The slide valves of the inside cylinders work back to back in the usual way between them. The low-pressure slides are placed below the cylinders, and are driven by a modification of Walschaert's gear. The high-pressure valve gear is of the Stephenson type, and the point of cut-off can be varied independently for the high and low-pressure engines. The boiler pressure is 156 lb. per square inch. The boiler is fed by two Friedmann injectors, one No. 7, always at work, and the other No. 10. The steam pipe for the small cylinders is inside the smoke-box, which also contains two large exhaust pipes from these cylinders, which constitute an intermediate receiver. The volume of this receiver is nearly six cubic feet. A reducing valve loaded to 75 lb., for admitting steam direct to the low-pressure cylinders, is fixed near the top of the intermediate receiver pipes in the smoke-box. The entire engine has been designed by M. de Glehn, manager of the Société Alsacienne de Construction Mécaniques. It will be seen, as we have said, that the engine resembles in certain respects Mr. Webb's engines; but the differences are important. Mr. Webb uses a single low-pressure cylinder, and the action of this cylinder is, as is well known, to cause trains to start with a jerking motion; also, inasmuch as it may be standing on a dead centre, it cannot always assist in starting a train. M. de Glehn's engine having four cylinders, has practically no dead points. It is urged against Mr. Webb's system that the huge low-pressure piston must require much power to drive it at high speeds, and that is one of the reasons why, as has been alleged, the compound engines cannot attain a very high speed. We do not quite see, however, that if there is anything in this argument—which we doubt—M. de Glehn has gained much by using two cylinders instead of one. All the objections raised against the non-coupling system obviously apply to one system as much as to the other, and it is a noteworthy fact that in his latest engine, shown at Manchester, Mr. Webb has coupled the high and low-pressure axles.

Last year five trials were made with the engine which we have briefly described between Paris and Longueau, and between Paris and Lille, and a large number of diagrams was taken. The results obtained were in some respects curious. It was found that there was excessive compression in the small cylinders, the pressure amounting sometimes to more than that in the valve chest. To reduce this, both the outside and inside laps of the slide valves were twice diminished. The compression still remaining too high, the clearance was increased by reducing the thickness of the pistons. These changes were made and their effects noted during the first four runs. All the diagrams were taken from the leading ends of the cylinders; during the fifth trial they were all taken from the back ends. It appears strange that any modifications should have been made in the valve gear on the evidence of cards taken from one end only of the cylinders, but so it was. The diagrams from the large cylinders showed nothing remarkable, save a great fall of pressure when the cut-off took place early in the small cylinders. During expansion condensation to the extent of about 5 per cent. took place in the high-pressure and re-evaporation to the extent of about 8 per cent. in the low-pressure cylinders. The condensation appeared to be a little greater at the back than at the front ends, possibly by reason of the cooling effect of the piston-rods. It was found that when the intermediate receiver pressure was high, the back pressure in the low-pressure cylinders was considerable; but that with a small pressure in the receiver, the back pressure was considerably lower than in non-compound engines, working with high grades of expansion. At first, when the clearance amounted to about 8 per cent., the compression rose in the small cylinders to as much as 200 lb. on the square inch. With the thin pistons, the clearance amounted to about 13 per cent., and the compression line did not rise above a point proper to the valve-chest pressure. In the large cylinders the terminal pressures varied between about 70 lb. and 1·5 lb., according as that in the intermediate receiver was high or low, and the compression in the same cylinders often exceeded the receiver pressure. As to liquefaction, the results obtained varied continuously and through wide limits in the small cylinders. In the low-pressure cylinders the condensation was pretty uniform at 27 per cent. This was attributed in part to the cylinders being outside and more exposed to cooling influences. Concerning the economy realised, the results obtained were not very satisfactory. It was found that the compound engine burned 6 per cent. less coal than the average of six other engines of the same type, and doing the same duty, but non-compound. The consumption of oil and tallow, on the other hand, was greater for the compound engine. Taking, however, the performance of all the other compound engines on the line of nearly similar type, the compound engine had an advantage of 19 per cent. in fuel and 11 per cent. in feed-water. Up to the 30th of June, 1887, this engine had run 45,880 miles, and had been in regular work since the end of November, 1886. It is not quite so powerful as non-compound engines of the same type.

The results seem to be in many respects the same as those which have been obtained in this country. They are, however, on the whole, less satisfactory than those which Mr. Worsdell seems to have secured. There is so much difficulty in arriving at any accurate information concerning the London and North-Western engines that we can make no comparison with them. The de Glehn type does not seem to us to possess any special advantage which can make it popular. It may be regarded perhaps in the same light as some of the earlier varieties of the compound engine tried at sea. It will be remembered that all these died natural deaths; and the compound engine never was a success until the sole difference between it and the ordinary non-compound engine lay in the fact that the latter had two cylinders of the same size and the former two cylinders of different sizes. Mr. Worsdell's engine does not differ from an ordinary locomotive save in this sense, and its chances of ultimate success are consequently all the greater. It is very probable that the circumstance that the wheels of M. de Glehn's engine are not coupled reduces its tractive power considerably. It is known that engines of the Webb type first slip their trailing drivers and choke the intermediate receiver, when, of course, they become powerless, and the low-pressure cylinders have to take up the running for a revolution or two. Thus, if any slipping takes place, the tractive power is instantly reduced one-half. The use of four cylinders instead of three helps matters very little. Nothing of this kind can take place, of course, in Mr. Webb's coupled engine, nor in Mr. Worsdell's engine, the low-pressure piston of which always keeps out of the way so to speak, of the high-pressure, no matter how much slipping takes place.

As to the economy realised by the compound engine on the Chemin de Fer du Nord, we confess we are somewhat sceptical. It would be quite possible to take any one locomotive out of a dozen of the same type, and doing nominally the same work, and by putting it into the hands of a very careful and competent driver and fireman to make it get on with 6 per cent., or even more, less fuel than its compeers. There is much more than 6 per cent. difference between a good and a very good fireman. With all the honesty of purpose in the world, it is difficult for the most careful experimenter to arrive at the truth about locomotive performance. The true test must in the end be the coal, lubrication, and repair bills, not of one or two, but of at least a couple of dozen engines, and even these bills must be for considerable periods of time. The proper principle to follow is to make the compound engine as like the non-compound as possible. If this principle be fully carried out, the locomotive superintendent will have the satisfaction of knowing that he is playing a game of "heads I win, tails you lose," because he sacrifices nothing certain in the pursuit of a possible gain. Even, for example, if an engine of the Worsdell type did not show any remarkable economy in fuel, it would be no worse than an ordinary non-compound engine. But this certainly cannot be said of such an engine as that on the Chemin de Fer du Nord. Everything in it has been staked on the saving of fuel, and if that end be not secured in a large degree, the engine will find its way to the scrap heap in a very short time.

OFFICIAL INQUIRY INTO THE EAST LONDON WATER SUPPLY.

THE presence of eels in a portion of the East London water supply has been for some time past a problem of a very puzzling kind both in theory and practice. How to account for the eels was one difficulty, and how to get rid of them was another. The matter was not merely one of curiosity, but it had its sanitary aspect. The eels could be tolerated while alive, but they were insufferable when dead. They choked the service pipes, became putrid, and half-poisoned the consumer. The waterworks of the East London Company were like a fountain sending forth bitter waters and sweet. Month by month the analytical chemists were reporting the water supply as being remarkably free from organic matter and altogether pure and excellent, while sundry dwellers in West Ham were declaring the water to be absolutely putrid and poisonous. Others, more philosophical, took advantage of the fish supply, and inwardly thanked the Water Company for supplying food as well as drink. Thus, on July 12th, 1886, it is recorded that one William Penfold, of Plaistow Park, saw the Water Company's men flushing out a pipe in Beaumont-road, when a large eel, about 18 inches long, was extricated. The official report states concerning this eel that "Penfold caught it, took it home, and ate it." No evil consequences are said to have occurred; but it was otherwise in the case of some people occupying a house in West Ham. A putrid eel in the supply pipe so polluted the water that seven persons who drank it were made ill. In West Ham alone, from April to December last year, there were 32 authenticated instances of the detection of eels in water pipes. In 24 instances the eels were dead or putrid, in six they were alive, and in the other cases their condition was not stated. The Corporation of West Ham, as the urban sanitary authority, lodged a complaint on the subject with the Local Government Board. The illness of Sir Francis Bolton, the Metropolitan Water Examiner, caused some delay in dealing with this question; but after the death of Sir Francis, the newly-appointed Water Examiner, Major-General A. de Courcy Scott, was requested, in conjunction with Mr. W. H. Power, to conduct an inquiry into the quality of the water supplied by the East London Company. That is to say, they were to learn all that could be learned concerning the eels, and to report thereon. This they have done, and their report has just appeared, arriving at conclusions which are singularly at variance with the views which formerly prevailed.

Prior to this investigation the presence of the eels was accounted for by the breakdown of an old filter-bed on that portion of the works of the East London Company which is situated at Lea Bridge. This event took place in 1879, and had the effect of mingling unfiltered water with that which was filtered. It was thought that some small eels and other fish thus found access to the mains of the Water Company, and subsequently bred and multiplied therein. How the creatures lived was a mystery, unless the filtered water was far less pure than it was officially reported to be. If the eels lived on each other, there would at length be only one eel left, and he must die through lack of another eel to live upon.

Still the idea that the eels had made their home in the mains was firmly believed by the officials of the Water Company, and they took infinite pains to evict the intruders, by flushing the mains through the dead ends and in other ways. Little did they think while thus ejecting the eels at one end that the creatures were coming in at another. Yet such is the process described in the report drawn up by General Scott and Mr. Power. The theory that eels bred and multiplied in the mains is discarded. It would be contrary to the nature of eels to do anything of the kind. Eels, says the report, only produce their young in salt water, or at least in water that is brackish. This we may say at once is not the fact. We have seen eels taken by the thousand out of the mud of a small pond more than sixty miles from the sea, and far removed from a river. The water certainly was not brackish. The first clue to the mode of intrusion practised by these East London eels is found in the fact that they stand in immediate relationship to the Company's reservoir at Old Ford. Mr. Bryan, the Company's engineer, and an officer of great ability, states that very rarely indeed had eels at any time manifested themselves in the Company's water pipes elsewhere than in the district directly served from the Old Ford reservoir. But how were the eels, in the first instance, to find their way from the broken-down filter at Lea Bridge to the reservoir of filtered water at Old Ford, some two miles off? On this point General Scott and his colleagues observed insuperable difficulties in the way of the popular theory. The filtered water sent from Lea Bridge to the reservoir at Old Ford enters the latter through screens of wire gauze having interspaces measuring only $\frac{1}{42}$in. On the other hand, the filtered water which is pumped into the district mains at Lea Bridge has no screens to pass through, except such as would readily admit the passage of eels. Yet these fish have not troubled the district which takes its supply direct from Lea Bridge. But mains connected with Old Ford have supplied eels from a period as far back as 1881, and perhaps earlier. That these fish came from Lea Bridge to Old Ford, and afterwards multiplied at that spot and in the mains connected with it, was contrary to all probability. Wire gauze with interspaces the size of a pinhole could only admit the newly hatched fry of small fish. But eels being hatched in salt or brackish water would have some distance to travel before they reached the works at Lea Bridge, and would then be too large to pass through so fine a screen as that which would meet them on their journey to Old Ford. From the reservoir at the latter spot there were taken in the month of October last year eels varying in weight from a few ounces to several pounds. Clearly these could not all have entered the reservoir at the time when the filter bed at Lea Bridge broke down in 1879. Neither would they be the result of successive generations of eels, seeing that they could not enter from Lea Bridge, and they could not breed in fresh water. But the case is stronger still, for it is stated that the Old Ford reservoir was cleaned out in 1884. How then could this variety of fish have been developed in little more than two years?

One circumstance affecting the Old Ford eels was that they were not blanched, attenuated, or blind, as had been alleged, but were fine lively eels, such as might be obtained from ordinary and suitable sources. After all, whence came they? Not from Lea Bridge, for the way was blocked; not from breeding in the reservoir, for eels could not thus be produced. General Scott and Mr. Power put their explanation in modest terms. They advance it in hypothetical form, but evidently consider it much more probable than the theory which formerly existed, though they admit that something still more plausible than their own explanation may yet appear. The solution offered is certainly singular, and yet is supported by a weight of argument which entitles it to the utmost respect. The Old Ford reservoir is close to the river Lea, and eels are capable of travelling over land—snake fashion—especially where the ground is covered with wet grass. The East London eels are supposed to have shifted their quarters on certain occasions from the Lea to the Old Ford reservoir. This they might be induced to do by the extreme pollution of the Lea, which might well be distasteful sometimes even to eels. Full-grown eels descend the Lea in autumn, while the small fry and adult female eels ascend the stream in spring and summer. It is stated that eel fry, during their upward journey in spring could, by their power of climbing and their capacity for passing over land, surmount seemingly impassible barriers intervening between their starting point and the upland waters. The Old Ford reservoir is admirably situated as a trap for eels disposed to wander. The surface of the ground is not many feet above flood level, and the river bank on the company's side of the stream is much less steep than elsewhere in the neighbourhood. The ground surface, which forms the roof of the reservoir, is clothed with grass, calculated to encourage the progress of such "emigrant and exploratory eels" as might elect to leave the unsavoury river at this inviting spot. In the roof of the reservoir are many man-holes nearly flush with the surface of the ground, and not always perfectly closed. Through the apertures thus left, the erratic eels, attracted by the clear and wholesome water below, might easily drop into the reservoir. Lacking nourishment in the filtered water, the imprisoned eels would be likely enough to pass on into the engine wells, there to be pumped up into the mains. The autumn eels would seek to continue their "down stream" journey to the sea, and while instinctively out-racing the current, would ultimately run their heads against the taps in the tanks of the West Ham householders. The hypothesis thus formulated accounts for the presence of the eels by a succession of individual arrivals from without, and dispenses with the idea that eels were permanently domiciled in the mains. In this way we can account for the fact that the eels have varied greatly in their number from year to year. In 1884 the pipes were frequently blocked by the intrusion of these fish. In 1885 there is no certain evidence of the presence of eels, whereas in 1886 they abounded.

It appears that the plague of eels extended to rather less than one-fourth the entire area supplied by the East London Company. As to the prospect for the future of the West Ham water supply, the new theory is far more hopeful than the old. If a colony of eels were in possession of the water mains, and were able to reproduce their kind in such an abode, the chance of expelling them would be rather remote. But the case appears to be otherwise. The company are now advised to insert wire gauze screens between the Old Ford reservoir and the engine wells connected with it. A further suggestion is made that wire gauze baskets should be suspended under the man-holes in the roof of the reservoir, so as to catch and retain any intrusive eels which might attempt to plunge into the water. This novel kind of eel-trap may perhaps grow into a permanent institution, and may furnish a useful hint to persons elsewhere who go in pursuit of eels. The "scare" at West Ham has at least added something to our knowledge of the habits of eels and the practical results flowing therefrom. Had the officers of the East London Company been previously familiar with this by-path of natural history much money would have been saved and considerable agitation of the public mind prevented. "Knowledge is power," and the oddest kind of knowledge sometimes becomes useful; but it seems that only at a very recent date have the habits of eels been understood to the extent necessary for the successful issue of this Government inquiry into the peculiar phenomena of the East London water supply. Only it is possible after all that the explanation is wrong from beginning to end. As we have said, eels breed freely in nearly stagnant ponds, and no one seems to have ever seen an eel climbing into the reservoir. The truth, however, can soon be ascertained. It is only necessary to set traps as proposed in the manholes, and ascertain the result.

LORD CARNARVON ON IMPERIAL DEFENCE.

We very recently wrote upon the subject of the character of the forts now being constructed for the defence of our Imperial coaling stations abroad, and of the armament which it appears to be the intention of our authorities to provide for them. Lord Carnarvon's letter to the *Times* of August 24th strongly emphasises the remarks we then made; so strongly, indeed, that it justifies our again, and after so short an interval, returning to the subject. This journal may claim to have been the first to direct attention to the defenceless state of our foreign coaling stations. That was done now a good many years back, and it was not long after our first article on the matter appeared that public action was called for. It is not unnatural therefore that, as having been first in the field to ventilate the dangers that have since been so fully recognised, we should watch with particular attention every contribution to the literature of this subject. Lord Carnarvon's letter is a particularly valuable item in such contribution. He was president of the Commission which was appointed shortly after our first article above referred to appeared, and in that capacity he had full opportunity of weighing the evidence adduced before the Commission and of estimating its importance. Our latest remarks went to show that there was a seeming desire on the part of the home authorities to shirk their part of the bargain into which they entered with the Colonies, and the letter we have named fully confirms the suspicion we expressed, and what is more, makes known to us on high authority the cause of that shortcoming. With that portion of his lordship's letter which refers to home defence we do not propose to deal. It will be sufficient to quote such parts of it as, as we have named, support and accentuate the complaints to which we have before directed attention with reference to our coaling stations; leaving aside, as apart also from our present object, all considerations relating to the defence of Australian ports. For we feel certain that the great communities of Australia and New Zealand may well be left to fight their own battles and maintain their own claims with and against the defaulting parties to the engagement. But with regard to Crown Colonies, we know that they are individually too weak to secure their own case against the bureaucracy of the Colonial-office which rules them from Downing-street; and the latter by itself is also powerless to overrule the decisions taken by the magnates of the Treasury. We may class among the principal stations coming under the category we have named, Hongkong, Singapore, Mauritius, Colombo, and Trincomalee, while we fear there is good ground for alarm that even our chief ports in the West Indies, and several in India proper, might also be similarly classed as being deficient in the power of influential advocacy. With respect to such ports, Lord Carnarvon has written—"These communities have as a rule performed their part of the contract; we have in every case left our share unperformed either wholly or in part." What the deficiency is that Lord Carnarvon complains of we have in our latest article indicated. His letter refers to the main point of that deficiency by the deduction that these ports remain unfortified "because we have not yet sent out the armament which we engaged to provide." The letter characterises as a "melancholy apology" for this shortcoming the excuse offered to him that "the manufacture of modern armaments is so slow that two years are needed for the construction of a gun with its proper mountings. A "melancholy apology," indeed, with the facilities England possesses for engineering work; that, in the case of war breaking out, we are being left, by the dilatoriness sheltering under such an excuse, almost entirely defenceless as regards the coaling stations, the safety of which is vital, not only to our commerce in time of peace, but to the successful carrying on of hostilities in the event of war. But Lord Carnarvon does not allow so weak an excuse to remain unexposed. "Even the auxiliary armaments, those machine and quick-firing guns which are absolutely necessary in modern war, which, even without the heavier guns, might, for purposes of defence, have an almost incalculable value, and which can be procured and sent out at once, are subjected to the same fatal delay." The real reason why we are left exposed to the danger of unpreparedness in the event of war is, as the letter shows, due to the desire of our successive Governments to present as moderate budgets as possible to Parliament. In order to secure this end, expenditure which is of vital importance to the nation, which is demanded for the equitable fulfilment of the contracts entered into with our colonies, is being shelved year after year. What hope can there be that one Ministry more than another will refuse to be subject to an influence which places party above national interest? The Australian colonies, as we have said, to a great extent walk alone. They have spent a sum approaching five millions sterling on their defensive works, and may probably be deemed to be safe against ordinary attack. But at those points which are most vital to maintaining communication with our distant Possessions we are being left, owing to the causes so forcibly demonstrated by Lord Carnarvon, almost wholly defenceless. As he remarks: "Forts built at great cost stand useless for want of the necessary guns, or guns are transferred to some place where they are wanted from another place where they cannot be spared." Such a position of affairs demands the strongest possible protest, one that shall shame our authorities out of a false economy which may possibly have most dangerous results to our maritime and colonial supremacy. As to the complaints which reach us respecting the inefficient character of such armament as has already been supplied, Lord Carnarvon says nothing which affects our coaling stations, but he mentions the fact that "the Mersey, with the wealth of Liverpool, has only the so-called defence of some old 38-ton guns." The natural deduction is that the interest of distant Possessions will be even more lightly regarded, and we have before shown how numerous and grave are the complaints which illustrate and justify such a deduction.

ENGLISH IRONSTONE AND SPANISH ORE.

Many of the mines in Great Britain are now idle, whilst those in Spain are working at their full capacity, and their exhaustion is now canvassed as one of the possibilities of an early future. Very large quantities of the Spanish iron ore are imported into this country; and though the basic process may, under certain conditions, make us independent of this ore to a considerable extent, yet there can be no doubt that the substitution of Spanish ore for local has had much to do with the dulness in the iron mining district. In Cleveland, for instance, we have only 52 furnaces using Cleveland ironstone out of 95 at work and 155 erected. In other words, little more than a third of the smelting plant in existence is now in operation in that great district smelting its own abundant ores. What is the cause of this? for it is now clearly shown that the local ironstone will make good steel by the basic process, though the facts as to the relative cost of the two methods of manufacture are not as plainly told. One of the chief causes must be stated plainly—as plainly as it is stated in the paper on "The Iron Ores of Bilbao," read by Mr. Head at the meeting of the British Association a week ago. It is that the cost of the labour in producing one ton of ore in the Bilbao district is fivepence, whilst in Cleveland it is more than elevenpence. Such a difference must have its effect on the demand for the two kinds of ore. But in addition to this there is the fact which is not stated in the paper—that the sea freight on the ore from Spain to the north-east of England used to be 10s. per ton, and it fell to 4s. 6d. per ton! In other words, many things combined to reduce the cost of the Spanish ore to the user here. It is important to ascertain whether those influences which have made Spanish ore so cheap here will continue. The tendency will be on the part of labour to rise in Spain; there is more work there than there was; there is more communication with other parts where labour is better paid, and the work of extracting the ore will grow harder. Freights have risen and are still rising, and are likely to rise; that rate which was 4s. 6d. per ton is now 5s. 3d., and with the scarcity of boats in comparison to what there was, it may be looked upon as certain that we shall find a further increase in the rate of freight from the Bilbao ore district. We have more than passed the cheapest era in the Spanish ore trade, and we may now expect that, coincident with any scarcity in the ore, there will be more cost at this end, and that apart from any suggestion of duty levied by Spain. It is quite possible that there may be supplies of hematite drawn from other points, but all that have been suggested lie at such greater distances that it is certain the cost, deposited at the smelting works here, would be much in excess of that of the Bilbao ore of late. Hence it would seem that in the future we must look to these rich ores as likely in all probability to be more costly to the smelter, and thus there will be more margin out of which to pay for the process of fitting our less pure ores for manufacture into steel. There can be little doubt that this is the solution of the difficulty which would be most to the advantage of this country, and it is the one which seems most likely, though the exact period of its attainment cannot be defined. But the increasing price of Spanish ore must be looked on as one of the factors which will bring that about, and already the higher freights, actual and expectant, will have their influence. Dearer hematite iron ore seems now certain, though the increased competition of the smelters may make it not so easily resolvable into higher-priced hematite iron.

