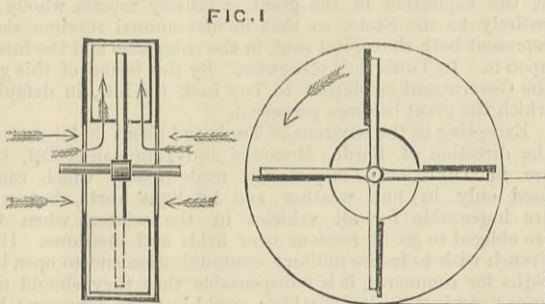


THE EFFICIENCY OF FANS.

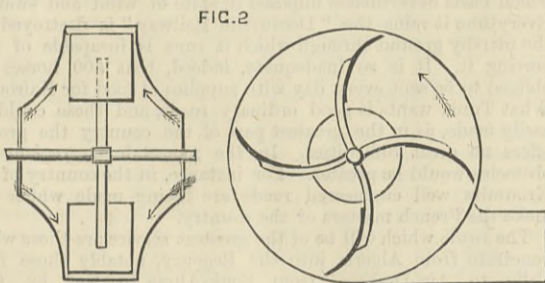
THE articles which have appeared in our pages concerning the efficiency of various kinds of fans tried at Reading, have turned to these machines the attention of many persons who have hitherto troubled themselves very little about them. We have already received several letters commenting on the Reading trials, not a few of which supply proof that the writers of them have everything to learn concerning fans. Under the circumstances we think that a short and simple explanation of the principles involved in the action of fans may prove useful.

Air, like every other gas or combination of gases, possesses weight; some persons who have been taught that the air exerts a pressure of 14.7 lb. per square inch, cannot, however, be got to realise the fact that a cubic foot of air at the same pressure and at a temperature of 62 deg. weighs the thirteenth part of a pound, or over one ounce; 13.141 cubic feet of air weigh one pound. In round numbers 30,000 cubic feet of air weigh one ton; this is a useful figure to remember, and it is easily carried in the mind. A hall 61ft. long, 30ft. wide, and 17ft. high will contain one ton of air.

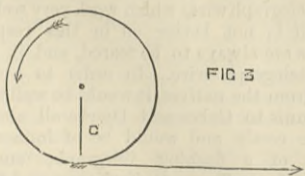
The work to be done by a fan consists in putting a weight—that of the air—in motion. The resistances incurred are due to the inertia of the air and various frictional influences; the nature and amount of these last vary with the construction of the fan. As the air enters at the centre of the fan and escapes at the circumference, it will be seen that its motion is changed while in the fan through a right angle. It may also be taken for granted that within certain limits the air has no motion in a radial direction when it first comes in contact with a fan blade. It is well understood that, unless power is to be wasted, motion should be gradually imparted to any body to be moved. Consequently, the shape of the blades ought to be such as will impart motion at first slowly and afterwards in a rapidly increasing ratio to the air. It is also clear that the change of motion should be effected as gradually as possible. Fig. 1 shows how a fan should not be constructed; Fig. 2 will serve to give an idea of how it should be made.



In Fig. 1 it will be seen that the air, as indicated by the bent arrows, is violently deflected on entering the fan. In Fig. 2 it will be seen that it follows gentle curves, and so is put gradually in motion. The curved form of the blades shown in Fig. 2 does not appear to add much to the efficiency of a fan; but it adds something and

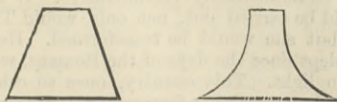


keeps down noise. The idea is that the fan blades when of this form push the air radially from the centre to the circumference. The fact is, however, that the air flies outwards under the influence of centrifugal force, and always tends to move at a tangent to the fan blades, as in Fig. 3, where the circle is the path of the tips of the



fan blades, and the arrow is a tangent to that path; and to impart this motion a radial blade, as at C, is perhaps as good as any other, as far as efficiency is concerned. Concerning the shape to be imparted to the blades, looked at back or front, opinions widely differ; but it is certain that if a fan is to be silent the blades must be narrower at the tips than at the centre. Various forms are adopted by different makers, the straight side and the curved sides, as shown in Fig. 4, being most commonly used. The pro-

FIG. 4.



portions as regards length to breadth are also varied continually. In fact, no two makers of fans use the same shapes.