LITERATURE.

The Health of Nations: a Review of the Works of Edwin Chadwick. With a Biographical Dissertation. By Benjamin Richardson. 2 vols. Longmans, Green, and Co. 1887.

A review of even an ordinary essay or treatise usually can convey but a general idea of the nature of the book under notice, even when the essay represents but a small portion of the life experience of its author. The task that Dr. Richardson undertook was to review and summarise not merely the life-long works of a man during nearly half a century, but those of an exceptionally industrious, if occasionally mistaken, worker, and one whose attention and time were devoted to the many branches of the subject defined in the title his reviewer has chosen. Though our task is to put before our readers some information as to the nature of Dr. Richardson's book, we must at the outset tell them that so large was the mass of matter embodied in the records of Mr. Chadwick's life which he had to notice, and so careful has he been to eliminate every redundancy, that with the limited space at our disposal we can convey but a faint idea of the extent of ground covered by him. As might be expected, Dr. Richardson begins his review with, to quote his own title, "a biographical dissertation," and he commences this with the following passage:—"To relate in a plain and simple form the more important details of the life of Mr. Edwin Chadwick, the author of the works included in these two volumes, is the object of the present dissertation." Dr. Richardson then goes on to say that Mr. Chadwick has but one desire—that the record shall be as simple and brief as possible. Dr. Richardson states that his friend has placed before him facts which he recalls from his earliest days, leaving him free to make his own selection. That "he shall treat these facts honestly, according to his desire and their own excellent desserts, so that those who may in the future desire to comment on him, and the numerous works which he has added to the nineteenth century, may be sure that in these few pages they are in the possession of the truth from its original sources." "To the facts directly derived

I shall add some few impressions derived from my own personal, and for a long time intimate, knowledge of my friend during an unbroken and increasing friendship, which, commencing in the early days of the Epidemiological Society, about the year 1853-54, has continued till this hour, a period of over thirty-three years."

Mr. Chadwick was born in 1800, and his reviewer tells us that in 1862 he wrote an essay on his character for the *Social Science Review*. The title of the essay was "Edwin Chadwick as a Social Reformer." In the first lines of it the author tells his readers that "whenever the social history of this period shall be written by an impartial observer, freed from the jealousies and parties by which we are surrounded, such observer will find amongst the noted men of the time no one more difficult to appreciate, to define, to paint, than Mr. Edwin Chadwick." "Though he made laws, yet he was not in the Legislature. He did something for sanitation, yet was not a doctor. He advanced education, yet was not a schoolmaster. He was not even a great writer. He was not an orator." His biographer sums up the reasons why Mr. Chadwick attained so much influence, and so largely contributed to effect so many sanitary reforms. "He has the faculty of seeing in any reform that he is contemplating what, under existing conditions, may be at once judiciously and effectually removed, and what may be judiciously and safely left as the basis on which to lay a structure entirely new. His poor law labours all admit of this reading, and the reading explains much that would otherwise be very obscure." Dr. Richardson goes on to deal with other points of character in Mr. Chadwick which we cannot now quote, save one, which we must quote:—"It is urged by those who oppose Mr. Chadwick that, making the best of him, he does no more than think the same thoughts that other men think, and that, in fact, he is not 'an original man.' Admitted. But then he has the faculty of putting things forward in an original way, which, after all, is the soul of originality." "And in this faculty, we assume, lies at least one great element of all his skill and all his success. If we were to ask him, as some one once asked the great Duke, 'By what faculty did you win your victories?' we suspect that he would give the same answer, 'By common sense.'"

Dr. Richardson tells us that Mr. Chadwick came of a Lancashire family, Wesleyan by religion. His mother died while he was quite a child, but he remembers that she was a sanitarian *pur et simple*. "Morning and evening ablution of unquestionable quality was the rule for all her children." His family went to London when he was ten years of age, and his education, begun at Longsight and Stockport, was continued under private masters there, under whom he chiefly took lessons in classics and languages more than in the ordinary branches of study. He made progress in Spanish, French, and Italian, and found these of great use to him in after life. For his profession he selected law. During his legal studies he, like many others, supported himself by his pen. His first essay was published in the *Westminster Review* of April, 1828, and was on the subject of life assurance. The following circumstances led up to its production. The Government actuary, Mr. Morgan, had made a statement before a Parliamentary Committee upon the soundness of the Government annuity tables, to the effect that although the social condition of the middle classes of England had improved, their expectation of life had not done so, or more correctly speaking, had not lengthened. Mr. Chadwick's attention was drawn to this statement by his friend Dr. James Mitchell, of Aberdeen, an eminent actuary, as a question requiring to be more carefully studied, before an opinion so sweeping could be accepted. He accordingly investigated the matter, and found Mr. Morgan was mistaken, and that as a fact the expectancy of life in the classes specified had improved in proportion to the improvement in the social and moral condition in which they moved. The article in the *Westminster Review* attracted the attention of Mr. Grote, Mr. James Mill, and Mr. John Stuart Mill. In 1830, Lord Grey's Government determined to carry out a commission of inquiry on the extant Poor Law of England. The Commissioners appointed were the Bishop (Blomfield) of London, the Bishop of Chester, Mr. W. Sturges Bourne, Mr. Nassau Senior, Mr. Henry Bishop, Mr. W. Coulson, and Mr. Henry Gawler. Mr. Chadwick was appointed one of the assistant Commissioners. We are told that the Commission found that under the old poor law, founded by Elizabeth, there were 16,500 local administrations in the form of separate parishes. Some members of the Commission were for perpetuating this system. Mr. Chadwick opposed it, arguing that larger administrative areas must be formed in order to obtain the executive service of duly qualified and responsibly paid officers acting under the orders and the supervision of a central board elected by the representatives of the people.

Altogether the preliminary biographical notice is excellent, and gives the reader a clear idea of the man whose writings form the subject matter of Dr. Richardson's review. Of these writings he tells us that at the time he is collating his book he is surrounded by a library of no mean size, and one which he thinks the most industrious scholar could not read through with any hope of becoming master of its contents in less than from two to three years. The first instalment of the library dates from the year 1828, while the latest bears the date 1885-6, and treats of physical education and physical training for the young. Speaking of Mr. Chadwick's writings as a whole, his reviewer says of them that they embody two ideals, "Unity and Prevention," observing that throughout them all can be discerned a steady advocacy in favour of unity of design in all the departments treated of, and that unity is for the prevention of crime, of pauperism, and of disease; in fact, for the prevention of evil. Under this general conception there is suggested also throughout the works the promotion of, as well as the extension of knowledge, as the root of all that is progressive. "If there be any check upon human knowledge, there can be no prevention of the greatest national miseries which have to be prevented. If knowledge be free and in free operation, then prevention is omnipotent, and what is called cure a myth. With knowledge free and effective there would be nothing to cure—no crime, no poverty, no disease." "In the above sentences," says Dr. Richardson, "I have tried to give the general spirit which pervades this unique library." Further on in his review of the library, Dr. Richardson remarks that all the statements made by Mr. Chadwick are not expressions of opinion, but are statements of facts. He also observes that the unity advocated means that isolated efforts by fractions of nations never can effect great reforms. Nothing can do so but the united efforts of a whole people, or at all events, of large communities.

We come now to the review itself, which epitomises very clearly the subject matter of much of Mr. Chadwick's literary records and essays. One of the first essays dealt with is one dated April, 1828, and entitled "An Essay on the Means of Insurance against the Casualties of Sickness, Decrepitude, and Old Age." With additional notes and corrections, it was republished in 1836 by Charles Knight. Of this essay Dr. Richardson speaks as follows: "In the first place, the essay is remarkable for the history it presents of a memorable period half a century ago. In the second place, it supplies us with our author's first and original views on various matters of practice affecting national progress, of the qualities of mind which lead to an arrest of progress, and of the qualities helping on progress. Lastly, it affords us an excellent survey of the special subject on which the essayist particularly dwells, life insurance as it was in 1828, together with a review of the life and health of the nation at a period immediately before the railway system commenced its reforming and civilising spell." Beginning with social history in 1828, the essayist congratulates society on the improved value —duration—of life, owing to the great improvement in the general mode of living amongst the people during the previous twenty years. The higher classes are represented as more temperate and less afflicted with *ennui*—"the disease of unfurnished minds." The vice of hard drinking being on the decline, the physical condition of the aristocracy was greatly improved, the "spindle-shanked lord" of Fielding's time having become portly by better habits and partly by plebeian alliances, "in obedience to the general law of nature which is effectual for the improvement of the lower animals, replaced by persons generally taller and better made than their parents." The habits of the labouring classes are also described as being much amended. They are depicted as having gained somewhat in knowledge and in habits of more varied and temperate enjoyment. The domestic habits of artisans are noticed. They are said to be less dirty and irregular. Their houses better constructed, and they had more faith in ventilation. Vaccination, better nursing of infants, and better medical treatment also supported the conclusion that, on the whole, the value of life was increased. "The homes and habits of the wage classes have risen towards a better and purer state as the homes and habits of the rich have descended—from undue luxury—towards the same; and if angels have not been brought down from the skies, mortals have been raised towards them." Another point in this essay is that dealing with "Practical Men." Mr. Chadwick criticises those who call themselves such under the claim that because in some science or art they have learned perhaps to perfection a certain number of technical details, therefore they are masters of the science or the art, and alone have a title to be recognised as the authorities on it. About these men Mr. Chadwick writes as follows:—"The common reliance on the accredited testimony of practical men is declared to be founded upon an assumption that those who have been long engaged in a particular pursuit must necessarily have obtained, or are at least likely to possess, the whole of the existing knowledge relative to that pursuit, and must therefore be the most competent to form a correct assumption of its bearings. By nothing are such persons so distinguished as by their indifference to the progress and result of any investigation which may be carried on relative to that pursuit and to the utility of any new facts that may be elicited with respect to it." This opinion of such men was supported by the evidence given by some of them before Select Committees of the House of Commons, sitting in 1824-27, to report upon the laws relating to friendly societies. Some of these had formed their opinions on the state of society in 1791, and cared not to examine whether the circumstances affecting the duration of life were altered since that date. Elsewhere the essayist says:—"The best of the practical men of routine are those whose pride slumbers, who are not roused to resist amendments proposed by others, and who merely follow as rules of office the old monk's rules of life—'Go through your business in a way to excite no complaint; always admire and praise everything done by your superiors in office or party; and only see merit in those by whom you are likely to be ousted; receive your salary quietly; get yourself into no troublesome opposition, but let the mad world go on as it will go, for it will always go as it will go.'" Mr. Chadwick, however, does not permit the mere theorists, however advanced, to escape. "So far from this," says his reviewer, "some really interesting touches of information are supplied relating to such men which remind us of the philosopher in 'The Last of the Barons,' who fell short of glories by sticking at trifles. Not trifles to him, but to us who know." The following anecdote is told of the fate of a great inventor who was outwitted by a "practical man." The inventor had constructed a most important and complex machine for work on cotton fabrics, and in full confidence in the soundness of the inductions upon which his invention was based, called together all his friends to see it start. The power was applied, but lo! the machine could not be got to move. A shrewd practical man looked on. He would make the machine move on condition that he had a share in the profits. The inventor consents. The practical man, still practical, pushes his bargain still closer. He must have, before he acts, the security for the share of his profits signed and sealed. The practical man and the inventive man retire into the counting-house and clench the contract. The practical man puts the document which is to bring him a fortune safely into his purse as a matter of course. What next? It is very simple. He returns to the obstinate machine, he takes from his pocket a piece of chalk, with which he rubs one of the rollers to prevent the fibres of the cotton from adhering to it. In an instant the vast machine is in motion, and works with entire success. The truth of the story is very doubtful, but as an apologue it is neat. Winsor, an inventor of the system of lighting cities and towns by gas, is cited as another example. He tried to form a joint stock company, and promised enormous profits. He was only treated with ridicule. He had, in fact, quite overlooked the cost of the pipes through which the gas must be conveyed. Dr. Richardson's review is a small library in itself, and worth study. All the points affecting the duration of life are summarised in it. The influence exercised by the dietaries in different prisons and penal establishments is given. The returns from 128 gaols in England and Wales are taken for the years 1830-31 and 1832. The total number of commitments amounted for the three years to 97,279. The total number in prison at any time was about 25,000. Out of these twenty were taken having the highest scale of dietary, twenty having it medium, and twenty having the lowest. The effect of feeding on duration of life in these places is shown thus. In the lowest diet series the cost of a prisoner per week was 1s. 10¼d., which afforded 188 ounces of solid food per week. Amongst prisoners so fed the percentage of sick per annum was three, and the mortality at the rate of 1·60 in the 1000. In the medium scale the cost per prisoner was 2s. 4½d. per week, or 213 solid ounces of food. With prisoners so fed the percentage of sick per annum was eighteen, and the death rate one in 320, or a fraction over three per 1000. In the highest dietary the cost per head per week was 3s. 2d., or 218 ounces of solid food. The percentage of sick per annum was 23½, and the mortality 1 in 266. The deduction to be drawn is that the lower the scale of feeding the better for the health. Of course such a deduction would be quite erroneous, and the bare figures set forth are of no value whatever. They afford an excellent example of the unscientific and even unintelligent way in which statistics can be handled.

Dr. Richardson has so classified the essays and writings of Mr. Chadwick that a student seeking information has but to refer to the index, or even to turn over the pages and their headings, to ascertain at once what is the matter there treated of. To give a faint idea of the extensive scope of Dr. Richardson's two volumes we may take a few page-headings at random. In one place we find, on the left-hand pages, "Essays, Political and Economical;" on the right these are subdivided thus, "Dietaries, Sickness, and Mortality." Then in the same class of essays comes "Taxes on Knowledge." Here will be found arguments in favour of a free press in every sense, such as no stamp duty on newspapers, no tax on paper, printing, or book trading, and instances are given of the evils that prevailed when such taxes existed; and even amusing anecdotes are given of the enormous influence exercised by a mere handful of reporters as regarded the publication of Parliamentary debates. Next come "Intemperance and Measures for its Suppression," "Competitive National Economy," wherein is considered the working of British as compared with foreign railways, "Economy in Gas and Water Supply," in "Interment of the Dead," in "Sanitation;" then come "Essays Educational and Social," "Education as a Corrector of Crime," "The Half-time System of Education," "The Physiological Limits of Mental Labour," "The Psychological Limits of Mental Labour," and "Education of the Young for Military Service." Writing on this Mr. Chadwick comments on the beneficial moral influence exercised by it. Of it he says:—"The physical exercise in the military drill is a visible *moral* exercise in all that is implied in the term discipline, viz., duty, obedience to command, order, self-restraint, punctuality, and patience." The eleventh chapter deals with Mr. Chadwick's views about the economies of education. Dr. Richardson begins it thus:—"Amongst the various arguments advanced by our author in favour of education for the whole nation, one of the most powerful is that which rests on the economical aspects of education, and of the different ends of the culture of man. This topic turns up so repeatedly in his writings, there is some difficulty in selecting out the passages in which it is dwelt upon with most force and most originality. On the whole, I think I find it placed in the strongest form and clearest light in an address delivered before the National Association for the Promotion of Social Science on the opening of the session 1869-70. We were at that time looking forward for the work of the School Boards throughout the kingdom, and for the establishment of a system which should secure the education of every child in England and Wales." One of the heads of this address is entitled, "Man as a Subject of Culture." Under it Mr. Chadwick refers to and examines the educational systems of France, Austria, Germany, and Italy.

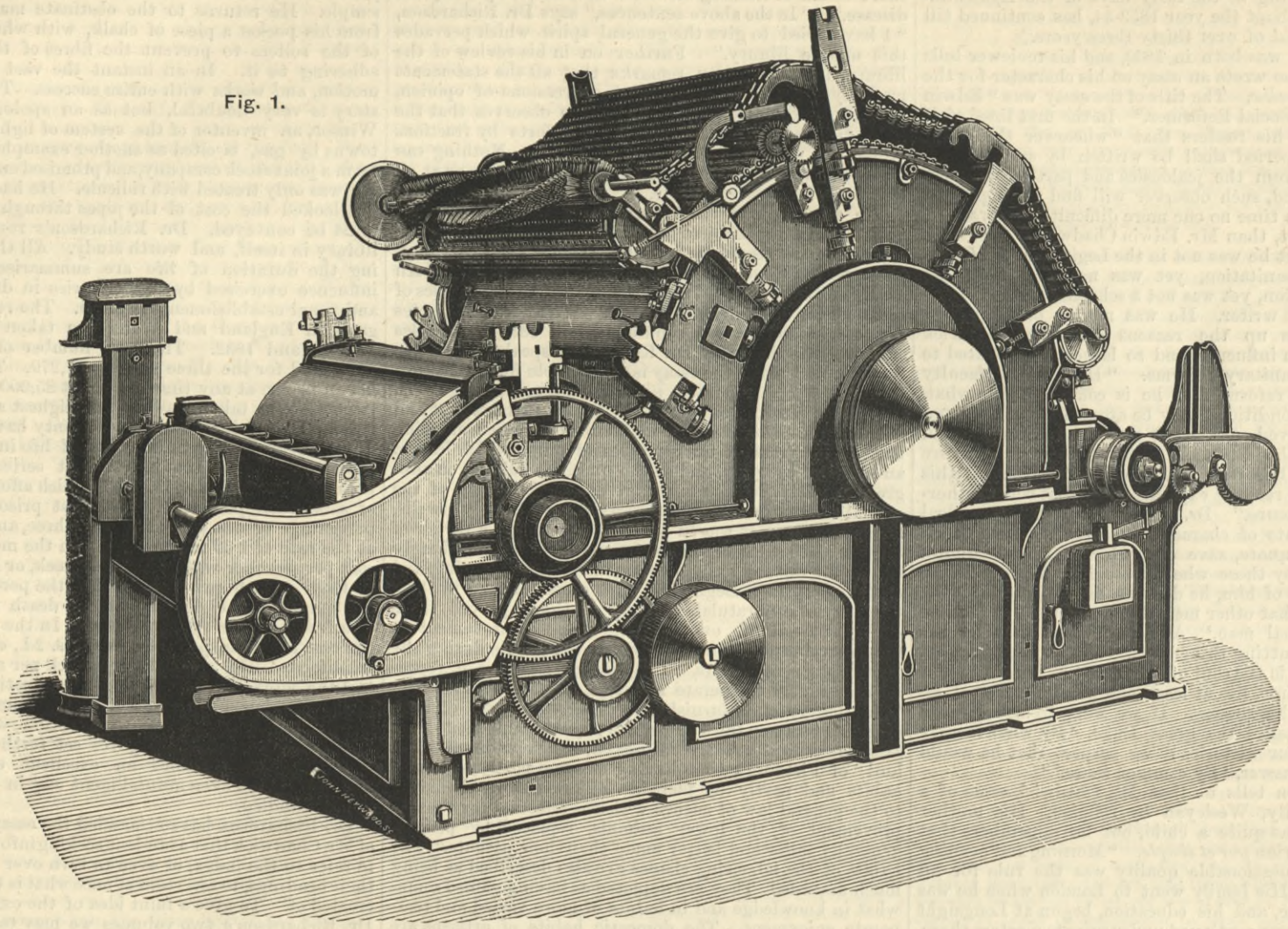
Other essays and papers dealt with by Dr. Richardson refer to the training of youth, to sanitation as regards good dwellings, effective water supply, efficient systems of drainage, good food and clothing, the moral influence of recreation, pure air, and pleasant surroundings and exercise. We have devoted a good deal of space to this book because it is in many respects a literary curiosity. The estimation in which Mr. Chadwick's labours and writings are held by those who know anything about them does not in all cases coincide with Dr. Richardson's views. However, as we have said, the book is interesting and curious; not the least curious thing about it is that it should have been published at all.

THE Greenwich Hospital pension of £50 a year, for chief engineers, has been conferred on Mr. George Crichton, in the room of the late Mr. Thomas Brown, inspector of machinery.

IMPROVED CARDING ENGINE.

MESSRS. HETHERINGTON AND SONS, MANCHESTER, ENGINEERS.

Fig. 1.



THE BRITISH ASSOCIATION.

During the meeting of the British Association many works and places of interest were thrown open for inspection. We have, in the following notices of a few of them, endeavoured to place before our readers only those points which are likely to possess interest for them.

HETHERINGTON AND SONS' SPINNING MACHINERY WORKS.

The Vulcan Works of Messrs. John Hetherington and Sons, situated in Pollard-street, Ancoats, and employing about a thousand men, are exclusively devoted to the production of machinery for cotton spinning, for many improvements in the details of which they hold several valuable patents. The firm not only makes, but also practically uses the various machines, so as to judge the effect of the modifications and improvements introduced. With one minor exception therefore the visitors to these works had the opportunity of studying the whole process of cotton spinning in its latest phase, from the bales of raw cotton, which arrive compressed by hydraulic machinery, to the finest yarn from which fabrics are now woven to imitate silk.

The first machine through which the raw cotton passes is the opener, which loosens the compressed bale and knocks out the worst of the dust. The only opener with a vertical cylinder is that invented by Mr. Crighton, which was proved in Court to have brought him in so large a sum of money that his application for a renewal of the patent was refused. From this machine the cotton is passed on by a mill-hand to the scutchers, three or four of which are kept going by one opener. The scutcher still further loosens and cleans the cotton while forming it into a "lap" or fleece ready for the carding engine. These two machines with improvements in arrangement made by the firm were shown and described.

Fig. 1 shows the carding engine as improved by Messrs. Hetherington. This is probably the most complex as well as important of all the machines for spinning cotton. Its office is to take out any dirt which may still remain, and also to lay the fibres side by side and form them into a "sliver," or very soft and unsubstantial rope without any twist. The improvements chiefly relate to what is known as the "flexible bend," the arched plates, shown by the letters *b b* in Figs. 2 and 3 annexed. In ordinary carding engines the "flexible" is outside the "bend" in the framework; but in the machine under notice it is placed inside next to the revolving cylinder, thereby shortening the "flats" by about 5½in. and reducing the friction, while giving the same amount of carding surface. The new and the old arrangement of flat are shown by Figs. 4 and 5 respectively. The flats are T bars of cast iron, to which the "wire clothing" or wire card is attached, and between which and the cylinder, also wire clothed, the "lap" passes while undergoing the operation of carding. What has been regarded as the principal defect of the "revolving flat" carding engine, viz., the great difficulty of insuring accurate mechanical construction where most required, that is to say, in the surfaces of the "flexible bends" over which the flats travel, is completely overcome by this improvement. The best condition for ensuring the operation of carding being properly performed is that the wire on all the flats resting on the bends and the wire on the cylinder be in the closest possible proximity short of actual contact; and this should hold good for every position of the flats as they travel over the bends. The bends must therefore be accurately concentric with the cylinder, or in other words, every point of the carding surface should be equidistant from the centre of the shaft. Though this is easy to obtain at first starting, a difficulty arises when the wear of the wire has to be compensated. This wear does not take place so much, owing to the cotton; but the ends of the wires that eventually become blunt are sharpened by passing, in the return journey, across an emery roll placed in the bearings—shown in the general view—at the top of the machine. To compensate for this shortening of the wires, both of the flat and of the cylinder, the bend must be capable of assuming a smaller periphery, while at the same time remaining concentric with the cylinder. The middle of the bend may, indeed, be readily adjusted by slotted plates and screws; but it is also necessary to draw in the ends radially, so as to make the whole bend concentric with the cylinder. Messrs. Hetherington accomplish this by springing inwards the bends near their ends with set screws, the adjustment being made at three points including the middle one. Even in new cards, with the bends as they leave the lathe, it is difficult to obtain the concentricity required, and it becomes almost impossible to keep the adjustments right when the bends are sprung in about three-eighths of an inch. A uniform curvature cannot be relied upon, even if after long experience the best shape and section of bends have been obtained. It cannot be guaranteed that both ends will be the same in every respect, that they have been cast alike, or that the iron is equally elastic throughout the bends. Furthermore, the weight of the flats causes a deflection in the bends, which is another source of error. The result is inferior carding, a large proportion of the wire on the flats being too far removed from that on the cylinder—over a thirty-second of an inch, perhaps—and on account of the want of perfect similarity in the bends, a flat may be carding properly at one end and doing nothing at the other, or, again, it may be carding properly at one part of its travel and not carding at another. Another source of inaccuracy is that, in springing, the bends will buckle and destroy the trueness of their circular surfaces, so that the ends of the flats ride upon their edges, and not, as they should do, upon the full width.

Fig 2.

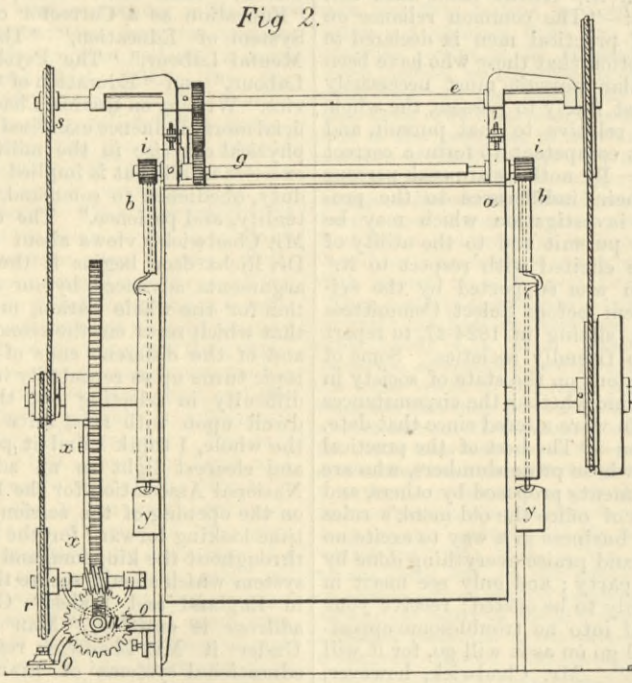
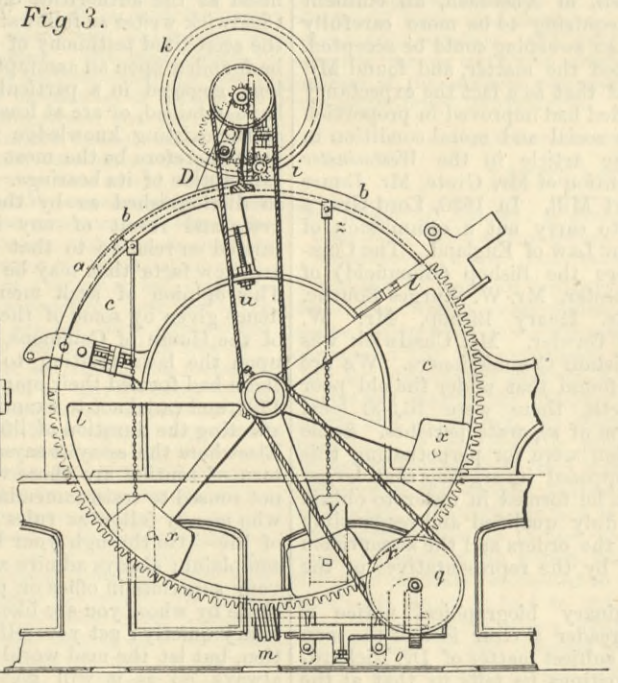


Fig 3.



BEND TRUEING MACHINE.

The method pursued to get over these difficulties is as follows: The cylinder, Figs. 2 and 3, being placed in position, the bends *b b* turned a little larger than necessary, are put in their places, and are weighted by rods and weights *y*, at the points shown, in order to obtain the proper deflection. Bearing in mind the fact that the deflection of a beam weighted in the middle is the same as if the weight were disposed uniformly over the whole surface, and knowing the weight of the flats, the weights *y* are easily determined so as to exert the same effect. To the cylinder is attached the trueing up apparatus, consisting chiefly of the milling cutters *i i*, one for each bend, and both on the same shaft *g*, being driven by a temporary pulley, and the band *f*, from the shaft *e*. The toothed segment *x*, with worm and gearing on the bracket *o*, temporarily attached, which constitutes the feeding motion, is driven by the bands as shown. It turns the cylinder very slowly, so that in a few hours the cutters will pass from one end of the bands or flats to the other, accurately trueing them up over their whole length and taking out all the irregularities due to uneven springing, buckling, and the weight of the flats. In the case of existing carding engines the cutters are carried by an arm keyed on a temporary shaft, and the flats being removed, the apparatus clears all the brackets and fixings on the engine and turns up the bends in the same accurate manner as in new carding engines. The revolving cylinder is covered with the wire clothing, which is made with hardened and tempered needle-pointed wire, the flats being covered with finer wire card, and the "doffer," or the taking-off roll, with wire of an intermediate degree of fineness. The approved test of wire is to give it a sharp pitch or kink, when it should break on being drawn back; if it breaks before it is too hard, and if not then it is too soft. Notwithstanding that they are made of cast iron, the flats are straightened by hammering. They must be perfectly true and also of equal thickness at the ends to the 500th part of an inch, because they have to travel first on their face and then on their back with the wire upwards. To test the truth of the flats, the firm has devised a machine which, by multiplying levers, shows on a scale the thickness of the two ends to the required degree of accuracy. The flats are drilled in a multiple drilling machine,

as many as eighty-two ⅛in. holes, ⅜in. centre to centre, being drilled together perfectly true and equidistant. The drills, which are thus quite close together, are driven in a very simple and ingenious manner, which we are requested not to describe. This drilling is to receive the lead rivets, made in a machine like those for wire nails, which attach the wire clothing. Attached to the carding engine is the coiler, the improved form of which places the sliver in the can, so as to leave no hollow space in the middle. The cans are taken to the draw frame, compactly arranged and having Hetherington's patent can stop motion, by which the machine knocks off when the fresh can is full. The object of this machine is to draw the fibres more regularly, and, where as many as six or eight slivers go in at the back of the machine, only one of equal fineness passes out at the front.

The next machine is the slubbing frame, a new arrangement of which was being tried with cotton experimentally during the British Association visit. This is the first machine which gives any twist to the sliver, and places on a bobbin what now approaches to yarn, and indeed is yarn of the quality used for coarse caddy quilts.

The cotton, now on bobbins, is placed in a "creel" prepared for it, and then goes through exactly the same process in the intermediate frame as in the slubbing frame, except that it is drawn out to about half its former diameter. It then passes on to the roving frame, similar in its action to the two other frames, but again reducing the diameter three or four times. The cotton, now completely yarn, goes next to the mule, a self-acting specimen of which was shown at work. Roberts improved on Crompton's hand mule—so called from its being supposed a hybrid between two machines, viz., Arkwright's drawing roller and Hargreaves' jenny—by making it self-acting. The machine shown was that of Roberts' improved in detail by the firm. This is the final stage in spinning yarn, which is made from "one's" to "three hundred's," that is to say, there are one to three hundred hanks of 840 yards to the pound. If very fine numbers are being spun, the comber is used after the first drawing frame, being invaluable and almost indispensable for fine yarns, made from long staple cottons, the woven goods from which have all the appearance of silk tissue.

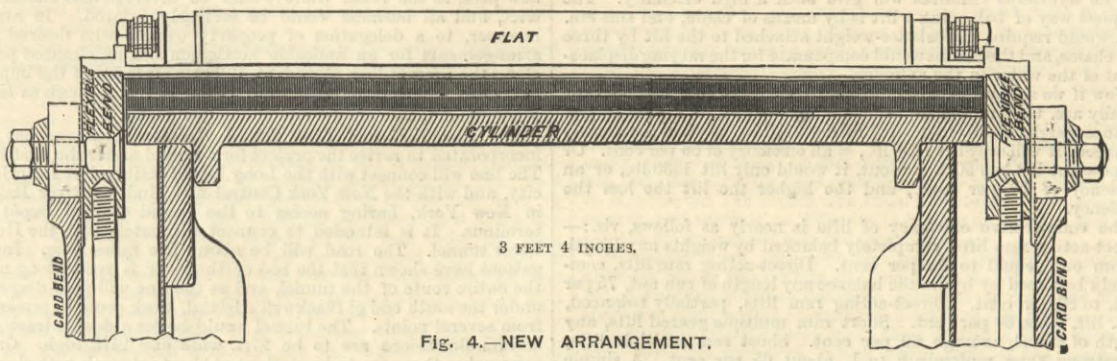


Fig. 4.—NEW ARRANGEMENT.

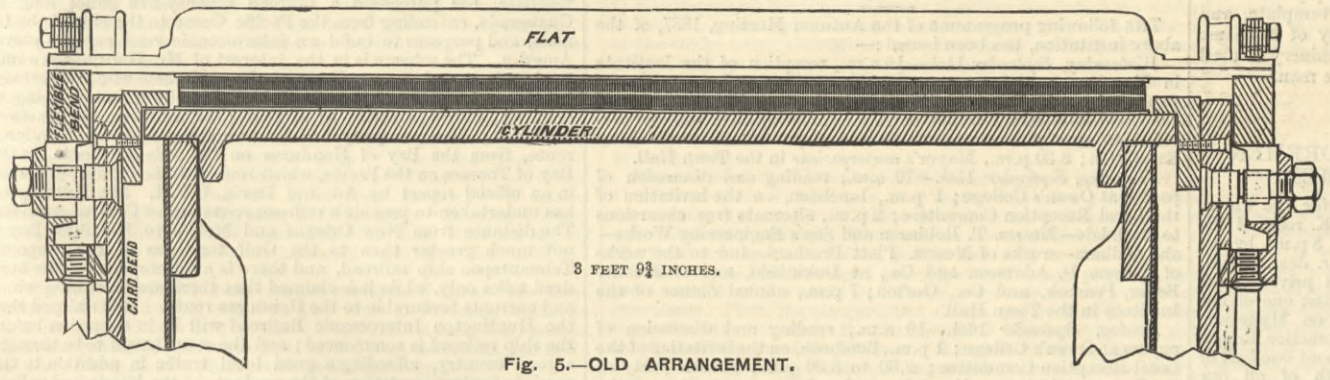


Fig. 5.—OLD ARRANGEMENT.

MESSRS. CRAVEN BROS.' MACHINE TOOL AND CRANE WORKS.

The Vauxhall works of Messrs. Craven Bros. lie off the Rochdale-road, Manchester, and employ from 400 to 500 men. The present is the first occasion that they have been thrown open to visitors. Besides machine tools, many of which are made specially for particular purposes, the company makes a large number of overhead travelling cranes, specimens of which in their various stages of development toward the present type are applied to the various shops. These are generally for lifting 20 or 25 tons; but 60 and 70 tons are not uncommon sizes, and one of 120 tons has lately been supplied to Woolwich Arsenal. The overhead crane in one of the shops is provided with two chains and hooks, the smaller, for light work, being raised and lowered at four times the speed of the larger. All these cranes are driven by an endless rope running along one side of the shop, and worked by the line shafting, all three motions of raising and lowering, travelling and cross traversing, being commanded by one man from his seat. In the case of all but very slight spans, the intermediate bearings of the cross shafts are depressed automatically while others rise, thus permitting of the carriage passing.

In the company's standard lathe both the longitudinal and the transverse cuts are given automatically by a traverse shaft at the back of the bed, thus leaving the screw unworn for screw-cutting. A large lathe for Sheffield has a bed 110ft. long, cast in three parts, for turning, boring, and rifling guns up to 40ft. long. There is now in the shop a machine for boring the cylinders of portable engines, planing the guide bars, and boring out the bearings, all at one setting, so as to ensure accuracy. There is also a large slotting machine, with 10ft. stroke, for ordinary steel ingot work at Sheffield, that will weigh 100 tons when finished, the main body casting alone weighing 21 tons. A crank sweep machine, for cutting out the webs of locomotive crank axles and rounding the pins at the same operation, has a circular cast steel disc with cutters let into its periphery. Another machine planes the web flats to receive a wrought iron hoop shrunk on.

Great attention is paid to the surface of castings, one having been rejected because it bore marks owing to the metal having been run too cold. No special precaution is, however, taken in moulding beyond securing the best labour. Foundry sand is obtained in the neighbourhood; and the moulds are coated with ground plumbago in the usual manner. A moulding machine is used whenever possible; and plate moulding is resorted to for a succession of small parts or objects.

MESSRS. DE BERGUE AND CO.'S IRONWORKS.

The Strangeways Ironworks of Messrs. De Bergue and Co. are situated on the banks of the river Irwell—silver now no more, but golden rather in a sense—where they are somewhat cramped for room. About 200 men are engaged in turning out girder, bridge, and roof work, with which the company has long been identified. The principal job now in hand is the roof of the Lancashire and Yorkshire Railway Bradford Station, consisting of two bays of 100ft. span and 500ft. long. The ribs were sent away rivetted up in five pieces, lifted into place by a travelling scaffold having two Scotch cranes on the top, which raise the sections, maintained in position by the scaffolding until the joints are rivetted up. The purlin girders are all lifted into place by the same cranes; and when a bay is complete the scaffold is made to travel forward for the next.

A prominent object now at the works is a double shearing machine combined with an inverted engine—cylinder 17in diameter by 12in. stroke—giving out about 25-horse power at high speed. This machine has been made by the company for the new locomotive works of the Lancashire and Yorkshire Railway at Horwich Junction, to which an excursion was made on Thursday, and will shear heavy puddle bars 20in. by 2in., steel tires, and even hard steel rails, which snap with a report like that of fire-arms.

The manager has long sought after a Utopian machine which shall turn out rivets like sausages—raw material in at one end and finished product out at the other; but he has been reluctantly constrained to fall back on a less ideally perfect but more practical machine, viz., the De Bergue rivet maker. The bar is heated for about 2ft. of its length in a Wilson reverberatory furnace and cut off in lengths by reciprocating shears. The blanks fall down a shoot, whence they are picked up by a lad and fed into dies eight in number, formed in the periphery of a vertically revolving disc. As each in turn comes under the action of a lever worked by an excentric, it is headed and then pushed out by a fixed internal excentric having its greatest excentricity towards the bottom. As the disc revolves it brings the excentric into contact with the end of the rivet just headed and pushes it out. The rivets are heated in a portable furnace fired by Hannay's Lucigen, which the company has successfully turned to this purpose, after having used it for lighting the works. It is perhaps unnecessary to say that this appliance depends for its action on creosote oil being drawn along in the form of a spray by a current of air, injector fashion. The nozzle of the Lucigen is inserted in an orifice in the furnace plate, and heats the rivets rapidly and uniformly. The great advantage, however, lies in the portability of the whole apparatus, thus saving the necessity of bringing hot rivets long distances.

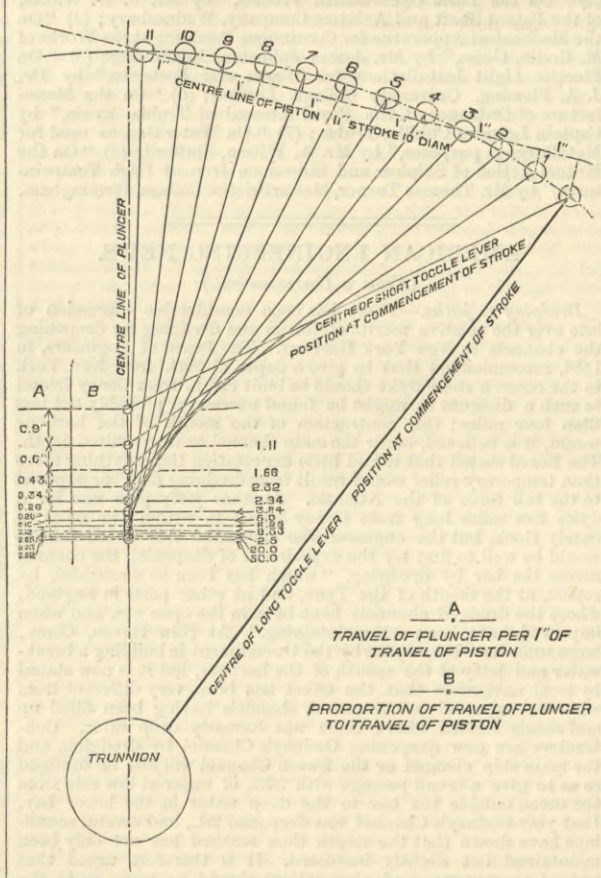


DIAGRAM SHOWING PLUNGER TRAVEL.

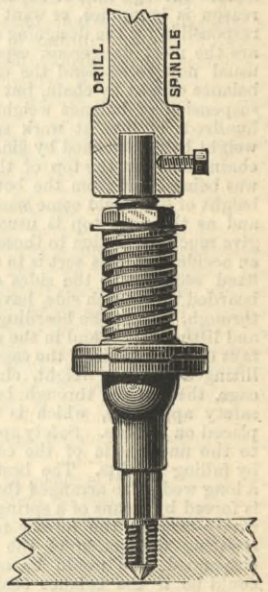
Notwithstanding the large amount of rivetting done at these works, there is only one set of rivetters employed, this being found the most expensive labour of all, as well as that which can be least depended upon. Hydraulic rivetting has been abandoned owing to the difficulty of regulating the power, but chiefly through the nuisance with pipes and joints, on account of the high pressure required. Now, for more than a year past, all except corner rivets are closed by Allen's pneumatic rivetter—described and illustrated in THE ENGINEER—subsequent experience with which has abundantly justified the favourable anticipations then formed. The principal advantages, we are told, are that the first cost of plant is little more than half that of hydraulic rivetters, while the expense of maintenance is less; the work is at least equal in quality to that of the best hydraulic machines with 25 per cent. greater production at half the power; the pneumatic is more cleanly and manageable, and can be used in any temperature without fear of freezing or bursting pipes; there is no expensive accumulator; the air, at 70 lb. pressure, may be carried by ordinary flexible tubing; and the machine, which may be suspended from an ordinary crane or tackle, will work upwards, downwards, or at any angle.

We append a diagram showing the travel of the heading plunger for each inch of piston stroke. It will be seen that the proportion of effect to power exerted gradually increases, with correspondingly diminishing travel of the header, until attaining its maximum at the completion of the operation. With a cylinder 10in. diameter a pressure of 50 tons can be exerted, amply sufficient for inch rivets; and the pressure from the piston is conveyed to the ram through differential levers combining to form a toggle joint. Two of these machines are in active work at Messrs. De Bergue's works, the compressor, also designed by Mr. Allen, being fixed on one side of the large yard, and the power conveyed by ordinary steam pipes to the various shops, whence it is led to the machines by ordinary three-ply india-rubber tubing.

In the fitting shop a power rivetter is being fitted up on a frame cast in mild steel by Whitworth. The first complete and portable pneumatic plant, consisting of steam boiler, air compressor, and receiver, was fitted up by Messrs. De Bergue and Co., for rivetting up the frame of a large gasometer at Greenwich, 150ft. high and 250ft. in diameter. The second is being fitted up, with parts supplied by the company, at Messrs. Head, Wrightson, and Co.'s works, Stockton, for working portable pneumatic rivetters on the South Western Railway bridge at Putney, for erecting which the last-named company has the contract.

MESSRS. FRANK PEARN AND CO.'S PUMP AND COMPRESSOR WORKS.

Messrs. Frank Pearn and Co., whose works are at West Gorton, have long been identified with pumping machinery, but they also make air-compressors and steam engines, and quite recently have turned out for other engineers a very useful shop appliance, the "lightning tapper"—described below—originally designed by Mr. Frank Pearn for home use, but now so much in request that production cannot keep pace with the demand. The piecework system, together with employing machines whenever possible, and also getting the utmost out of machines, accounts for the large production—between five and six hundred pumps annually, delivering from 30 gallons to 100,000 gallons per hour each. For instance, we saw two pumps clamped down together on the table of a planing machine, the two valve faces being planed by two tools simultaneously. Then there is a double-boring machine for boring together the steam cylinders of two pumping engines. A couple of emery grinders save a great deal of filing and machinery, and everything is generally done to gauge, as the various pumps are, as a rule, made in sets of at least ten at a time. Patterns are made at the works, and also small forgings, but it is found cheaper to get made out all the castings, both brass and iron, and forgings weighing over 2 cwt. It is the usual practice to forge the excentric sheave on the crank shaft of small engines and to turn it up, except on the periphery, at one general setting. The shop has lately been cleared of a considerable number of large pumping engines for well-known houses; but there are now, as usual, about four hundred small pumps in hand.