As the work done by a fan consists in imparting motion at a stated velocity to a given weight of air, it is very easy to calculate the power which must be expended to do a certain amount of work. The velocity at which the air leaves the fan cannot be greater than that of the fan tips. In a good fan it may be about two-thirds of that speed. The resistance to be overcome will be found by multiplying the area of the fan blades by the pressure of the air and by the

velocity of the centre of effort, which must be determined for every fan according to the shape of its blades. The velocity imparted to the air by the fan will be just the same as though the air fell in a mass from a given height.

This height can be found by the formula $h = \frac{v^2}{64}$; that is to say, if the velocity be multiplied by itself and divided by 64, we have the height. Thus, let the velocity be 88 per second, then $88 \times 88 = 7744$, and $\frac{7744}{64} = 121$.

A stone or other body falling from a height of 121ft. would have a velocity of 88 per second at the earth. The pressure against the fan blades will be equal to that of a column of air of the height due to the velocity, or, in this case, 121ft. We have seen that in round numbers 13 cubic feet of air weigh one pound, consequently a column of air one square foot in section and 121ft. high will weigh as many pounds as 13 will go

times into 121. Now, $\frac{121}{13} = 9.3$, and this will be the resistance in pounds per square foot overcome by the fan. Let the aggregate area of all the blades be 2 square feet, and the velocity of the centre of effort 90ft. per second, then the power expended will be $\frac{90 \times 60 \times 2 \times 9.3}{33,000} =$

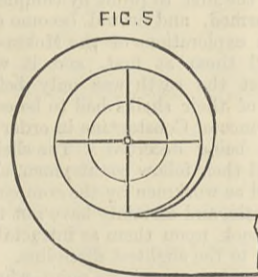
3.04-horse power. The quantity of air delivered ought to be equal in volume to that of a column with a sectional area equal that of one fan blade moving at 88ft. per second, or a mile a minute. The blade having an area of 1 square foot, the delivery ought to be 5280ft. per minute, weighing $\frac{5280}{13} = 406.1$ lb. In practice we need hardly

say that such an efficiency is never attained.

The number of recorded experiments with fans is very small, and a great deal of ignorance exists as to their true efficiency. Mr. Buckle is one of the very few authorities on the subject. He gives the accompanying table of proportions as the best for pressures of from 3 to 6 oz. per square inch.

Dia. of fans.	Vanes.		Dia. of inlet openings.
	Width.	Length.	
ft. in. 3 0	ft. in. 0 9	ft. in. 0 9	ft. in. 1 6
3 6	0 10½	0 10½	1 9
4 0	1 0	1 0	2 0
4 6	1 1½	1 1½	2 3
5 0	1 3	1 3	2 6
6 0	1 6	1 6	3 0

For higher pressures the blades should be longer and narrower, and the inlet openings smaller. The case is to be made in the form of an arithmetical spiral widening, the space between the case and the blades radially from the origin to the opening for discharge, and the upper edge of the opening should be level with the lower side of the sweep of the fan blade, somewhat as shown in Fig. 5.



A considerable number of patents has been taken out for improvements in the construction of fans, but they all, or nearly all, relate to modifications in the form of the case and of the blades. So far, however, as is known, it appears that, while these things do exert a marked influence on the noise made by a fan, and modify in some degree the efficiency of the machine, that this

last depends very much more on the proportions adopted than on the shapes—so long as easy curves are used and sharp angles avoided. In the case of fans running at low speeds, it matters very little whether the curves are present or not; but at high speeds the case is different. The fans used in ventilating ricks will be, for the most part, driven at moderate speeds, we should imagine; and the efficiency of such machines can only be improved as the result of experiments. As we have said, the amount of experimental information available on the subject of fans is very small. Such as it is, it is well worth discussing in our columns.

THE NORTH-EAST COAST EXHIBITION OF MARINE ENGINEERING AND NAVAL ARCHITECTURE.

No. I.

ONE of the largest and most successful exhibitions of this kind which has been held in these countries was opened to the public on Wednesday in the buildings of the Royal Aquarium at Tynemouth, a few miles from Newcastle-on-Tyne; and though many of the exhibits are still incomplete or unfinished, the committee are to be warmly congratulated on having done much good work in so short a time, for it is only a fortnight since the Aquarium came into their hands for preparation, and only three months since the first idea of the Exhibition suggested itself to Messrs. F. C. Marshall and George Renwick. To very many who saw the speed with which in five days the Agricultural Hall, London, was prepared for the opening of the Naval and Submarine Exhibition in April last, a fortnight may seem to be a long time; but the Exhibition now open at Tynemouth is considerably larger than was its forerunner and parent in London, while the facilities are by no means so great for the placing of heavy exhibits in position—therefore much credit is due to the managers and prime movers in this case. That this Exhibition would not have been so warmly taken