LIGHTNING TAPPER.

Great saving of time and labour is effected by the "lightning tapper," by means of which all holes, even those known as "dead bottom," are tapped under the drilling machine directly after they are drilled, and without unclamping the part from the bed or table. The tapper consists of a spindle inserted in the drill spindle socket at top, and carrying the tap at bottom. It is divided about the middle by a yielding coupling, a journal on the lower portion entering the socket in the upper; but the normal position is preserved by a spiral spring pressing on a loose flange in contact with a corresponding flange in the lower portion. The upper flange has a projection on its lower surface fitting in a corresponding recess in the lower flange, the sides of the projection and recess being bevelled off at an angle of 45 deg. The effect of this arrangement is that when the plug tap has reached the bottom of the dead bottom hole it ceases to revolve, because the resistance of the spring is overcome, and the upper flange slips round over the lower. This useful tool may be used in any drilling or screwing machine, either vertical

or horizontal, ensuring all holes being tapped to one depth, straight and uniform, while it prevents the breakage of taps. It is made in three sizes: No 1 from ⅛in. to ½in.; No. 2 from ½in. to 1¼in.; and No. 3 from 1in. to 2in.; the compression of the spring being regulated by a nut to suit the various sizes of taps.

MESSRS. GRESHAM AND CRAVEN'S INJECTOR AND BRAKE WORKS.

The Craven Ironworks of Messrs. Gresham and Craven, Ordsall-lane, Salford, give employment to 220 hands—the normal complement. Being cramped for ground space, and the work not being of a heavy nature, it is carried on in the three floors as well as on the ground floor, a lift serving to convey the work from one floor to another. Besides making the original Giffard injector, which some customers still insist on having, the firm makes a simple one of its own—the "Automatic," in which there is no difficulty in regulating the steam and water. Nearly all the tools are by Smith and Coventry, including Cooper's brass-finishers' lathe, a model of convenience. The capstan, carrying six tools—all that are required for finishing small brass work—is moved up quickly by a handle, pitch wheel and chain, while threads are put on by bringing down, on the outside of the part to be screwed, a tool like a plug tap, carried by a lever. The flats of hexagon heads on injector caps are finished at the same setting as that for turning the caps. Formerly, when a brass and iron surface came in contact, the two were ground and fitted together when cold; but it was found that, owing to the unequal degree of expansion in the two metals, the joint did not keep tight when under steam. Now, therefore, the joint is made under steam at the working pressure.

The firm also makes the vacuum automatic brake, a full-sized working model of which, as applied to a train of six carriages, was shown in action to the visitors. The cast iron cylinders of the brake are turned by being clamped on to the face-plate of a lathe, vibration being reduced to a minimum by using a stout square bar, carrying a very short round-nosed tool at its extremity. The piston is packed by an india-rubber ring, which rolls in the cylinder at each stroke, and the piston-rod gland is packed by a fixed rubber ring. The piston-rod is of wrought iron sheathed with brass cast on to it. By means of one of the lathes above referred to, it is found possible to finish no less than a thousand universal couplings for the hose pipe with one grinding of the tools. All parts are made to template, and therefore interchangeable; and yet, with so many of the same oft-recurring articles, no perfectly automatic machinery is used besides the lathes, two of which are tended by one man.

THE LONDON ASSOCIATION OF FOREMEN ENGINEERS AND DRAUGHTSMEN.

THE first monthly meeting of this Association for the winter session was held on Saturday, the 3rd inst., in the K. room of the Cannon-street Hotel, when the chair was taken at 8 p.m., by the President, Mr. W. Powrie, and the vice-chair by Mr. Jas. Ronald, of Woolwich Arsenal. After the usual routine and private business was disposed of a paper was read by Mr. Suggate, one of the members of the Association, entitled "Jottings on Hydraulic Lifts." Mr. Suggate stated that in engineering practice known under the name of hydraulic work was embraced about one-half of all our civil engineering and about one-fourth of all our mechanical engineering. Thus, we have canals, sea walls, docks, &c., under the first head, and pumping engines, water motors, hydraulic lifts and cranes, hydraulic machine tools, presses, &c., as the main divisions under the second head. There is a quantity of good literature available on all of these subjects with the exception of hydraulic lifts, and it is curious what notions inexperienced engineers have of this class of machinery. The cheap form of commercial lift as made at the present time is a very dangerous article. In fact, it is doubtful if we can consider more than two out of every three lifts put down as trustworthy, and unless careful supervision be exercised by the owners, we may expect to hear of several lift accidents during the next few years; but if no one is injured, they will not attract attention. There are two reasons for the inferiority of lifts. The first and by far the larger reason is competition. One manufacturer will say in effect, "why need we spend more money in the making of a better article than our competitor, whose lift takes very well with the public? Ours of the same type will do as well, and if the purchaser suffers through lack of supervision, that is his affair." The other reason is ignorance, or want of experience, on the part of those responsible for the designing and erection of lifts. Suspended lifts are the most dangerous, especially where chains are used. It is usual now to suspend the cage by wire rope or ropes, and the balance weight by chain, but wire rope ought to be used for the suspension of balance weight as well as cage. There are many hundreds of lifts at work suspended by ½in. chains, the balance weight being attached by ⅝in. or ¾in. chain., and if either of these chains broke at the top of the well hole at the instant the cage was being lifted from the bottom, a length of chain equal to the height of lift would come smashing down on the top of the cage, and as the cage top is usually only matchboarding, it could not give much protection to those inside. The best way of preventing an accident of this sort is to attach the chains to brackets or arms fixed securely to the sides of the cage. Let the well hole be boarded up on each side, having a vertical slit for the arms to pass through, so that the boarding forms a partition between the cage and lifting chain, and in the event of the chain breaking it merely falls down the side of the cage without damaging it. Again, when lifting a balance weight, chains are attached to the top of the cage, their falling through breakage is nearly certain to foul the safety apparatus, which is almost invariably, though wrongly, placed on the top. Safety apparatus ought in every case to be fixed to the under side of the cage, to prevent risk of its efficiency by falling weights. The best kind of safety apparatus consists of a long wedge, so arranged that if the lifting chain snaps the wedge is forced by means of a spring between the cage runner and guide, firmly securing the former to the latter, the weight of the cage assisting the action of the wedge. Ram lifts are safer than suspended, and would be as safe as any mechanical apparatus could be if the balance chain was attached to arms or brackets projecting from the ram crosshead and the cage partitioned off from the chain, as explained above for suspended lifts; but the general practice is to attach this chain to the centre of the top of the cage, thus ensuring death or injury to the occupants of the cage in case of breakage. A serious accident occurred a few years ago with a large lift in Paris, through the cage getting detached from the ram head. The balance weight being attached to the top of the cage, drew it up with such force to the top of the well hole as to kill or disable most of the passengers. This shows the necessity of not only having the balance weight chain attached to the bottom of the cage, but to a crosshead securely attached to the ram. The best way, however, of avoiding risk of damage from chains is to do away with them altogether; and there are several hydraulic balances now in use which enable us to dispense with these and the weights also. All hydraulic balances with internal pistons or stuffing boxes are objectionable, as it is difficult to detect leakage, and a great deal of trouble is experienced in getting at the internal packing.

Customers seeking tenders for lifts should insist upon the quantity of water consumed per journey being given in the estimate, so that a comparison of the consumption of water can be made along with the price, for a cheap lift may become a very dear one to the purchaser, and a low first cost may mean a large consumption of water. The weight of the load, the height it is lifted, and the available pressure, determine the kind of lift, so far as economy in the consumption of water is concerned. Thus in some circumstances a direct-acting ram lift is the most economical, while in others a short ram multiple lift uses the least water; but in any case, for passenger work, the direct-acting ram lifts, where properly fixed, are preferable to the suspended lifts, even at a sacrifice of economy. The most economical is the direct-acting ram lift completely balanced by weights, and one of this class with an 8in. ram and 50 lb. pressure will lift, exclusive of friction, a load of 2500 lb. But friction and speed, say at 2ft. per second, reduces this load to 2140 lb., or putting it another way, the efficiency of this lift is 85 per cent., 15 per cent. going for friction and speed, and no hydraulic balances will give such a high efficiency. The simplest way of balancing a lift is by means of chain, and this 8in. ram would require the balance-weight attached to the lift by three ⅝in. chains, and the chains would compensate for the varying displacement of the water in the cylinder.

Now if we suppose the lift to be only partially balanced, as they usually are, the run-out of the lift being 30ft., and having a ¾in. balance-weight chain, instead of lifting 2140 lb., as when completely balanced, it will only lift 1650 lb., = an efficiency of 66 per cent. Or suppose the lift has 50ft. run-out, it would only lift 1330 lb., or an efficiency of 53 per cent., and the higher the lift the less the efficiency.

The comparative efficiency of lifts is nearly as follows, viz.:—Direct-acting ram lifts, completely balanced by weights any length of run out, equal to 85 per cent. Direct-acting ram lifts, completely balanced by hydraulic balance any length of run out, 75 per cent. to 80 per cent. Direct-acting ram lifts, partially balanced, 50ft. lift, 50 to 60 per cent. Short ram multiple geared lifts, any length of travel, average 60 per cent. Short ram multiple lifts, Armstrong type, multiply 6 to 1, about 65 per cent. A simple and good rule for ascertaining the size of a direct-acting ram is to deduct the total weight of the balance chain weight from the load to be lifted, and call the result the reduced load. Subtract from the working pressure in pounds per square inch 4 lb. for speed and 3 lb. for every 7ft. of lift, and call the result the reduced pressure. Divide the reduced load by the reduced pressure, and the result is the approximate area of the ram.

A discussion followed the reading of the paper, which was wound up by the President, and a cordial vote of thanks to Mr. Suggate terminated the proceedings.

IRON AND STEEL INSTITUTE.

THE following programme of the Autumn Meeting, 1887, of the above institution, has been issued:—

Wednesday, September 14th.—10 a.m., reception of the Institute in Manchester, and meeting for the reading and discussion of papers; 1 p.m., luncheon at Owen's College, on the invitation of the Local Reception Committee; 2 p.m., conveyances will be provided to convey the members to the Royal Manchester Jubilee Exhibition; 8.30 p.m., Mayor's *conversazione* in the Town Hall.

Thursday, September 15th.—10 a.m., reading and discussion of papers at Owen's College; 1 p.m., luncheon, on the invitation of the Local Reception Committee; 2 p.m., alternate free excursions to Rochdale—Messrs. T. Robinson and Son's Engineering Works—and Oldham—works of Messrs. Platt Brothers—and to the works of Messrs. D. Adamson and Co, at Dukinfield, and of Messrs. Beyer, Peacock, and Co., Gorton; 7 p.m., annual dinner of the Institute in the Town Hall.

Friday, September 16th.—10 a.m., reading and discussion of papers at Owen's College; 1 p.m., luncheon, on the invitation of the Local Reception Committee; 2.30 to 5.30 p.m., garden party at the Towers, Didsbury—Mr. Adamson's; 7 p.m., reception of the members at the Royal Jubilee Exhibition by the Executive Council.

Saturday, September 17th.—An excursion will be arranged for to Chatsworth, Haddon Hall, and Buxton.

A large number of works, in Manchester and the neighbourhood, will be open to the inspection of members during the three days of the meetings.

The following papers will be read and discussed, so far as time permits:—(1) "On Testing Machines," by the president; (2) "On recent Metallurgical and Mechanical Progress, as illustrated at the Manchester Exhibition," by Mr. Thomas Ashbury, Manchester; (3) "On the Basic Open-hearth Process," by Mr. J. W. Wailes, of the Patent Shaft and Axletree Company, Wednesbury; (4) "On the Mechanical Apparatus for Continuous Moulding at the Works of M. Godin, Guise," by Mr. James Johnston, Manchester; (5) "On Electric Light Installations for Works and Factories," by Dr. J. A. Fleming, University College, London; (6) "On the Manufacture of Ordnance at the Royal Arsenal of Trubia, Spain," by Captain Leandro Cubillo, Trubia; (7) "On Water Gas, as used for Metallurgical purposes," by Mr. A. Wilson, Stafford; (8) "On the Mutual Action of Sulphur and Silicon on Iron at High Temperatures," by Mr. Thomas Turner, Mason Science College, Birmingham.

AMERICAN ENGINEERING NEWS.

(*From a Correspondent.*)

Dredging v. jetties.—There has been considerable discussion of late over the relative merits of jetties and dredging for deepening the channels in New York Harbour. The Board of Engineers, in 1884, recommended that to give a depth of 30ft. from New York to the ocean a stone dyke should be built S.S.E. from Coney Island to such a distance as might be found necessary, probably not less than four miles; this contraction of the mouth of the harbour would, it is believed, scour the main channel to the required depth. The Board stated that it had little expectation that anything more than temporary relief would result from dredging on a bar exposed to the full force of the Atlantic. Another jetty plan was for a dyke five miles long from Coney Island to within two miles of Sandy Hook, but the engineer who suggested this stated that it would be well to first try the experiment of deepening the channel across the bar by dredging, "which has been so successful, by report, at the mouth of the Tyne, and at other ports in England, where the dredged channels have been in the open sea, and when improved, have been self-maintaining." At New Haven, Conn., large sums have been spent by the Government in building a breakwater and jetty at the mouth of the harbour, but it is now stated by local navigators that the effect has been very different from what was expected and intended, channels having been filled up and shoals formed where there was formerly deep water. Contractors are now deepening Gedney's Channel by dredging, and the main ship channel or the Swash Channel will also be dredged so as to give a broad passage with 30ft. of water at low tide from the ocean outside the bar to the deep water in the lower bay. Last year Gedney's Channel was deepened 2ft., and careful soundings have shown that the depth then reached has not only been maintained but slightly increased. It is therefore urged that careful experiments and observations should be made as to the effects of dredging before the harbour mouth is contracted by a dyke such as is favoured by the Government engineer in charge of the harbour work.

Railroad tracks in cities.—Up to within a few years ago there was no hesitation in granting railroads right of way through the streets of cities, and this practice is even now preserved in the West. In the larger cities, however, the inconvenience and danger of level crossings and trains running down the streets is being felt and acknowledged. In Chicago the tracks are now crossed by viaducts for the important streets, and in St. Paul, Minn., all the streets are to be carried over or under the tracks. The Pennsylvania railroad runs on the level through Jersey City, N.J., to its terminus on the Jersey shore of the Hudson, and as there is a very large number of level crossings the impediment to travel is very serious, and many lives are lost annually. Outside the depôt two or three streets cross the yards, and as there are there probably twenty lines of rails with trains and engines arriving, departing, and switching constantly, it is a long and dangerous trip to cross, especially for wagons, in spite of the cautions of four or five flagmen. The railroad company has several times proposed to elevate its tracks through the city, and has prepared its plans and estimates, but the city has always taken exception to the route, and nothing has been done. The people and the manufacturers approved the project, but the local authorities invariably hampered it. Now the company proposes to replace an existing double-track wooden trestle in a different part of the city, now used for freight, with a four-track iron structure, and will run its passenger traffic over the new route. The citizens are vigorously opposed to this new plan, as the retail trade would be diverted into another district, and all business would be seriously injured. In answer, however, to a delegation of property owners who desired some arrangements for an amicable settlement of an elevated project along the present line, President Roberts stated that the improvement was determined upon, and would be put through as fast as possible.

The New York and Long Island Railroad Company has been incorporated to revive the project for a tunnel under the East River. The line will connect with the Long Island Railroad at Long Island city, and with the New York Central and Hudson River Railroad in New York, having access to the Grand Central Depôt as a terminus. It is intended to connect ultimately with the Hudson River tunnel. The road will be about five miles long. Investigations have shown that the bed of the river is rock along nearly the entire route of the tunnel, and as the line will pass diagonally under the south end of Blackwell's Island, work could be prosecuted from several points. The tunnel would be for a double track road, and its dimensions are to be 27ft. wide and 21ft. high. On the approaches there are to be stations at short intervals with elevators to the surface and the elevated railroads. The fare is to be 5 cents. An ingenious scheme for an "inter-metropolitan" railroad for the cities of New York and Brooklyn is a double track belt railroad, crossing the East River twice by tunnels 3200ft. and 3600ft. long and being on viaduct through the cities. The tunnels would be far enough apart to accommodate the up-town and down-town traffic and serve as auxiliaries to the present elevated roads. The south tunnel would be near the lower end of the Manhattan Island. The scheme provides for masonry viaducts, and tunnels composed of wrought iron or steel double shell caissons, sunk by pneumatic process. The traffic, however, is by no means sufficient to give much show for so comprehensive a scheme.

Developing Central America.—C. P. Huntington, the railroad magnate, has purchased a railroad seventy-five miles long in Guatemala, extending from the Pacific Ocean to the city of Guatemala, and purposes to build an inter-oceanic road across Central America. The scheme is in the interest of Mr. Huntington's railroad system, and of a syndicate of the capitalists who are developing the coal and iron resources of Alabama, the intention being to open up Central America as an outlet for the various products of Alabama. The company has been investigating the Honduras route, from the Bay of Honduras on the Atlantic Ocean, to the Bay of Tonseca on the Pacific, which route was favourably endorsed in an official report by Admiral Davis, U.S.N. Mr. Huntington has undertaken to provide a railroad route across Central America. The distance from New Orleans and Mobile to Honduras Bay is not much greater than to the Gulf terminus of the proposed Tehuantepec ship railroad, and there is a difference of a few hundred miles only, while it is claimed that there are prevailing winds and currents favourable to the Honduras route. It is claimed that the Huntington Interoceanic Railroad will be in operation before the ship railroad is commenced; and the route is said to be through a good country, affording a good local traffic in addition to the receipts for transportation of the products of the Mississippi valley, and of the coal and iron mines, furnaces, &c., of Birmingham, Ala. There are great expectations of the results of this comprehensive scheme.

The law on brakes.—In consequence of the recent railroad accidents for which the failure of air brakes is held responsible, the Railroad Commissioners of Massachusetts have issued a circular to the railroad companies of that state calling attention to the law relating to brakemen. The law requires that there shall be stationed on every passenger train "trusty and skilful brakemen equal in number at least to one for every two cars in the train, and one such brakeman upon the last car of every freight train, which car must always be equipped with a good and sufficient brake."

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending September 10th, 1887:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m.: Museum, 8866; mercantile marine, Indian section, and other collections, 4135. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. to 6 p.m.: Museum, 1143; mercantile marine, Indian section, and other collections, free, 3169. Total, 17,313. Average of corresponding week in former years, 19,095. Total from the opening of the Museum, 25,874,682.

THE FRENCH IN JAPAN.—We read in *Le Courrier d'Haiphong* of June 16th:—"French triumph for French Industries: It is in Japan that French industry has achieved its latest success. The Creusot Works have obtained a contract for the construction there of nineteen small vessels. They will be sent out from France all ready for putting together." We are also informed that the Creusot Works have, through their representative in China, concluded a contract with the arsenal at Foochow, amounting to a total of £37,000 sterling, for the supply of material required for the construction of steel gunboats for the Canton River.

SANITARY INSTITUTE OF GREAT BRITAIN. — The tenth Autumn Congress, 1887, will be held at Bolton, from September 20th to September 24th. The Health Exhibition, including sanitary apparatus and appliances, in connection with the Congress, will be held in the Drill Hall and special building, Silverwell-street, from September 20th to October 15th. The following programme has been issued:—Tuesday, September 20th:—1 p.m.: Reception of members of the Congress, by his worship the Mayor, in the Reception-room, Town Hall. 1.30 p.m.: Public luncheon. 3 p.m.: Opening of exhibition in the Drill Hall, Silverwell-street, by his worship the Mayor of Bolton, and announcement of awards by judges. 8 p.m.: First general meeting, opening address by Right Hon. Lord Basing, F.R.S., in the Albert Hall. Wednesday, September 21st:—Section I.—"Sanitary Science and Preventive Medicine," in the Town Hall. 10.30 a.m.: Address by Professor J. Russell Reynolds, M.D., F.R.S., F.R.C.P. 11 a.m. to 1 p.m.: Papers and discussions on "Sanitary Science and Preventive Medicine." 2 to 5 p.m.: Ditto. 8 p.m.: Conversazione. Thursday, September 22nd.: Conference of medical officers of health, in the Town Hall. 10.30 a.m.: Papers and discussions on matters which come specially within the province of medical officers of health. Section II.—"Engineering and Architecture," in the Town Hall. 10.30 a.m.: Address by Professor T. Hayter Lewis, F.S.A., F.R.I.B.A. 11 a.m. to 1 p.m.: Papers and discussions on "Engineering and Architecture." 2 to 5 p.m.: Ditto. 8 p.m.: Lecture to the Congress, by Arthur Ransome, M.D., F.R.S., in the Albert Hall. Friday, September 23rd:—Section III.—"Chemistry, Meteorology, and Geology," in the Town Hall. 10.30 a.m.: Address by August Dupré Ph.D., F.C.S., F.R.S. 11 a.m. to 1 p.m.: Papers and discussions on "Chemistry, Meteorology, and Geology." 2 to 4 p.m.: Ditto. 5 p.m.: Closing general meeting of Congress, in the Town Hall. Saturday, September 24th:—Excursions; particulars will be announced in a future programme. 8 p.m.: Addresses to the working classes, in the Albert Hall, by Major Lamorock Flower, A. Wynter Blyth, M.R.C.S., Henry Law, M. Inst. C.E. Admission by ticket. A public dinner will probably be arranged during the Congress.

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

(*From our own Correspondent.*)

ORDERS continue to accumulate at the sheet mills, where there is now scant fear of a want of full work for some weeks to come.

Bars, too, are in rather a stronger position than last week, and from some markets there is a perceptibly improving demand for marked descriptions. These last-named qualities remain on the basis of £7. Medium bars are £6 5s. down to £6, and common sorts can be occasionally had down to £4 15s., but £5 is the price of what may be termed a best common bar. At that price a reliable brand was being offered yesterday and to-day, both in Birmingham and Wolverhampton.

Touching the North Staffordshire trade in this article, the present prices of Messrs. Robert Heath and Sons, of the Biddulph Valley Ironworks, Stoke-on-Trent, and the Ravensdale Ironworks, Tunstall, are as follows:—Flats, from 1in. by ¼in. to 6in. by 1in., rounds and squares, ½in. to 3in., £5 5s.; best ditto, £5 15s.; double best, £6 5s.; best bevelled, from 1in. by ¼in., £6 15s.; best grooved horseshoe iron, from 1in., best turning, to 3in. diameter, Staffordshire angle iron, from 1 by 1 by ¼ united inches, all £5 15s.; best Staffordshire angle iron, £6 5s.; double best, £6 15s.; tee iron, to 8 united inches, £5 15s.; best ditto, £6 5s.; best angle and channel, £7 15s.; bridge or tank plates, £6 5s.; best boiler, £6 15s.; double best, £7 5s.; treble best, £9 5s.; annealed tank plates or sheets, not thinner than 13 w.g., or over 4ft. wide, £6 5s.; "Ravensdale" best hoops, 1in. to 5in., ordinary gauges, £6 2s. 6d.; "Ravensdale" best waved hoops, 1⅛in. to 16 w.g., £6 7s. 6d.; best half round and convex, best ovals, best cantop, ⅜in. and 1in., all £5 15s.; bridge and tram rails, £5 10s.; wheel spoke and grate bars, £5 5s.; best rivet iron, from ⅛in., £7 15s.; fencing wire, 0 to 4 w.g., £7 5s.; best boat head iron, £5 15s., all delivered Liverpool or equal.

Sheet makers are so full of work that they are unable to accept new business at current rates. And as the number of such firms is increasing, there is less reluctance to recognise the advance of 2s. 6d. per ton, which was last week quoted by some well-placed firms. Singles are strong. Some firms quoted £6 5s. as their price, while others accepted £6. More business is being done in doubles at £6 7s. 6d. up to £6 10s., while for lattens there were makers who, having an accumulation of orders upon their books, did not hesitate to ask £7 7s. 6d. and £7 10s.

At that figure the iron is much below the price at which it should stand at a time of so heavy requirement. Without, however, the practicability of securing combined action amongst the makers to get up prices, there has still been more than a strengthening of rates in the past month. Doubles are worth quite 5s. per ton more than a month ago.

The black sheets of Messrs. Morewood and Co., Birmingham, are quoted:—"Woodford" brand, up to 20 B.G., £7; 21 to 24 B.G., £8 10s.; 25 to 26 B.G., £10; 28 B.G., £10 10s. Close annealed "Woodford Crown," for the above gauges respectively, £9 10s., £11, £12 10s., and £13; close annealed "Woodford Best," £11, £12 10s., £14, and £14 10s.; close annealed "Woodford Best Best," £12 10s., £14, £15 10s., and £16; close annealed "Woodford Best Best Best," £14 10s., £16, £17 10s. £18; "Woodford Charcoal," £16, £17 10s., £19, and £19 10s. Mild steel sheets, by Siemens-Martin process—close annealed—£13, £14 10s., £16, and £16 10s.

The galvanised sheet makers are particularly busy. The shipments during August were no less than 12,908 tons, being an increase of 3456 tons on the year. This brisk demand has resulted in prices having been advanced 5s. to 7s. 6d. on the month, and there is every prospect of a still further considerable rise.

More is being done in strips, which are £4 17s. 6d. for gas piping use, £5 2s. 6d. to £5 5s. for general hoops, and a further 5s. for baling use cut to lengths.

Supplies of basic steel continue to leave the works of the Staffordshire Steel and Ingot Iron Company to be built into bridge erections in India, South America, and other distant markets.

Foreign pigs are changing hands this week in better quantities, and sellers report that inquiries reaching them are of a more encouraging character. Some time must, however, yet elapse before there is any need for buyers to enter the market with much spirit. Meantime prices are kept up on last week's basis of 36s. for Northamptons, 37s. for Derbyshires, and 39s. 6d. to 41s. for Lincolnshires.

Staffordshire qualities of the superior sort are prejudiced by the extent to which steel in billets and blooms is used up in the iron mills; but the demand for the inferior kinds for basic steel making is so heavy that prices of the brands of this order in largest request are much firmer than would otherwise be the case. Cinder pigs are from 31s. 6d. down to 30s. 6d.

Native pigs of all-mine quality are 52s. 6d. down to 50s., and part-mines are 40s., while hematite forge pigs are about 52s. 6d.

The manufacture of electrical machinery is one of the industries best furnished with orders in the district. Manufacturers of dynamo machines and other similar appliances have sufficient work in hand to keep them fully engaged during the remainder of the year. Some local work will be provided if the intention of the Coseley Local Board to substitute electricity for gas is carried into effect. One large ironworks in that locality is negotiating for the adoption of electricity. This action is due to the alleged exorbitance of the gas company's charges.

Local hardware manufacturers are in receipt of a fair number of orders from India and the Antipodes; from the West Indies and South America also orders are arriving to a satisfactory extent, and makers who do business with Canada are increasingly active.

At this moment the engineers and machinists are engaged in the execution of a moderately large number of orders; they cannot, however, see very much work ahead. There is more activity in the heavy ironfounding branch; several firms in South Staffordshire are busy in the production of telegraph posts for export.

The Bromford Ironworks, Oldbury, which were in the possession of Messrs. John Dawes and Sons, are to be offered for sale in Birmingham to-day—Thursday. The loose stock will be sold to-morrow. The works are in complete going order, and they have been inspected by several ironmasters.

Fifteen thousand operatives engaged in the wrought nail trade in the Bromsgrove and up-country districts went out on strike on Monday for an increase in wages of about 10 per cent. They ask for a return to the prices known as the 1879 list, less 10 per cent. It is stated by the leaders of the men that they have submitted to reduction after reduction until their position has now become intolerable.

From the statements of the leaders of the chainmakers on strike it would appear that many operatives are working longer hours and are receiving less wages than the Association allows. Determination is expressed to renew the strike again and again rather than permit the extension of these practices.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The condition of the iron trade in this district remains much the same as I have reported for several weeks past, and there is no specially new feature that calls for particular notice. So far as pig iron is concerned, the condition can only be described as one of continued stagnation of trade. For their small requirements, consumers go on either replacing contracts as they run out, or buying from hand to mouth, and in this way there is slow business doing; but it is altogether without life, and there is no indication of any enlarged requirements coming forward, whilst prices remain on the extremely low basis which has been ruling for some time past, what little fluctuation there does take place being mostly in the favour of buyers, although makers, as a rule, show a decided firmness in holding to present rates as the lowest point to which they are prepared to go. Hematites also remain in very poor demand, with makers generally firm, but the actual selling prices in the open market rather easier. Except that the shipping demand is for the present fairly good, the condition of the finished iron trade remains very unsatisfactory. There is no appreciable expansion of home trade requirements, and makers have as much as they can do to maintain their prices.

There was again only a very dull market at Manchester on Tuesday. Business to a moderate extent was reported in some of the cheapest brands of pig iron, but for the higher priced iron there was comparatively little or no inquiry except here and there for small parcels for special requirements. Lancashire makers still quote 38s. 6d. for forge and 39s. 6d. for foundry, less 2½, delivered equal to Manchester, but beyond occasional small sales to regular customers, they are doing little or nothing. In Lincolnshire iron sales of foundry iron have taken place at about 30s., less 2½, delivered equal to Manchester; forge numbers are, however, very little inquired for, except at prices which makers are not disposed to accept. Business has also been done in Derbyshire foundry iron at about 40s., less 2½, delivered here, and at this price it is competing successfully with Middlesbrough, which although easier than last week, is still difficult to get at anything under 42s. 10d., net cash, for good named foundry brands delivered equal to Manchester. In Scotch iron there is quite as much underselling as ever, and there is no difficulty in buying at quite 1s. and 1s. 6d. per ton under makers' nominal quotations.

Hematites meet only with the smallest possible inquiry, and although one or two makers still quote 53s. to 53s. 6d., less 2½, for No. 3 foundry qualities delivered into the Manchester district, there are ready sellers in the open market at 52s. 6d., less 2½.

In the manufactured iron trade there is still a fairly good business doing for shipment, which keeps most of the forges fully employed, but home trade requirements show no improvement. The recent restricted output from the mills, as the result of the hot weather and the prolonged drought, has helped to give strength to the market, but, notwithstanding this, makers have not been able to get up their prices, and for delivery into the Manchester district £4 17s. 6d. is the full average figure that is being got for bars, £5 5s. for hoops, and £6 7s. 6d. to £6 10s. for sheets.

As regards the engineering branches of industry, they remain on what may be termed a stationary condition. In some departments a fair amount of inquiry is reported, and most of the leading concerns amongst engineers and machinists are kept moderately well employed. There is, however, no actual progress being made towards improvement, and where new work is got it has, apart from speculation, to be taken at excessively low cut prices, which in many cases render it questionable whether the orders are worth having or not, except that they help to keep working. The returns of the trades union societies are also stationary as to the numbers out of employment, and the improvement which a month or so back was being reported in the gradually lessening number of members receiving out-of-work support has received a check, which shows that trade generally has not entered upon that return to activity which the secretaries of the various societies have set forth in the reports.

Messrs. Smith and Coventry, of Manchester, have just added to their stand at the Exhibition a very ingeniously-arranged machine for making cigarettes. It is the invention of a Russian, and is called Jadovsky's patent. The machine shown at the Exhibition is the third that has been made, and is the only one in England. Without the aid of drawings I can only describe very generally the main features of the machine. There are three principal sets of operations: First, the manipulation of the paper that forms the cigarette tube; second, the formation of the mouthpiece; and third, the filling in of the tobacco. The whole of the motions connected with these operations are actuated from one main shaft, which is driven by belt gearing from a small engine or by hand power, and the machinery is carried in a very compact arrangement on the top of an iron table. The paper for forming the cigarette tube is fed automatically into the machine from a roll containing sufficient paper for about 30,000 cigarettes. The paper is then stamped with the trade mark or brand and passed along a slide to a pair of scissors, which cut off suitable lengths; during the cutting off, the outside edge of the paper is held by a clip which forms a portion of a roll by which the paper is rolled into tube form, whilst, in the act of cutting off, one edge of the paper is pasted on an automatic roller, which exposes a fresh pasting surface for every tube. The roller which forms the tube is given two turns by a segment wheel on the main shaft, and is then at rest during the feeding forward and cutting off of the paper. As soon as the tube is formed it is wiped off the roller by an india-rubber disc into a carrier, and by an adjustable arrangement it is placed in position to receive the mouthpiece, which forms the second operation. The mouthpiece is automatically cut off from an endless roll of cartridge paper, the paper being cut with a point at one end, and this point is caught in a revolving twister, which rolls up the mouthpiece, and as soon as this is done it is by another automatic arrangement pushed into the end of the tube, the outside spring of the mouthpiece holding it in position. With the mouthpiece attached, the tube is carried to the next position, ready for receiving the tobacco, which is fed along a trough on an endless band in a regulated quantity. The tobacco is cut off in quantities sufficient for a cigarette, and falls into a compressor, where it is pressed into a plug or circular shape, and is then forced by a plunger through the compressor into the paper tube, which during this operation is held in tension. The cigarette is then moved into another position, where the rough tobacco is trimmed off, and being now completed, it is ejected on to an endless band and is delivered into a suitable receptacle. The various operations for making the cigarette are all completed at each revolution of the main shaft, and there are five main operations going on simultaneously. The machine, I understand, is capable of making 3000 to 3500 cigarettes per hour, and a syndicate is being formed for working it in England.

The quarterly meeting of the Manchester Association of Engineers was held on Saturday at the Grand Hotel, but the business was of a purely formal character, the most important being the election of four honorary and three ordinary members.

As the season advances there is necessarily some increased demand coming forward in the market for the better qualities of round coal for house fire consumption, but the improvement so far is only making itself very slowly felt, and four days a week still represents the full average time that most of the collieries are working. The common classes of round coal for steam and forge purposes and engine classes of fuel are perhaps moving off rather more steadily now that, with the close of the holidays and the more plentiful water supply, works are getting in more regular operation, but the demand all through is still only very poor, with supplies abundant. Prices remain much the same as last quoted, with no present indication of any upward movement, best coal at the pit mouth averaging 8s. to 8s. 6d.; seconds, 6s. 6d. to 7s.; common coal, 5s. to 5s. 6d.; burgy, 4s. 6d. to 5s.; best slack, 3s. 6d. to 4s.; and common sorts, 2s. 6d. to 3s. per ton.

For shipment the demand is extremely dull, and good qualities of steam coal do not average more than 6s. 9d. per ton delivered at the high level Liverpool, or the Garston Docks.

Barrow.—There is a quieter tone to report in the iron trade this week. The demand for all descriptions of hematite pig iron is less active than it has been for some time, the fact being that consumers' wants are fairly supplied for some time to come, as most of the inquiries for iron are for forward delivery. There is, however, no scarcity of orders to go on with, and as makers are very fully sold forward, they are not in position to feel the present inactive tone in the market. So long as the consumption of pig iron is maintained at the present rate, there is no reason to fear that makers will run short of orders, and the probability is that the consumption will increase rather than decrease, because makers of steel are using more iron, and are likely to use still more in the future. This, of course, is entirely distinct from the ordinary consumption in the general trade. Stocks of iron are fairly bulky in the hands of second-hand dealers, but makers do not hold much stock. They are, in fact, delivering practically all their make on to trucks for immediate consumption. A large proportion of the furnaces are in blast—over four-fifths—and some of those standing are out for repairs, or in the hands of makers who are not doing as full a trade as the main body of the producers of the district are. Prices are steady at 45s. 6d. per ton for parcels of Bessemer iron in mixed numbers net f.o.b., or on trucks at makers' works; while No. 3 forge and foundry iron is quoted at 44s. 6d. per ton. Sales, which have not been extensive lately, are reported at about 1s. per ton below these figures. The steel trade is well employed in almost all departments. There is still a remarkably good demand for rails, but makers are not in a position to accept much new business as they are so full of orders. Their mills are regularly and briskly employed, and they have in hand and in prospect fully a twelvemonth's work. Prices of rails are steady at from £4 2s. 6d. to £4 7s. 6d. per ton net f.o.b., for sections of 50 lb. per yard. Blooms, bars, and billets, represent a quieter trade than of late, but some good orders are held, and the mills are almost regularly employed. There is a fair consumption of merchant qualities of steel, and the trade in wire, hoops, &c., is satisfactory. There is not much doing in steel for shipbuilding purposes, but it is highly probable that orders will be very plentiful shortly. No change can be noted in the shipbuilding trade. At Barrow not a single ship is on the stocks, but there is a very brisk inquiry, chiefly from foreign sources, and builders are expecting orders. There is more activity in the marine engineering and boiler departments than in the erecting shops, but even in the former there is not much activity, and engineers could do ten times the amount of work if they had it to do. Finished iron workers are doing a very quiet trade, and there is no prospect of any improvement. The iron ore trade is steady, and there is a good demand for the better qualities of metals, prices being firm at late rates. A proposal has been set on foot at Barrow to erect works and commence the trade of wood pulp manufacture. The names of Mr. Partington, paper maker, Glossop, and Mr. T. Briggs, Manchester, are associated with the scheme. At present the difficulty in the way is as to an efficient and adequate supply of water, and it is hoped and believed that this will be satisfactorily got over. All operations have ceased at the works of the Vulcan Steel and Forge Company, Barrow. A mill has been put down at these works by Mr. Daniel Adamson, of Manchester, to manufacture weldless ring hoops for boilers in the same way as tires are produced. This is the patent of Mr. J. Windle, engineer, of Barrow, and at a time when higher boiler pressures are required for triple and quadruple expansion engines, it is unfortunate that an opportunity is not afforded to the patentee to achieve the practical success of his important invention. Mr. Windle claims that he can secure greater strength with thinner plates, and that the boiler can be worked at higher pressures with less danger than under the present system.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

ANOTHER bed of coal has been reached at the Wharncliffe Woodmoor Colliery, Carlton. This, it is expected, will provide more employment for the mining population.

The South and West Yorkshire collieries continue to do an increasing business with Hull. For the eight months to August last there were 1,167,672 tons taken to the great Yorkshire port, compared with 873,112 for the corresponding period of last year. The quantity taken last month was 164,968 tons, against 128,448 tons for August of 1886. The exports from Hull to foreign markets last month were 71,804 tons, as compared with 81,067 tons for August, 1886. For the eight completed months of this year the exports are 571,280, against 393,046 tons for the similar period of last year. The principal increasing markets in foreign parts are South Africa, South America, Austria, Belgium, Denmark, East Indies, Egypt, France, Germany, Gibraltar, Holland, Italy, Malta, Russia, Spain, and Sweden and Norway. Russia's increase is from 87,373 to 131,495 tons; France, from 14,458 to 50,618; and Sweden and Norway, from 99,253 to 138,555 tons.

Hardware and cutlery have increased in value of exports of late, although not to any great extent, the amount last month being £243,433 against £234,156 for August of 1886. The increased business has mainly been done with Germany, Holland, Spain and Canaries, United States, Brazil, Argentine Republic, and British Possessions in South Africa. The steel trade has greatly advanced during the whole year in the foreign markets, and the month just closed shows a corresponding increase, the value exported during August having been £172,644 against £135,286; of this increase the United States ranks for the largest share, its call having advanced from £55,268 to £101,799. For the eight months the increase is no less than from £839,145 to £1,475,944, of these values the United States took in August, 1886, £297,826 and last month £881,909.

The death is announced of Mr. Henry Atkin, at his residence, Norwood, Surrey. For upwards of sixty years Mr. Atkin resided in Sheffield, being engaged in the cutlery business as a member of the firm of Joseph Rodgers and Sons, of No. 6, Norfolk-street, from which establishment he retired thirty years ago. In 1849 he occupied the Master's chair of the Cutlers' Company, and at the time of his decease was Senior Past Master Cutler. It is a somewhat singular coincidence that whilst enjoying his usual good health on the anniversary of the Cutlers' Feast he was seized with apoplexy whilst stooping in his drawing-room, and died after an illness of five days, in the eighty-ninth year of his age.

Another cage accident is reported in the Yorkshire coalfield, this time at Denaby Main. As a draw of water was being brought up the cupola or return air shaft, the wire rope connecting the ascending cage with the engine suddenly snapped in two without any warning, and the cage fell to the bottom of the shaft, where it was dashed to pieces. The rope parted about half-way, where the ascending and descending cages meet. A full batch of datalers had come out of the pit only the draw before. The wire rope appeared to be perfectly safe when examined a few hours previously, and the part where it snapped is the only place found to be defective.

A vigorous effort is being made to establish a new miners' union on a purely non-political basis.

The Canadian tariff regulations, as recently revised, are injuriously affecting the file trade. Several Sheffield manufacturers, struck by the falling-off in their file orders, wrote their agents on the subject. One replies thus:—"The demand for files here is not nearly so great latterly, as the native article is rapidly superseding the imported one. Under the new tariff manufacturers import their steel free of duty, while imported files pay 35 per cent. This brings them in too dear, except for special favourite brands."

The Sheffield United Gas Light Company, in its report for the half-year ended June last, announces that it is able to pay the maximum dividend—10 per cent.—without trenching on reserve, as on the former occasion. This is partly attributable to the increased receipts from residual products, which have long been at very low values.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

THE attendance at the Cleveland iron market, held at Middlesbrough on Tuesday last, was good; but not much business was done, and a further reduction took place in the price of pig iron. The Glasgow market was reported weaker, owing to the unfavourable dispatches from America; and as the Cleveland trade is largely dependent on the tone at Glasgow, dulness again prevailed, and buyers are withholding their orders. Merchants are now accepting 34s. per ton for No. 3 g.m.b., for prompt delivery; or 1½d. to 3d. less than they were willing to take last week. Makers

no longer hold out for 35s., and are prepared to accept 34s. 6d.; but buyers are not willing to give so much, and few transactions are recorded. Forge iron, in common with other grades, is weaker, and can be bought for 32s. per ton, or 3d. below last week's price.

Stevenson, Jaques, and Co.'s current quotations are:—"Acklam hematite," (mixed nos.), 45s. per ton; "Acklam Yorkshire," (Cleveland) No. 3, 35s. per ton; "Acklam basic," 36s. per ton; refined iron, 48s. to 63s. per ton, net cash at furnaces.

Warrants purchased at 33s. 11d. to 34s. per ton, but no desire to speculate in them is apparent, and few sales are made.

Messrs. Connal and Co.'s Middlesbrough stock of pig iron is steadily decreasing. The quantity held on Monday last was 330,902 tons, or 1005 tons less than a week previously.

Shipments from the Tees are fairly good this month, there being a decided improvement in the exports to foreign ports. Up to Monday night the quantity of pig iron sent away was 28,723 tons, as against 25,457 tons in August. During the same time 18,380 tons of manufactured iron and steel were exported.

Orders for finished iron have recently come in somewhat more freely, but prices have scarcely been maintained; indeed, slight concessions have been made all round to secure orders.

The value of goods of all kinds, except coal and coke, exported from the Tees last month was £228,931; from the Tyne it amounted to £215,553.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THE Glasgow pig iron market, which closed very flat last week, has shown more animation within the last few days, and the prices of warrants were somewhat higher. Speculative warrants were last week down below 42s., but they have this week been above that figure. Still, the condition of the market has not, on the whole, been very strong. It has been sustained mainly by the good shipments of the past week, which are officially reported at 10,184 tons, as compared with 7928 in the corresponding week of 1886. Of the total quantity no less than 3660 tons went to Italy, 1150 to the United States, and 900 to Canada. Since last report one furnace has been put out of blast at Langloan, there being now eighty-four in operation, against eighty-two at this date last year. The additions to stocks in the warrant stores are now comparatively small.

The current values of makers' pigs are as follows:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 48s. 6d.; No. 3, 44s.; Coltness, 53s. 6d. and 44s.; Langloan, 49s. 6d. and 45s. 6d.; Summerlee, 51s. 6d. and 43s.; Calder, 48s. 6d. and 42s. 3d.; Carnbroe, 44s. and 40s.; Clyde, 46s. 6d. and 41s. 6d.; Monkland, 43s. 3d. and 39s. 6d.; Govan at Broomielaw, 43s. 6d. and 39s. 6d.; Shotts at Leith, 49s. and 45s. 6d.; Carron at Grangemouth, 52s. and 44s. 6d.; Glengarnock at Ardrossan, 49s. and 41s.; Eglinton, 43s. 6d. and 39s. 6d.; Dalmellington, 44s. and 40s. 6d.

The arrivals of Cleveland pig iron at Grangemouth for the past week were 7221 tons, as compared with 6158 in the same week of 1886, and there is a total increase in these imports since 1st January of 17,856 tons, the total during that time amounting to 234,841 tons.

In the basic steel trade there is a fair amount of business passing. The shipment of basic steel from Ardrossan in the past week amounted to 482 tons. Two additional furnaces have been placed on the manufacture of basic.

Malleable iron is steady, and there has been some talk of a combination among the makers for keeping up prices, if not also bringing about a further increase.

The coal trade is fairly active, and the inland demand has increased in consequence of the colder weather. It may now be expected that contracts of importance will come into the market. There is some chance of the prices hardening a little, but the supplies are so ample that only a very small increase is expected. The past week's shipments from Glasgow were 26,333 tons; Greenock, 2979; Ayr, 10,230; Irvine, 2474; Troon, 5660; Burntisland, 8886; Leith, 4962; Grangemouth, 14,058; Bo'ness, 5905; and Granton, 1710; total, 83,197 tons, as compared with 77,705 in the corresponding week of 1886.

The colliers are working fuller time than hitherto, having in several important districts ceased keeping a holiday every Thursday.

Much dissatisfaction is expressed by the Scotch coalmasters on account of the statement made in the House of Commons the other night by Lord Charles Beresford (in reply to Mr. Stephen Mason), that he would rather give 13s. a ton for Welsh coals for the ships of the navy than 3s. a ton for Scotch coals. There are different qualities of Scotch coals just as there are different kinds of Welsh, but the best Slamannan steam coal is hardly, if at all, inferior in staying power to the best Welsh, and the former can be delivered to the war ships in the Forth and Clyde at 8s. 6d. a ton, or as compared with 13s. for Welsh. The most curious part of the business is that the Scotch coalowners actually hold certificates from the Admiralty in favour of their coal, which is almost invariably used by shipbuilders for testing the speed of their vessels. The Scotch steam coal is likewise used in all the fast deep sea steamers that come to our ports, and the coalmasters have constantly large contracts on hand for supplying it to the best vessels belonging to foreign nations.

About 12,000 tons of new shipping was launched from Clyde shipyards in the course of the past week, and it is expected that important fresh contracts will presently be placed.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

THE railway season of 1887 will long be regarded as a remarkable one. It is now coming to a close, and railway directorates are in good heart for extensions and improvements. It is fully expected that certain schemes now maturing will figure in the next parliamentary session, and I shall not be surprised at the "Monmouthshire" again seeing the light. The virgin valleys of Monmouthshire, so far as the lower measures are concerned, will bring this imperatively to the front, and ample capital is in readiness. Meanwhile speculative minds are suggesting the doubling of the Cambrian, and opening up the north more extensively, of the Great Western finding its way south to Aberystwith, of mid-Wales taking up again the nearer route to Aberystwith, and of the connection being formed between the Radnorshire valleys and Glamorgan. In the meanwhile, the Rhondda and Swansea Bay is being pushed on vigorously, the Barry is far advanced, the Roath extension also, and the conversion of the Treforest, Caerphilly, and Newport into a passenger line is expected to be one of the early events of the next year.

In many respects the steel trade may be considered as satisfactory. Swansea Exchange on Tuesday was well attended. Home hematite was quoted at 48s. to 48s. 6d.; Bessemer blooms, £4 4s.; bars, £4 15s.; Siemens bars, £5 2s. 6d. delivered, cash 2½; steel rails at £4 5s. to £4 7s. f.o.b.; merchants bars, iron, £4 10s. In tin-plates prices remain unaltered, though stocks are visibly on the increase, in consequence of deficient shipping to hand. This was expected, as the clearances last week only amounted to 20,778 boxes. Prices are:—Iron coke tins, 13s.; Bessemer steel up to 13s. 6d.; Siemens ordinary, 13s. 6d. to 13s. 9d.; best from 15s. 6d. to 18s. 6d., according to brand and finish. Wasters much in demand from 12s. 6d. Charcoals dull.

Steam coal quotations are unsteady, and the drop of 1s. in best qualities seems to be sustained. Prices are now 8s. 3d. to 8s. 6d. for best steam. A month or two ago the same coal fetched 9s. 3d. to 9s. 6d. Small steam threatens to be lower than ever. In times of depression, when large steam was even slightly lower than at present, small steam was from 4s. 3d. to 4s. 6d., and at its best 5s. per ton. Quotations now are down to 3s. 6d., and it is not improbable but that it will be lower still.

There has been a great falling off in inquiry at the ports generally. Cardiff, as usual, has suffered most, and the export of coal to foreign parts was in marked contrast to that of a few months ago. Newport showed a diminished export, and the slackness appears to have told throughout the district. In this case the stormy weather, which is not unfrequently credited with the ill-doing, is not to blame, and the only reason I can assign is that foreign coaling stations being now amply stocked, demand has lessened. House coal continues in little demand, and prices are unaltered. Pitwood is at 15s., best price, and in demand; coal-owners are getting in large supplies against winter requirements, so prices are slightly on the advance.

The local opinion on the Coal Mine Bill, which is now only awaiting the Royal assent, is favourable, with two exceptional clauses. These are, the provision for making the Clanny lamp illegal, and the other clause limiting the speed of lowering and raising men to three miles an hour. With regard to the Clanny, it is the lamp most approved of by the colliers; and with respect to the limit of speed, where 500 men are concerned it will tell adversely against the colliers and output. With these exceptions the Bill is regarded in the district as substantial law, conceived on the broadest lines, for the protection of the workmen, and the due development of the coalfield of South Wales.

AMERICAN NOTES.

(From our own Correspondent.)

NEW YORK, September 10th.

ADVICES received from the leading commercial and manufacturing centres in the Interior show that during the past week or ten days a general improvement in demand has set in for material for agricultural requirements, hardware, lumber, tools, machinery, &c. The crops have been good, and farmers and planters are willing to increase their outlays for the coming year. Merchant steel of all kinds is in very good demand, and new shops are springing up west of the Mississippi River. Large manufacturing establishments are projected, among them—steel works, car works, one or two locomotive works, wheel and axle works, &c. Prices throughout the East are very firm, because of the fact that manufacturers are generally very well sold up. Pig iron makers have contracts on hand for three-quarters of a million tons. Bar iron makers are sold one to three months ahead. Sheet mills have two to three weeks' contracts on hand. Steel rail makers are unable to fill orders under three months. Several mills are taking orders for next winter's delivery at 36 dols. to 37 dols. A large amount of textile and mining machinery is going South to the Gulf States, where a general industrial revival is absorbing a large amount of foreign and American capital. No downward tendency in prices of crude or finished material is probable during the next six months.

An immense amount of bridge-building will be done throughout the North-West during the coming winter, when rivers which are to be bridged have two or three feet of ice on them. This time is the favourite for bridge construction, because of the saving effected by the presence of that solid foundation to work on.

The lumber industry throughout the country is in very good shape. Strong prices throughout the spring and summer have caused an increase in supply of both hard and ordinary woods. The exportation of all kinds of wood is increasing. Building operations are being prosecuted with unusual zeal, and skilled labour is in great demand in all of the larger cities. Labour troubles seem to have pretty well disappeared for the present, and the working men are now directing their attention to political action, with a view of accomplishing legislative reforms.

Trade combinations are being formed in several branches of industry. Three are now being formed in the iron trade, and two or three more are talked of. Agents of foreign houses have negotiations favourably progressing for some 50,000 to 60,000 tons of foreign material. The iron trade quotations are as follow:—Old rails, 23·50 dols. to 24 dols.; for tees, D.H., 24 dols. to 24·50 dols.; steel rails, 36 dols. to 38 dols.; steel blooms, 31 dols.; billets, 31·50 dols.; slabs, 31·50 dols. to 32 dols; foreign steel rails, 40 dols. at Gulf; boiler steel, 3½c. to 4½c.; American tool steel, 7½c.

The month of August has been an unusually active one, but very few consumers of iron or steel are purchasing for future needs. The generally accepted opinion among manufacturers and consumers is that quotations will remain substantially where they are. Much money is being invested in new plants and in the extension of old ones. The extraordinary demand for iron and steel and everything into which they enter has stimulated a spirit of investment which will probably not be arrested until the over-production epoch arrives. Capitalists are besought by promoters of all manner of industrial enterprises to invest money, all the way from 10,000 dols. to 1,000,000 dols.

The blast furnace builders have a year's work ahead. In all probability next year will witness even greater activity than this year. Protection will be a national political issue. Public opinion is nearly equally divided upon the question. The industries have been exceptionally prosperous during the present administration, and it will be no easy matter to supplant it. The phenomenal industrial activity of America is attracting attention of British and German manufacturers. No less than seven contemplate removal to this side soon. The supply of natural gas is increasing, and new localities are found where gas is obtained in great abundance. Artificial gas is also being made for manufacturing uses at a very low cost. Several natural gas pipe lines are projected, which aggregate 400 miles in length. Much excitement prevails in the gas fields over the enormous outflow of some of the wells, which reach from six to twelve million feet every twenty-four hours.

NOTES FROM GERMANY.

(From our own Correspondent.)

THE cheerful tone noticed last week continues to prevail on the Rhenish-Westphalian and other markets of this country; for several articles the demand, indeed, has increased, and prices in general show a decided tendency to move upwards, and the least that can be said is that they have assumed greater firmness. In Silesia the wrought iron and steel works are abundantly supplied with orders, and prices are again to be raised for the coming quarter. The boiler plate and sheet mills have just formed a combination, and are about to join the general sales bureau at Berlin, which shows that there is confidence in the stability of the present improved trade. The pig iron market is not quite so buoyant, because signs of over-production are beginning to be apparent, which is also the case in other districts, and it is to be hoped will be checked in time, though it does not look likely, as old furnaces are being repaired preparatory to blowing-in again. The foundries and constructive workshops are busy, but the prices realised are still very unsatisfactory.

The demand for iron ores in the Western districts has rather increased than otherwise, so prices are firmly maintained as last noted, and Luxemberg oolites now range from M. 1.85 to 2.25 p.t. The condition of the crude iron market is about the same as last week. For Siegener pig M. 47 is now demanded, and spiegel still finds customers abroad at last quotations. Forge pig is still in full request, but has not risen, the present price being M. 46.50 p.t., though more is asked. The output of the furnaces is nearly all sold to the end of the year. The condition of the foundry, Bessemer, and basic iron trade has undergone no change from last week. The wrought iron trade is very brisk, and is likely to remain so for some time to come, and the rolling mill combination has so far every reason to be satisfied with its beginning, for it must not be forgotten that large parcels of bars had been contracted for by the separate works before the syndicate could get into operation, and the situation would be improved still further if the amalgamation of all the syndicates, now under consideration, takes place. At present all the bar and sectional iron rolling mills and forges are regularly and well employed night and day all the week through, at prices varying from M. 115 p.t. upwards, which are easier and easier from week to week to obtain. Hoops are just now in special request, and all the works full of orders, at slightly enhanced prices. Wire rods have improved in demand, and are firmer in price, which can now keep pace with the raw materials as they rise. Boiler plates keep steady at M. 150 p.t., which is being paid without resistance. Sheets are in that abnormal position of being in great demand, not paying at the market prices, and yet not being able to make a rise because of extreme competition, though a combined arrangement regulating prices exists. However, a rise of M. 5 p.t. is shortly to be risked. The steel works are well employed on orders which will keep them on for a length of time, some doing most in rails, others in sleepers; others, again, in blooms, billets, wheels, and axles. The tendering at Berlin this week for 5100 t. of rails is anxiously looked forward to by the home works to learn what sinister influence foreign bids may exercise on the prices. The machine, boiler, constructive workshops, and foundries are nearly all much better off for work than they were, but only in exceptional cases at what might be called fairly remunerative prices. The rolled tube works are busy, and the convention has reduced the discount by 2½ p.c. The Vielle Montagne Company has raised the prices of rolled zinc to 420f. p.t. for Belgium, 200fl. for Holland, and £16 17s. 6d. for England.

The brassfounders were very well employed during last month, yet the prices for the finished goods keep very depressed, and are in no proportion to those of the raw metals. The foundries have orders in hand for the next three months to come.

The iron and steel prices are as follows, per ton and base price always: Good merchant bars, M. 115; hoops, 125 to 126; boiler plates, above 5 mm. gauge, 150; sheets—singles—135 to 140; iron wire rods, 110 to 111; steel ditto, 108 to 109; drawn wire, 130; and light rails, 110.

The Belgian iron market shows more firmness from day to day, the price of girders, caused by the heavy demand for Italy and the United States, has already been raised, and other sorts of rolled iron are to follow suit at once. No. 2 plates, which a month or two ago stood at 130f., are now noted at 135f., No. 3 at 155f., and No. 4 at 215f. p.t., but as the latter gauge is in great request 225f. has been obtained for them. The price of foundry pig has also been raised. The coal market is beginning to show more life, the demand for all sorts and for cokes has increased, and prices are firmer, with a rising tendency in sympathy with pig and bar iron, which have gone up in the last half year, respectively, 5f. to 6f. and 10f. to 15f. p.t. The Cockerill Company pays 50f. per share this year, like the last.

The French iron market on the whole is, if anything, rather worse than it was. It is true that the rolling mills in the Nord Department are pretty well engaged on girders and plates, but for other merchant sorts great dulness prevails, and within the last fortnight business in the Haute Marne district has sadly fallen off, Coke iron is noted there at 130f. to 135f., and mixed sorts at 140 to 145 p.t. As for the business at Paris, one of their trade journals complains that, it would appear as if in the future no more iron would ever be required, and that the merchants were selling off their stocks at any price they could get, for girders are now being offered at 120 and bars at 130f. p.t., which prices, however, are not accepted by consumers without a discussion first taking place. In the first half year 764,643 t. of crude iron, 378,897 t. of wrought iron, and 240,313 t. of steel have been produced.

At Bilbao iron ores have a firm tendency. Rubios superior costs 6s. 10d.; Campanil, 7s. to 7s. 3d. Shipments have decreased. The week's exports amounted to 89,000 t., but fewer vessels than usual have come into port. Up to September 3rd, 3,070,248 against 2,261,856 t. last year had been exported.

In geologising the projected new Turkish railway line in Asia Minor, Ismidt-Diarbekir, several mineral deposits have come to light, the chief of which consist of lead, copper and chrome ores and magnesia.

LAUNCHES AND TRIAL TRIPS.

THE new steamer, Firefly, which Mr. R. A. Macfie will place on the New Ferry station, took her trial trip on Saturday. This steamer is intended by Mr. Macfie to supply the needs of New Ferry, and has been built to his order by Mr. Waddington, of Seacombe. She is specially built, is a twin screw, and her trial trip to Runcorn on Saturday against a strong tide and rough sea was very satisfactory, she having attained a rate of over 9 knots per hour. The Firefly's length is 138ft., her breadth 18ft., and her depth 9ft. Her builders guaranteed a draught, with 30 passengers on board and 15 tons in bunker, of 5ft. 6in., but on Saturday her draught was 4in. less than this. She is 106 tons net register and figure. She is expected to make an average speed of 12 knots an hour, making her one of the fastest ferry boats on the Mersey, and she is classed A 1 at Lloyd's for channel purposes. The accommodation provided for passengers is of a most convenient description. She has a large deck saloon, with a promenade deck above. She has also a commodious after-cabin, with ladies' cabin and retiring room, while forward there is an excellent smoking saloon. The cabins and saloons are fitted with steam heaters. The machinery of the vessel is of the most improved class, and was constructed and fitted by Messrs. David Rollo and Sons, of Fulton Engine Works, Liverpool, under the superintendence of Mr. William Glover, It consists of two pairs of compound surface-condensing engines, having cylinders of 12½in. and 25in. diameter respectively, and a stroke of 18in. Each engine has a set of air, feed, and bilge pumps worked by links and lever from the L.P. crossheads, the circulating water being supplied by an independent centrifugal pumping engine. Steam of 100 lb. working pressure is supplied by a large steel boiler, having three of Fox's patent corrugated furnaces.

We recently noticed the launch from the Low Walker shipbuilding yard of Messrs. Sir W. G. Armstrong, Mitchell, and Co., of the steamer Ville de Calais, which has been specially built for the carriage of crude petroleum in bulk, and which is, we believe, the first steamer of the kind that has ever been specially constructed for this purpose. The Ville de Calais is built of steel to the highest class Veritas, and is capable of carrying 2400 tons d.w. on less than 18ft. draught. She is sub-divided by a longitudinal and athwartship bulkheads into numerous cells or compartments, each of which has its own expansion chamber, which latter also forms a receptacle for the gases which are evolved from the cargo. These arrangements in this vessel are of a very special description—petroleum in its crude state being much more volatile than refined; for this reason, also, the general construction of the hull and workmanship had to be treated more like boilerwork than ordinary shipbuilding; and before launching each compartment was tested with water, having a head pressure considerably considerably in excess of what would be sustained in ordinary working. There is a very complete installation of pumps on the Worthington system, both for discharging the cargo and equalising at will the amount of contained in the various compartments. The machinery is on the triple expansion system, by the Wallsend Slipway and Engineering Company, and during her trial on Thursday last worked with perfect smoothness and without the slightest hitch. The vessel was fully laden with water to the contract draught, and obtained a speed of 10 knots. On Saturday she sailed to Calais, where she has since arrived, all well, after a good run. The whole of the vessel's arrangements are of the most complete description, including a full electric light installation by Messrs. Clarke, Chapman, Parsons, and Co. Sir W. G. Armstrong, Mitchell, and Co. have given the construction of petroleum steamers their special attention, and the Ville de Calais is the third tank steamer delivered by them this year, the previous vessels being the Minister Maybach of 3300 tons d.w., and the Hans and Kurt of 2800 tons d.w.; whilst a fourth, named the Willkommen, of 4000 tons d.w., will take her trial trip this week; and the same builders have yet another vessel in hand in an early stage of construction.

NEW COMPANIES.

THE following companies have just been registered:—

Barancannes Copper Mining Company, Limited.

This company was registered on the 7th inst., with a capital of £100,000, in £1 shares, to acquire and work the Barancannes Mine, situate at Huerta de Revesa, near the town of Almadovar, in Portugal. The subscribers are:—

	Shares.
*Edmund A. Pontifex, Shoe-lane, engineer	1
Daniel Willink, East Molesey	1
E. T. Booth, 49, Arlingford-road, Tulse-hill	1
*N. Story Maskelyne, M.P., Swindon	1
W. Douglas Lawford, New Malden, Surrey, solicitor	1
F. W. Ulntridge, Cobham, Surrey	1
J. Barclay Holland, 41, Coleman-street, accountant	1

The number of directors is not to be less than three, nor more than nine; qualification, 200 shares; the first are the subscribers denoted by an asterisk, and Messrs. John Harvey, W. Fraser Rae, Henry Holmes, and Richard Huth, who have power to add two to their number; qualification, 200 shares; remuneration, £1000 per annum.

Bootle Market and Abbatoir Company, Limited.

This company proposes to establish a wholesale and retail fair or market for the sale of horses, cattle, live stock, dead meat, agricultural and general produce. It was registered on the 7th inst., with a capital of £18,000, in £1 shares. The subscribers are:—

	Shares.
T. M. Stanbury, Bootle, Lancashire, estate agent	1
*J. Howard, Bootle, Lancashire, merchant	1
*W. Poulson, Bootle, Lancashire, merchant	1
*J. Cripps, Waterloo, Lancashire, mercer	1
E. B. Roose, Bootle, Lancashire, chartered accountant	1
*E. Ascroft, Bootle, Lancashire, builder	1
*Caleb Wright, Tyldersley	1

The number of directors is not to be less than three, nor more than seven; qualification, £100 in shares or stock; the first are the subscribers denoted by an asterisk; remuneration, £105 per annum.

London Paper Barrel and General Waterproofing Company, Limited..

This company was registered on the 6th inst., with a capital of £3000, in £1 shares, to trade as waterproofers and paper makers, printers, publishers, advertising agents, manufacturers, and engineers. The subscribers are:—

	Shares.
C. K. Barnett, 111, Blenheim-crescent, W.	25
A. Schott, 41, Oakley-crescent, S.W., accountant	1
O. Dickins, 233, Albany-road, S.E., clerk	1
H. Sanguinette, 16, Old Bond-street, financial agent	1
J. R. Thaine, Imperial-road, Fulham, waterproofer	1
F. H. E. Shipton, 12, Draycott-place, Chelsea, engineer	1
A. G. Lachlan, 16, Coleford-road, Wandsworth, clerk	1

Most of the regulations of Table A apply.

Gateshead Stained Glass Company, Limited.

This company was registered on the 7th inst., with a capital of £2000, in £5 shares, to manufacture and deal in stained and other glass. The subscribers are:—

	Shares
H. Gordon Drummond, Newcastle, draughtsman	1
T. F. Sadler, Dunston-on-Tyne, draughtsman	1
F. A. Mein, Newcastle, glass painter	1
R. H. Hymers, Gateshead, lead glazier	1
R. Green, Kew, Surrey, glass manufacturer	1
G. R. Drummond, Newcastle, book-keeper	1
J. Neville Green, 19, Basinghall-street, agent	1

The number of directors is not to be less than three, nor more than five; qualification, £100 in shares; the subscribers are to appoint the first. The company in general meeting will determine remuneration.

Continental Lead and Iron Company, Limited.

This company was registered on the 6th inst., with a capital of £360,000, in £10 shares, to acquire, construct, maintain, and work lead smelting works and factories, in Italy, France, Spain, and other countries. The subscribers are:—

	Shares.
*Hy. A. Brassey, J.P., Maidstone	1
*Albert Brassey, Heythorp, Oxon	1
*A. M. Tapp, 4, Great George-street, chartered accountant	1
*C. Henfrey, Lago Maggiore, engineer	1
*J. H. Enthoven, 17, Gracechurch-street, merchant	1
*F. Enthoven, 17, Gracechurch-street, merchant	1
*A. Lataste, 6, Arlington-street, Piccadilly	1

The number of directors is not to be less than five, nor more than nine; the first are the subscribers, and Lord Brassey. The remuneration of the board will be determined in ordinary meeting.

Anglo-Scandinavian Steamship Company, Limited.

This company proposes to carry on shipping business and in particular for the carriage of ores and mineral substances, timber and other goods and merchandise conveyed by the lines of the Swedish and Norwegian Railway Company, Limited. It was registered on the 10th inst., with a capital of £100,000, in £10 shares. The subscribers are:—

	Shares.
*J. W. H. Williams, 1, Essex-court, Temple, barrister	1
*Alexander Beazeley, C.E., Thornton Heath	1
*Lord Brownlow Cecil, 6, Marine-parade, Dover	1
*J. J. Wilkinson, C.E., 95, Addison-road, W.	1
A. R. Jones, 38, Inverness-terrace, Hyde Park	1
*W. S. Lockhart, C.E., The Bank, Highgate	1
E. J. Ford, Sinclair-mansions, West Kensington Park, secretary to a company	1

The number of directors is not to be less than three, or more than six, the said railway company to have power to nominate from time to time four of the directors; the first are the subscribers denoted by an asterisk, and James Thomas Jarvis; remuneration, £700 per annum. Messrs. J. J. Wilkinson and J. T. Jarvis are appointed managing directors, and will be entitled to £500 per annum for their services, in addition to their directors' fees. An agreement entered into with the said railway company states that this company will forthwith exercise its borrowing powers by the issue at par of 5 per cent. first mortgage debenture bonds, payable to bearer, to the total amount of £100,000, to be redeemed at par by annual drawings commencing in the year 1891. The whole of the present share capital is to be issued as fully paid to the railway company, the said company also to have a preferential claim on the ships and vessels of this company for the carriage of goods and passengers conveyed by the railway company. In consideration of these concessions the railway company guarantees the payment of interest on the general debenture loan of this company, and also the payment of the redemption moneys of the debentures. The railway also undertakes not to employ any other ships than those of this company so long as the same are sufficient for their requirements.

Monkwearmouth Collieries Company of New South Wales, Limited.

This company proposes to acquire and work the colliery property, known as Monkwearmouth, situate in the parishes of Teralba and Stockrington, county of Northumberland, New South Wales. It was registered on the 10th inst., with a capital of £200,000, in £1 shares. The subscribers are:—

	Shares.
Ernest Wood, 4, Fenchurch-street, merchant	1
C. T. Gedge, 5, Fenchurch-street, merchant	1
R. E. Finlay, Billiter-square-buildings, merchant	1
F. M. Dutton, St. George's Club, Hanover-square	1
H. W. Hooper, Grove Park, Kent	1
E. S. Philip, Sydenham Villa, Dulwich	1
G. Richardson, 36, Nightingale-road, Clapton	1

The number of directors shall not be less than seven, nor more than seven, and the names of the first will be determined by the subscribers, who act *ad interim;* qualification, 300 shares. The remuneration of the board is to be £1500 per annum, with an additional £300 per annum for the chairman, and in addition thereto the directors will be entitled to £10 per cent. upon the surplus profits after payment of £15 per cent. upon the paid-up capital. The business in New South Wales may be managed by a local board of advice, consisting of not less than two, nor more than five members, who will receive £100 per annum each for remuneration until otherwise determined by the company in general meeting. The subscribers will also appoint the members of this board.

O'Kelly Torpedo Company, Limited.

This company was registered on the 12th inst., with a capital of £7000, in £50 shares, to acquire the invention of James O'Kelly and Bernard Ambrose Collins, for improvements in torpedoes, and in apparatus connected therewith, for overcoming the netting defences of war ships, part of which improvement is applicable to the steering of vessels provided with steam steering gear. The subscribers are:—

	Shares.
*John Barry, M.P., Kirkaldy	1
*E. Ostlére, Kirkaldy, manufacturer	1
C. Maxton, Kirkaldy, manufacturer	1
*S. Quin, Newcastle-on-Tyne, merchant	1
*W. Sutton, Newcastle-on-Tyne, hosier	1
J. Galpine, near Lenzie, Glasgow, agent	1
E. Dwyer Gray, M.P., Dublin	1

The number of directors is not to be less than five, nor more than seven; the first are the subscribers denoted by an asterisk, and Mr. James O'Kelly; qualification, six shares.

Hubert Gold Mines, Limited.

This company was registered on the 10th inst., with a capital of £155,000, in £1 shares, to acquire and work the Hubert Gold Mining property, situate at Nevadaville, Gilpin County, Colorado, U.S.A. The purchase is regulated by an agreement of 10th ult. (unregistered) between W. H. Bush, Ellen Garry, and Emily Balsinger, of the first part, John Septimo Rivolta, of the second part, and William Shrimpton (for the company) of the third part. The subscribers are:—

	Shares.
G. Maruti, 10, Curzon-street, Mayfair	1
J. W. Hall, 34, Drayton-gardens	1
W. T. S. Smith, 12, Pancras-lane, engineer	1
Horsley Woods, Ashford, Middlesex	1
J. Foster, 150, Fenchurch-street, secretary to a company	1
W. M. Barker, Devonshire Villa, Grove Park, Chiswick	1
W. J. Wenhé, 20, Heathfield Park, Willesden-lane	1

The number of directors is not to be less than three, nor more than five; qualification, 100 shares; the subscribers are to appoint the first; remuneration, £600 per annum, and, in addition thereto, 5 per cent. on the net profits remaining after payment of 15 per cent. per annum dividend.

Lincoln Carpet Manufacturing Company, Limited.

Registered on the 12th inst., with a capital of £100,000, in £10 shares, to manufacture carpets, carriage linings, and other similar fabrics. The subscribers are:—

	Shares.
*H. Newsum, South Park, Lincoln, timber merchant	200
*E. Waterhouse, J.P., Lincoln, draper	100
G. Bainbridge, Lincoln, draper	100
J. Boothman, Bacliffe Bridge, York, weaver	100
J. H. Teaque, Lincoln, clerk	20
*H. Teaque, Lincoln, engineer	50
*W. T. Page, Lincoln, solicitor	100

The number of directors is not to be less than three, nor more than five; the first are the subscribers denoted by an asterisk; qualification, 50 shares. The company in general meeting will determine remuneration.

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—Henry Lane, engineer, to the Terror, additional, to date 13th instant; and Richard W. Toman, assistant engineer, to the Hotspur, to date 13th instant.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Application for Letters Patent.

*** When patents have been "communicated" the name and address of the communicating party are printed in italics.

6th September, 1887.

12,030. STEAM ENGINES, H. J. Allison.—(*S. S. Stout and H. G. Underwood, United States.*)
12,031. PAINTS, &c., H. J. Allison.—(*G. W. Banker, United States.*)
12,032. CUTTING, &c., COAL, L. B. Atkinson, H. W. Ravenshaw, and F. Mori, Halifax.
12,033. LAMPS for BICYCLES, &c., G. King, Portsmouth.
12,034. DRAWING BOARDS and TEE SQUARES, A. Ledger, Manchester.
12,035. TURNING and BORING METAL CYLINDERS, W. Craven, London.
12,036. GLAZING, T. R. Shelley, Smethwick.
12,037. TYPE-WRITER, J. L. Cantelo, Liverpool.
12,038. HEATING APPARATUS, J. S. Doran.—(*J. Reilly, United States.*)
12,039. COOKING RANGES, S. Pickersgill and J. W. Frost, Derby.
12,040. ELECTRIC CABLES, H. Skerrett.—(*J. H. Dalzell, United States.*)
12,041. SEWING BOOKS, W. P. Thompson.—(*L. W. Fifield and A. I. Jacobs, United States.*)
12,042. ROLLING SEAMLESS TUBES, &c., W. P. Thompson.—(*C. Kellogg, United States.*)
12,043. TRAMWAY RAILS and SUPPORTS, De W. C. Cregier and C. T. Yerkes, Liverpool.
12,044. BICYCLES, G. J. Stephen, Liverpool.
12,045. MUSIC STAND and MUSIC SHEET, P. Mansfield, London.
12,046. HOLDING BUNDLES of PAPERS, O. S. Matthews, London.
12,047. WINDOW FASTENINGS, W. Fisher and C. Church, London.
12,048. SELF-SIGNALLING APPARATUS, E. K. Irwin, London.
12,049. SEWING MACHINE CUTTING KNIVES, L. Muther and R. G. Woodward, London.
12,050. SUPPORTING MECHANISM for VALVE STEMS, &c., E. P. Monroe, London.
12,051. LETTER-COPYING PRESSES, F. A. Paget, London.
12,052. FILLER used in FRENCH POLISHING, W. and S. Denham, London.
12,053. COMBINATION TOOL, A. B. Hardman and H. Green, Sheffield.
12,054. TRANSMITTING, &c., RICE, W. Brock, jun., P. McAra, J. Walker, J. A. Birrell, and J. Adam, Glasgow.
12,055. ROTARY DRIERS, A. Mills and C. E. Convis, London.
12,056. BUSK and SIDE STRIP for STAYS, A. E. Jones, London.
12,057. PURIFYING YEAST, A. G. Brookes.—(*C. G. P. de Laval and A. Bergh, Sweden.*)
12,058. MECHANICAL TOYS, G. Cole, London.
12,059. STERCOLINE, J. Torbock, London.
12,060. HYDRAULIC PROPULSION, &c., of VESSELS, S. Willington, London.
12,061. STAMPING, &c., METALS, T. R. Bayliss, London.
12,062. ROUNDABOUTS, J. Rose, London.
12,063. CIGARS, H. H. Lake.—(*J. R. Williams, United States.*)
12,064. KNITTING MACHINES, W. Westmoreland, B. Kerr, and I. L. Berridge, London.
12,065. FOOD COMPOUND, H. H. Lake.—(*J. H. Stebbins, jun., United States.*)
12,066. COCKS, VALVES, &c., E. Aldous, London.
12,067. VELOCIPEDES, W. Clegg, London.
12,068. AUTOMATIC VENT PEG, C. Wayte, London.
12,069. COUPLINGS for RAILWAY VEHICLES, H. L. Godden, London.
12,070. VENTILATION of RAILWAY and other CARRIAGES, H. L. Godden, London.
12,071. BOOTS, SHOES, &c., J. McDonnell, London.
12,072. CUTTING TABLE of BAND-SAWING and FRETSAWING MACHINES, E. Whibley, Plumstead.
12,073. ELEVATING or TRANSFERRING BEER, &c, P. Coquelle, London.
12,074. REGENERATIVE GAS FURNACE with PERIODICAL ACTION, J. von Ehrenwerth.
12,075. PRODUCING AZO COLOUR upon ANIMAL or VEGETABLE FIBRES or FABRICS in PRINTING or DYEING, B. Willcox.—(*The Farbenfabriken vormals Friedrich Bayer and Co., Germany.*)
12,076. ELECTRIC TELEPHONES, J. S. Sawrey, G. L. Anders, and H. Collet, London.
12,077. CONVERTING STRAW HATS into BASKETS, E. Midgley, London.
12,078. ARTIFICIAL CONSTRUCTIVE or ORNAMENTAL RAW MATERIAL, R. A. Gross, London.
12,079. FOLDING CHAIRS for INFANTS, &c., P. A. Rodriguez, London.
12,080. ROASTING COFFEE, &c., L. Petersen, London.
12,081. CAR AXLES, R. Haddan.—(*S. T. Wellmann, United States.*)
12,082. BROOMS, &c., A. T. Booth, London.
12,083. HAT GUARD FITTINGS, C. H. Eden, Manchester.
12,084. CONCUSSION PREVENTER, W. C. Baldwin, Selly Oak.
12,085. SAFETY STIRRUP, E. F. Bour, London.
12,086. TOILET or DRESS PIN, D. Allport, London.
12,087. WORKING an ENGINE by a CHEMICAL COMPOUND, E. Seage, F. Seage, and F. T. Reid, Exeter.
12,088. ROTARY PUMPS, R. H. Brownhill, Manchester.
12,089. STEAM and other HAMMERS, W. M. Wilson, Manchester.
12,090. EMPLOYMENT of PHENOLOID BODIES in the MANUFACTURE of WATER-PROOFED INDIA-RUBBER GOODS, W. Smith, Manchester.
12,091. JOINTS of PNEUMATIC TUBES, &c., F. B. Welch, Manchester.
12,092. CRADLES, F. Aldous, Manchester.
12,093. TUBULOUS STEAM GENERATORS, B. H. Thwaite, Liverpool.
12,094. SHIRTS, A. Jones, London.
12,095. SELF-ACTING EXTINGUISHER for LAMPS, G. Barnaby, London.
12,096. COLLAR and SHIRT STUDS, W. C. Alldridge, Birmingham.
12,097. COLLAR and SHIRT STUDS, &c., F. W. Lambert, Birmingham.
12,098. AXLES and NAVES for WHEELS, J. Shepherd, Manchester.
12,099. BICYCLES and TRICYCLES, J. Toy, Helston.
12,100. "COOKING STRIDES," T. Johnson, Dudley.
12,101. SEPARATING FUR and FUR WASTE, J. Nasmith, Manchester.
12,102. RAISING BEER, &c., A. McGlashan, Glasgow.
12,103. EXPANDING PISTONS for STEAM ENGINES, &c., T. Thompson and T. M. Favell, London.
12,104. COMBINED BATH and WARDROBE, &c., M. L. Ross, London.
12,105. PULP KNOTTERS, J. Gourlay, London.
12,106. BROILER, W. C. North, London
12,107. FIRE-ESCAPE, R. Belches, London.
12,108. ECONOMISING STEAM in STEAM ENGINES, W. W. Ridge, London.
12,109. FREEING WATER from AIR, A. Feldmann, London.
12,110. ATTACHMENT to SIGNAL LAMPS of a GONG, &c., J. L. Watkins, London.
12,111. ELECTRIC FUSES for MINES, W. P. Thompson.—(*E. Dumas, Paris.*)
12,112. WHEELS for BICYCLES, &c., P. Rousset and E. Ingold, Liverpool.
12,113. HEATING the FEED-WATER, &c., in STEAM BOILERS, R. Fraser, Liverpool.
12,114. TOBACCO PIPES, F. Weaver, London.
12,115. AUTOMATIC POWER or STROKE ADJUSTER for HYDRAULIC MOTIVE-POWER ENGINE, A. Alison, London.
12,116. LOCK-KNOB and SPINDLE, E. H. Johnson, London.
12,117. HEATING and CIRCULATING WATER, J. Lee, Liverpool.
12,118. ATTACHMENTS for HANGING UP GARMENTS, G. W. Hatton, London.
12,119. WIRE FRAME for SUPPORTING CUT FLOWERS, J., J., and A. Cheal, Crawley.
12,120. STOPPERING CASKS, F. H. Street and C. Ellis, London.
12,121. BOTTLE for containing POISONOUS LIQUIDS, &c., E. S. Hermes, London.
12,122. BUTTONS, A. Manton, London.
12,123. GLOBE and SHADE HOLDERS for GAS and other LAMPS, J. Grubb, London.
12,124. FLUID PRESSURE ENGINE applicable as a LIQUID METER, W. A. G. Schönheyder, London.
12,125. MARINE ENGINES, J. McLaren.—(*A. R. McKenzie, Australia.*)
12,126. ATTACHMENT of PIPES, &c., to OVERHEAD SUPPORTS, P. N. Kenway, London.
12,127. MECHANICAL BALANCED CHAIRS or COUCHES, A. Plant, Glasgow.
12,128. ADVERTISING APPARATUS, J. G. Lorrain, London.
12,129. DOUBLE PURIFIER or GAS WASHER, J. McEwen, London.
12,130. TELEPHONE, A. G. Cloake, London.

8th September, 1887.

12,131, SAFETY LOCK NUTS, K. G. Garbe and G. Wallace, London.
12,132. PATTERN BOOKS, &c., L. H. Brierley, Birmingham.
12,133. CROSS CUT SAW BENCHES, T. N. Robinson, Manchester.
12,134. BEARINGS in SEWING MACHINE STANDS, F. Taylor, Nottingham.
12,135. TAPS for MEASURING LIQUIDS, C. Windust, London.
12,136. THISTLE CUTTER, A. L. Olver, Bodmin.
12,137. WINDOW-BLIND RACK PULLEY, W. Burnet and D. Petrie, Dundee.
12,138. DRIP CUPS for UMBRELLAS, A. G. Nygard, London.
12,139. SHIPS' BERTHS, I. Chorlton and G. L. Scott, Manchester.
12,140. SUSPENDING BEDS, I. Chorlton and G. L. Scott, Manchester.
12,141. FOUR-HANDED REVERSIBLE DOOR LOCK, &c., G. Kelley, Wolverhampton.
12,142. DABBING BRUSHES, E. Gaunt, W. H. Cockcroft, and S. Best, Bradford.
12,143. DUST COLLECTORS, G. Behrns, London.
12,144. DYEING YARNS, T. F. Naylor, Kidderminster.
12,145. SELF-FIXING RACK LIFT, P. P. Burt and S. B. Edmonds, Birmingham.
12,146. PERAMBULATING VEHICLES for ADVERTISEMENT, G. P. Lemprière and J. A. and W. Daniels, Birmingham.
12,147. WATCH STAND and REGULATOR, N. Hall.—(*C. G. Hall, Mauritius.*)
12,148. SMOKE-CONSUMING and SELF-SETTING COOKING RANGES, G. Clark, London.
12,149. HYGIENE CONVENIENCE NAPKIN, C. Rubens, London.
12,150. LOCKS for CARRIAGE DOORS, W. H. Nisbit and W. W. Virtue, Glasgow.
12,151. PORTABLE GAS ENGINES, T. A. Galt.—(*J. Charter and G. S. Tracy, United States.*)
12,152. DWARF BICYCLES, E. A. Filby, London.
12,153. FILTER PRESSES, F. H. Danchell, London.
12,154. STOPPERS for CHAMPAGNE, &c., BOTTLES, H. P. Capreol, London.
12,155. VENEERING FELT HAT BODIES, J. and O. Oldham, London.
12,156. BOLTS for DOORS, W. Allen and R. A. Holmes, London.
12,157. POCKET CIGARETTE MAKER, A. Hamburg, London.
12,158. MAKING FELT, N. Ingrund, London.
12,159. STOPPERING BOTTLES, H. Heartfield, London.
12,160. BAKERS' OVENS, A. J. Roberts, London.
12,161. WATER METER, G. F. Redfern.—(*C. Berhaut, Belgium.*)
12,162. SODIUM, C. Humfrey, Liverpool.
12,163. BATHS, H. E. Eyre, Liverpool.
12,164. TAMING HORSES, &c., H. Sample, Liverpool.
12,165. ROLLER MILLS, C. O. Dost, Liverpool.
12,166. MAKING, &c., an ELECTRIC CIRCUIT, H. K. Read, London.
12,167. MECHANICAL TOYS, G. Cole, London.
12,168. OBTAINING POSITIVE BLACK INK COPIES, G. Bay, London.
12,169. PREVENTING INCRUSTATION in BOILERS, P. Alfieri, Naples.
12,170. PREVENTING ACCIDENTS with PERAMBULATORS, M. Willard, London.
12,171. SELF-LIFTING COVERS for DUST PANS, T. Simpson, London.
12,172. CLEANING BISCUIT PANS, &c., J., W. K., and G. S. Baker, London.
12,173. BRACE TAB CONNECTIONS, &c., T. Walker, London.
12,174. PREVENTING NUTS from WORKING LOOSE, S Bayliss, London.
12,175. SECONDARY BATTERIES, W. B. Adams, London.
12,176. BREECH-LOADING SMALL FIRE-ARMS, T. Perkes, London.
12,177. BUCKETS, A. Vogt, London.
12,178. BINDING the EDGES of LACE, R. Reader and G Kay, London.
12,179. TREATING ASBESTOS, C. Jackson, Nottingham.
12,180. HEATING or COOLING AIR, &c., G. Seagrave, London.
12,181. EXTRACTING OIL from SEEDS, W. H. Gilruth, London.
12,182. APPLYING BRONZE to the SURFACE of PAPER, W. B. Silverlock, London.
12,183. ADVERTISING APPARATUS, J. G. Lorrain, London.
12,184. PUBLICANS' PORTER DRAINER, M. Hickey, London.
12,185. MECHANICAL MUSICAL INSTRUMENTS, A. L. Mora, London.
12,186. TENNIS NET SUPPORTS, P. M. Justice.—(*F. W. Taylor, United States.*)
12,187. GAS MOTOR ENGINES, C. D. Abel.—(*The Gas Motoren Fabric Deutz.*)
12,188. GELATINISED GRAIN, J. Death and A. S. Tomkins, London.
12,189. TELEPHONIC APPARATUS, H. H. Lake.—(*E. E. Graves, United States.*)
12,190. TELEPHONIC APPARATUS, H. H. Lake.—(*E. E. Graves, United States.*)
12,191. SHUTTERS for PHOTOGRAPHIC CAMERAS, A. S. Newman, London.
12,192. ELASTIC COUNTER MAT, H. S. Roberts, London.
12,193. EXCAVATING APPARATUS, A. Vogt, London.
12,194. BURNERS, J. C. C. Read and G. F. A. Griffin, Mansfield.

9th September, 1887.

12,195. DOG for FASTENING TIMBER, R. E. and G. B. Ellis, London.
12,196. SEWING MACHINES, A. F. Wileman, Ealing.
12,197. CONSTRUCTION of THEATRES, &c., J. B. Petter, London.
12,198. FACILITATING INGRESS, &c, of PEOPLE to PLACES of PUBLIC RESORT, E. Diver, Kenley.
12,199. SIMPLEX PLANT SUPPORT, W. Hopwood, Gloucester.
12,200. CORLISS VALVES for MOTIVE-POWER ENGINES, W. Musgrave, Manchester.
12,201. AUTOMATICALLY DELIVERING CIGARETTES, &c., J. Simpson, Broughty Ferry.
12,202. SIGNALLING from PASSENGERS in TRAINS to GUARDS, M. Archer, Newcastle-upon-Tyne.
12,203. DYNAMO-ELECTRIC MACHINES, T. L. Hemming, Birmingham.
12,204. DREDGING APPARATUS, A. Vogt, London.
12,205. AUTOMATIC HAT-STRETCHING MACHINES, G. Atherton.—(*R. Eickemeyer, United States.*)
12,206. POUNCING MACHINERY for MAKING FELT HATS, G. Atherton.—(*R. Eickemeyer, United States.*)

12,207. Bolts for Doors, &c., J. H. Cartland, Birmingham.
12,208. Electro-magnets, S. F. Walker, Cardiff.
12,209. Belting, G. E. Stead, Manchester.
12,210. Hot-blast Stoves, J. T. King.—(*H. Kennedy, United States.*)
12,211. Detachable Pitch Compound Driving Chains and Wheels, W. Woollason, Lincoln.
12,212. Alarums, W., J., and F. Holmes, Bradford.
12,213. Boning, &c., Folds of Cloth, W. Anderson and R. H. Shaw, Ashton-on-Mersey.
12,214. Heel-building Machines, T. Sheppard, Leicester.
12,215. Tricycles, H. J. Lawson, London.
12,216. Velocipede, H. J. Lawson, London.
12,217. Bicycles, H. J. Lawson, London.
12,218. Road Vehicles, M. D. Rucker, London.
12,219. Car Wheels, J. H. Sams and La M. A. Thompson, London.
12,220. Collapsible Boxes, J. M. Shuttleworth, Liverpool.
12,221. Wool Buyers' Rule, W. S. Smee, London.
12,222. Disinfectants, &c., R. V. Tuson, London.
12,223. Buckle with a Tongue, C. C. Ellis, London.
12,224. Metal Tackle Blocks, G. A. Ford, London.
12,225. Shuttle Operating Mechanism for Sewing Machines, J. Bolton, London.
12,226. Secret or Permutation Locks, A. Warner, London.
12,227. Applying Oil to the Waves of Rough Seas, J. O. Spence, London.
12,228. Cycles, M. Hedderwick, Glasgow.
12,229. Carburetting Gas Lamps, A. Kitson, United States.
12,230. Electro-magnets, J. Taylor, London.
12,231. Transferring Coal from Wagons to Ships, G. Taylor, Penarth.
12,232. Anchors, G. Hartshorne and G. F. Simms, Birmingham.
12,233. Tramway, &c., Engines, A. Dickinson, Birmingham.
12,234. Facilitating Sorting of Rags, C. Holt and W. and T. Sefton, London.
12,235. Keys and Tree-nails for Railways, T. R. Stopford, London.
12,236. Gas Cooking Ranges or Ovens, T. Greenwood, London.
12,237. Uniting the Uppers to the Inner Soles of Boots and Shoes, W. Jackson, London.
12.238. Preparing Infusions of Tea, &c., R. Lewis, London.
12.239. Hand Saws, R. M. Johnson and T. H. Benton, Sheffield.
12,240. Movable Types, F. Perrin, Bristol.
12,241. Advertising Vans, H. S. Turner, London.
12,242. Furnace, F. W. Durham, London.
12,243. Magazine or Repeating Fire-arms, P. A. Comte de Sparre, London.
12,244. Indicators for Recording the Revolutions of Shafts, A. Dilhs, London.
12,245. Type-writers, H. Dobson and A. E. Wynn, London.
12,246. Removing the Scale from Steam Boiler and other Tubes, H. L. Currier, London.
12,247. Shaping and Trimming Slate, A. Spamer, London.
12,248. Dividing Arcs of Circles and Angles, T. C. Roussel, London.
12,249. Carbonating Liquids, W. McElroy and H. Connett, London.
12,250. Folding Lidded Box, C. Davis, London.
12,251. Milk Can or Bottle, T. Gilbeart, London.
12,252. Dynamo-electric Machines, R. P. Sellon, London.
12.253. Electrical Transformers, R. P. Sellon, London.
12,254. Converting Compound Engines with Double Expansion into Triple Expansion Engines, D. Joy, London.
12,255. Heating and Drying of Animal and other Matters, A. S. V. Abeele, London.
12,256. Device for Killing Flies, &c., E. F. Wells, London.
12,257. Combined Level Inclinometer Angle Measurer, and Protractor and Dividing Compasses, L. Charle, London.
12,258. Advertising Apparatus, J. G. Lorrain, London.
12.259. Fastening Device for Studs, &c., A. F. and F. W. Small, London.
12,260. Hanging Gridiron, A. Steer and E. O. Eaton, London.
12,261. Needle Threader for Sewing Machines, E. W. Hunnex and A. Edwards, London.
12,262. Paper Boxes, Bottles, &c. W. R Comings, London.

10*th September*, 1887.

12,263. Utilisation of Exhaust Steam for Tramway Engines, I. F. Cuttler, J. G. Cook, and Messrs. Entwisle and Nutter, Bradford.
12,264. Securing Knobs to Doors, &c., C. Mackey and E. V. Bailey, Birmingham.
12,265. Automatic Electric Governor, T. Christy, London.
12,266. Chimney Pot, J. Bradshaw, Preston.
12,267. Cutting Umbrella and Parasol Cloths, W. H. Ronald, Glasgow.
12,268. Curtain and Drapery Hooks, H. A. Done, Sutton Coldfield.
12,269. Miners' Safety Lamp, G. Hardy, Abram, near Wigan.
12,270. Pickers for Looms, S. Fielden, Manchester.
12,271. Brick Kilns, J. Davies, Manchester.
12,272. Process in Iron and Steel, G. Siddell, Sheffield.
12,273. Pneumometer, R. Howson and E. Crowe, Middlesbrough-on-Tees.
12,274. Electric Incandescent Lamps, L. Thomas, A. Ray, and J. Cunningham, Paris.
12,275. Folding Developing Tray, &c., W. Tylar, Birmingham.
12,276. Rivetting Boots and Shoes, J. Brown, Leeds.
12,277. Treatment of Zinc Ores, A. J. Shannon, London.
12,278. Guards for Carving Forks, T. Somerfield, Sheffield.
12,279. Domestic Fire Grates, E. B. Williams and J. C. Morgan, Sheffield.
12,280. Grinding Files, &c., W. Bright, Sheffield.
12,281. Bearings, J. W. Jenkins, Birmingham.
12,282. Connecting Pipes, J. Wotherspoon, Glasgow.
12,283. Washing, &c., Fibres, &c., M. Ashworth and R. Wild, Rochdale.
12,284. Lady's Safety Purse, G. H. Weitzmann and C. F. Hime, London.
12,285. Oil Compounds for Dyeing, &c., E. Bentz, Manchester.
12,286. Tripod Heads for Photographic Cameras, F. Miall, London.
12,287. Automatic Locking Apparatus for Wagons, R. Hudson, London.
12,288. Bicycle, W. W. Ford, London.
12,289. Garden Syringes, W. Fraser, London.
12,290. Football Inflater, W. Fraser, London.
12,291. Automatic Door Closer, W. Fraser, London.
12,292. Washing Photographic Prints, A. Marriott, London.
12,293. Centrifugal Machine Filters, W. P. Thompson.—(*W. Jäger* [*W. Pataky*], *Prussia.*)
12,294. Vertical Steam Generators, R. Hattrick, Liverpool.
12,295. Gravity Switch Back Railways, W. Hart and J. Ripley, London.
12,296. Vent Pegs, J. Read, Sheffield.
12,297. Enclosing Explosives in Shells, W. T. Chamberlain, London.
12,298. Exploding Shells by Percussion, W. T. Chamberlain, London.
12,299. Applying the Force of an Explosion in a Shell, W. T. Chamberlain, London.
12,300. Enclosing One Shell in Another, W. T. Chamberlain, London.
12,301 Steam Pile Drivers or Hammers, A. van Raalte, London.
12,302. Electric Brake Apparatus, G. Binswanger and W. R. Clark, London.
12,303. Preventing Collisions at Sea, L. Somzee, London.
12,304. Fire-proof Curtains for Theatres, W. E. Heath and W. Geddes, London.
12,305. Sewing Machines, C. Rainey, London.
12,306. Automatic Calenders for Clocks, G. Reimann, London.
12,307. Stone Saws, J. Peckover, London.
12,308. Pedestrian Speed Indicators, M. D. Rucker, London.
12,309. Vent Pegs, W. Smith, London.
12,310. Velocipedes, G. Singer and R. H. Lea, London.
12,311. Ventilating Apparatus, L. Sterne and H. F. Green, London.
12,312. Removable Stair Treads, H. H. Lake.—(*P. M. Petersen, Denmark.*)
12,313. Electric Bells, &c., H. P. F. Jensen, London.
12,314. Lamps and Burners, F. Grant, London.
12,315. Suction Dredgers, W. R. Kinipple, London.
12,316. Horse Collars, H. W. Loads and W. Armes, London.

12*th September*, 1887.

12,317. Velocipedes, T. Redman, Bradford.
12,318. Electric Current Meter, T. Parker, Manchester.
12,319. Oil-can, E. Gorton, Birmingham.
12,320. Arc Electric Lamps, C. L. Baker and C. Richardson, Manchester.
12,321. Setting Potatoes, &c., W. W. L. Lishman, Halifax.
12,322. Lock and Latch Staples, G. F. Newman, Birmingham.
12,323. Fire-lighter, J. M. Eglin, Glasgow.
12,324. Fastening Railway Rails, C. H. Huntley, London.
12,325. Telephonic Apparatus, W. Fairweather.—(*The Western Electric Company, United States.*)
12,326. Washing Machines, A. Barr, Glasgow.
12,327. Match-boxes, H. Courteen, Grantham.
12,328. Fireproof Curtains for Theatres, A. Melville, Birmingham.
12,329. Furnaces for Drying Barley, W. G. Hicks, Ramsgate.
12,330. Regulating the Supply of Gas, H. Royle, Liverpool.
12 331. Yarn Winding Machinery, J. D. Whyte, Manchester.
12,332. Extracting Aluminium from Minerals, S. Pearson, A. W. Turner, and W. Andrews, Birmingham.
12,333. Handles of Walking-sticks, &c., E. A. Olivieri, Birmingham.
12,334. Lamp Burners, M. Graetz, Berlin.
12,335. Cogged Wheels of Chain-geared Machines, H. O. Badger, Birmingham.
12,336. Burning Heavy Mineral and other Oils, L. Chandor, London.
12,337. Adjustable Folding Eye-glass, T. Bloor, Birmingham.
12,338. Anti-fouling Composition for Ships' Bottoms, &c., W. Fordyce, Glasgow.
12,339. Fluid Meters, G. A. Nussbaum, London.
12,340. Railway and Road Locomotives, J. Armstrong, London.
12,341. Window Fastenings, E. Kirby, London.
12,342. Infants' Feeding Bottles, J. G. Tongue.—(*C. Maistriaux, Belgium.*)
12,343. Velocipedes, M. Tarnopol, London.
12,344. Wire Strainer, J. Flynn and J. F. Kilburn, London.
12,345. Spinning Mules, G. Cooper and R. Beatty, London.
12,346. Steel Castings, J. D. Ellis, London.
12,347. Hardening Metal, T. J. Tresidder, London.
12,348. Cleaning Rice, B. C. Schumacher.—(*H. Schumacher, Germany.*)
12,349. Magazine, C. Wells, London.
12,350 Coiling Ropes &c. J. L. West and T. Laidler, London.
12,351. Syringe, J. P. Scheuck, London.
12,352. Distilling Tar, T. L. G. Bell, London.
12,353. Fire-resisting Compound for Nozzles, H. L. Foster, London.
12,354. Securing Solitaires, E. J. Taylor, London.
12,355. Colouring Matters, J. Imray.—(*La Société Anonyme des Matières et Colorantes et produits Chimiques de St. Denis, A. F. Poirrier, and D. A. Rosenstiehl, France.*)
12,356. Locomotive Tenders, F. B. Behr.—(*A. Mallet, France.*)
12,357. Anti-incrustation Preparation for Boilers, R. M. Bryant, London.

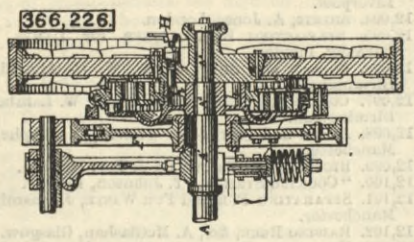
SELECTED AMERICAN PATENTS.

(From the United States' Patent Office Official Gazette.)

366,226. Traction Engine, *F. F. Landis, Waynesborough, Pa.—Filed March 21st*, 1883.

Claim —(1) In a traction engine, the combination of a master gear, journalled upon a fixed portion of the framework of said engine, an axle having three shouldered bearings, A^1 A^2 A^3, a spur gear H secured upon the bearing A^2 and provided internally with cogs having their faces parallel with the axis of said gear, and a hub forming a journal for the compensating-gear case, with the compensating-gear case having three pairs of spur pinions between the gear H and the traction wheel, substantially as and for the purpose described. (2) In a traction engine, the combination of a master gear, a gimbal-ring, and compensating-gear case connected by links with an axle provided with a fixed gear having chambers *h*, a loosely-journalled traction wheel, intermediate compensating gears, and a locking pin, substantially as and for the purpose described. (3) In a traction engine, a master gear provided with pockets F^1, adapted to receive the ends of gimbal-ring connecting-links, in combination with a gimbal-ring, substantially as described. (4) In a traction engine, the combination of a master gear provided with pockets, slotted links secured loosely in the pockets, and a gimbal-ring provided with cushioning devices against the ends of the links secured thereto, substantially as and for the purposes described. (5) In a traction engine, the combination of a master gear provided with pockets, links secured loosely in said pockets and to a gimbal-ring, and links secured to said gimbal-ring and to a compensating-gear case, substantially as described. (6) In a traction engine, a compensating-gear case provided with inwardly and outwardly projecting pinion pockets and peripheral lugs, a central bearing, and an oil pipe extending from the periphery to the bearing, substantially as shown and described.

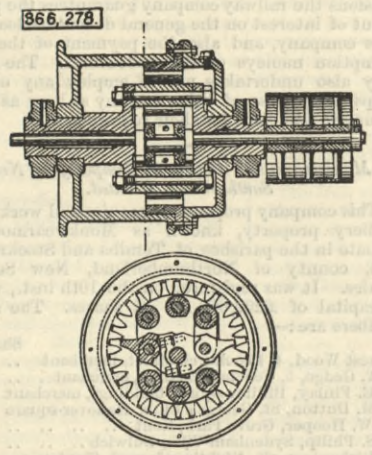
366,226.



366,278. Differential Hoisting Gear, *C. G. Toense, Cleveland, Ohio.—Filed September 3rd*, 1886.

Claim.—(1) In a differential gear, the combination, with a toothed ring, of revolving reciprocating pawls engaging the teeth of said ring, substantially as shown and described. (2) A differential gearing consisting of a toothed wheel, a shaft having an excentric, and reciprocating pawls and sleeves, all combined substantially as shown and described. (3) In a differential gear, the combination, with a drum, of a toothed wheel on the inside of said drum and pivotted reciprocating pawls mounted on an excentric of the driving shaft, substantially as shown and described. (4) In a differential gearing, the combination, with the driving shaft, of sleeves mounted loosely on the same, reciprocating pawls mounted on links or arms between the inner ends of the sleeves and on an excentric part of the shaft between the sleeves, and a drum provided with a toothed ring, with the teeth of which ring the reciprocating pawls can engage, substantially as shown and described. (5) The combination, with the shaft, of two sleeves mounted loosely on the same and having their ends connected by bolts and sleeves on said bolts, links on the sleeves of bolts, pawls pivotted on said links and mounted on an excentric part of the shaft, which is between the inner ends of sleeves surrounding the shaft, a drum mounted loosely on the sleeves of the shaft, and a ring having teeth fixed loosely on the drum, substantially as shown and described.

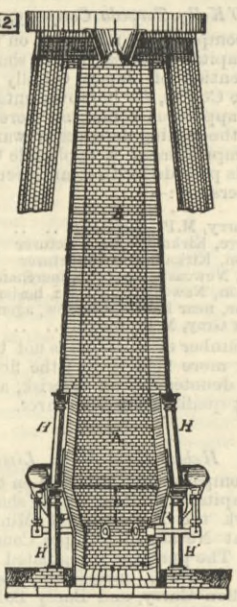
366,278.



366,282. Blast Furnace, *E. Walsh, jun., St. Louis, Mo.—Filed September 1st*, 1885.

Claim.—(1) A blast furnace in which the bosh C is located well down within the zone of fusion instead of at an upper and colder portion thereof, or at a portion too far removed horizontally from the heating influences of the ascending gases, as heretofore, substantially as shown, and for the purpose specified. (2) A blast furnace in which the bricks composing the walls of the furnace are laid at an inclination toward the centre of the furnace, substantially as described, and for the purpose specified. (3) The double row of columns H H^1, in combination with the furnace shaft B, formed as described, substantially as described, and for the purpose specified. (4) The double row of columns H H^1, supporting the furnace shaft B, in combination with the furnace A, formed as described, substantially as and for the purpose described.

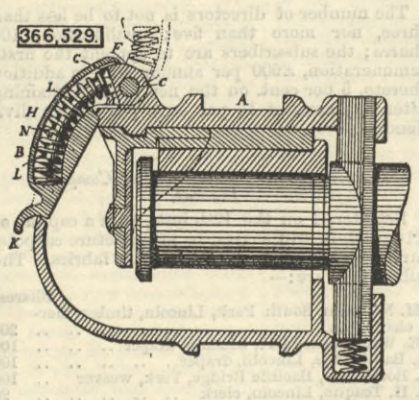
366,282.



366,529. Car Axle-box, *J. Timms, Colombus, Ohio.—Filed June 13th*, 1887.

Claim.—(1) The combination, with a car axle-box and its lid hinged thereto and provided with a hollow curved projection H on its upper part, of a curved rod L, provided with a head M, and a coiled spring N, and the cam knuckle C, substantially as set forth. (2) An improved lid for car axle-boxes, provided with the hollow curved projection H, a thumb piece K, and the knuckles E E, all formed in one piece, substantially as set forth.

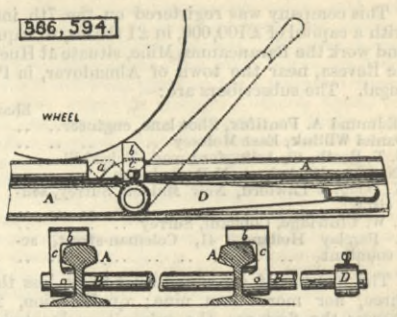
366,529.



366,594. Automatic Stop Block for Locomotives, *F. Merthsheimer, Evanston, Wyo.—Filed November 9th*, 1886.

Claim.—(1) In combination with the rail recessed in its upper face, the pivotted, vertically-swinging stop C, having the laterally projecting arm *b*, adapted to turn into the recess below the surface of the rail, or to bear upon and receive support from the rail, as occasion may require. (2) In combination with the notched rails A A, the transverse rock-shaft B, the stop blocks or arms C, secured to said shaft, and provided with the lateral projections *b* to overlie the rails, and the hand lever D, applied as shown, and serving as a weight to hold the stops normally in their elevated position. (3) In combination with a rail notched or recessed in its upper face, a stop block C, having a lateral arm at its upper extremity, a rock shaft on which said arm is mounted, and a hand lever applied to said rock shaft in the manner described and shown, whereby it is caused to hold the block normally in an elevated position to stop wheels advancing in one direction, while at the same time the block is left free to descend under the pressure of wheels advancing from the opposite direction.

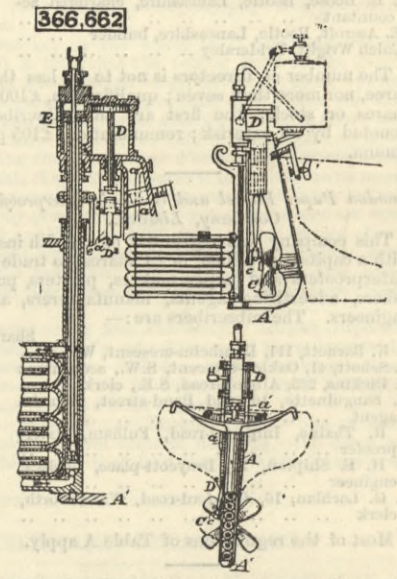
366,594.



366,662. Machinery for Propelling and Steering Boats, *S. E. Harthan, Worcester, Mass.—Filed November 26th*, 1886.

Claim.—A portable propelling apparatus for boats, consisting of the auxiliary stern-post frame adapted to be temporarily and detachably secured in stationary position to the stern of the boat and provided with a steam motor engine, and a screw propeller wheel mounted upon said frame with operating connections, substantially as and for the purpose set forth. The detachable stationary auxiliary stern-post A, having the backwardly-extended arm A^1, axis stud, crosshead guides a^1, combined with the propeller wheel C, the laterally swinging steering rudder pivotted to said arm, and the motor engine mounted on the upper end of said post, substantially as shown and described. The combination, with a boat, of auxiliary stern-post A, having guides a^1, and a backward-projecting axis stud near its lower end, the propeller wheel C mounted to rotate on said stud and provided with a crank *c*, the engine cylinder D, and valve box E, mounted on the upper end of said post, and the operating rods D^2 and *e*, connecting the propeller crank with the engine piston and valve mechanism, and means, substantially as described, for attaching said post to the stern of the boat and supporting the same with the propeller stud at stationary position axially in line therewith. A steering rudder constructed with an interior space or passage adapted to serve as a condenser and provided with a tubular standard, in combination with a pumping mechanism for removing the water of condensation, substantially as set forth. The combination, with the engine and its operating connections, of the condenser-rudder having the tubular standard, the perforated tube E^2, carrying the engine valves E fitted within said standard and serving as the exhaust pipe for conveying exaust steam to said condenser, and as a hinging support therefor, the feed-water pipe arranged within and connected at its ends with said exhaust tube and passing up through the valve chamber, the pump valves I *i*, and means for imparting reciprocating action to said valve tube and feed-pipe, substantially as set forth. A frame or auxiliary stern-post A, for supporting the propeller and engine, provided with a hollow or cavity as *a* for containing liquid fuel, substantially as set forth.

366,662.



366,848. Welding and Cutting Machine, *J. M. Long, Hamilton, Ohio.—Filed April 30th*, 1887.

Claim.—In a welding machine, the combination, substantially as set forth, of a bottom anvil, a back anvil, a reciprocatable top die, a reciprocatable side die, and mechanism for reciprocating the two dies in alternation The combination of frame A, ram C, cam shaft E, and fly-wheel loose upon the cam shaft and having clutch G, sliding clutch H, provided with a groove having bevel-ended notch X, clutch-shifting fork J, provided with a spring and arranged to throw the clutch into engagement, stop pin V, arranged to normally engage the clutch groove, and treadle W, arranged to withdraw the stop from the clutch groove. The combination, substantially as set forth, of frame A, ram C and its actuating mechanism, ram M and its actuating mechanism, involving a bell crank lever, excentric pivot T for said lever, and worm gearing U for rotarily adjusting said pivot.

366,848.