up by exhibitors, and be comparatively so easily pushed, had it not been preceded by the success at the Agricultural Hall, there can be no doubt; as also there can be none that the latest development of the Marine Exhibition has surpassed the first one, if not in general interest, certainly in size, in the number of stands, in the amount of local enthusiasm which it has raised, and in its situation. Glasgow and Edinburgh are, though in the midst of the greatest of the engineering and shipbuilding works, too far north to attract the capitalists of London to a marine exhibition; and London, though it may safely be termed the counting-house of the world, is too far south to tempt the Scottish manufacturers to exhibit there. But Tynemouth, which is the fashionable resort and watering place of north-country engineers, shipbuilders, and shipowners, and which is situated at the mouth of the river, and within a few miles of the Wear, Sunderland, Middlesbrough, the Tees, Stockton, the Hartlepoons, Blyth, &c., and equidistant from the capitalists and merchants of the south and the manufacturers of the far north, while surrounded by a large and enthusiastic maritime population, is the place most suited of all others for the holding of a successful marine exhibition.

The special train, containing the invited guests, as well as the patrons, president, and vice-presidents, left the central station at Newcastle shortly after mid-day, and on its arrival at the handsome new station at Tynemouth the Mayor of that town presented an address of welcome to the Earl of Ravensworth in his official capacity as President of the Exhibition. His lordship having replied, a procession was formed in the following order:—1st, Lifeboat drawn by eight horses; 2nd, Coble, with sails, gear, &c., drawn by two horses; 3rd, The boys and band of the Wellesley training ship; 4th, The Tynemouth Volunteer Life Brigade, with rocket apparatus; 5th, The band, Tynemouth Volunteer Artillery; 6th, The Executive Committee; 7th, the Earl of Ravensworth, the Duke of Newcastle, Earl Percy, Sir W. G. Armstrong, Mr. Marshall, &c., and the invited guests of the Committee, in carriages; 8th, The Consular representatives; 9th, The Mayor of Tynemouth and the members of the Council; 10th, The Mayors and members of the Councils of the boroughs of the north-east coast. The procession was witnessed by many thousands of people as it wended its way through the elaborately decorated streets, the Mayors of Tynemouth and the neighbouring towns having advised the suspension of all business and the presence of all people at the Exhibition or in the streets to give the visitors a warm welcome. It should be mentioned that not the least interesting contribution to the procession was a miniature lifeboat drawn by eight boys in scarlet uniforms.

On arriving at the Aquarium, the President, accompanied by those gentlemen who had assisted in the procession, ascended the platform which had been erected in the Winter Palace, as the great central hall is termed, and here the ceremony of inauguration was performed, the right hon. chairman delivering an appropriate and apt opening speech, touching briefly on the various classes of the Exhibition, and very judiciously measuring out a meed of praise to each. Other speeches were delivered by the Duke of Newcastle and Sir William Armstrong, and then the Exhibition was duly and formally declared to be open. A kind of scramble luncheon followed, and more speeches were delivered, amongst others by Mr. A. C. Kirk, Mr. Laing, Mr. Swan, Mr. John, representing the exhibitors, and by Earl Percy and Mr. Stevenson, M.P., as visitors. Upwards of 700 guests sat down to luncheon, and speakers and speeches were received with the utmost enthusiasm. So much of the day had been occupied with the purely formal part of the ceremony that but little time remained to see many of the exhibits or to do more than obtain a merely casual idea of the arrangement of the whole. The exhibits have been mainly divided into six classes or sections, under the following heads:—(1) Naval architecture, which possesses 181 exhibits; (2) marine engineering, with 247 exhibits; (3 and 4) fishing and life-saving apparatus, with 622 exhibits; (5 and 6) coast lighting and submarine engineering, with 58 exhibits. An additional section is devoted to workmen's models, of which some twenty-seven are shown. The catalogue, which is a most complete and admirable guide, is an absolute copy, as indeed are many other things about the Exhibition, of that of the Naval and Submarine Exhibition, the type, the style, and the whole arrangement being identical with it, and in all things in which the Committee has copied its predecessor, it has done so thoroughly, judiciously, and well. Out of the vast number of exhibits it would be impossible to make at present any selection of those which deserve the most attention; but some idea may be formed of the gigantic style in which the whole thing has been carried out, when we say that one exhibit alone, that of Messrs. Wigham, Richardson, and Co., comprises a pair of marine engines which weigh close upon 60 tons. The Wallsend Slipway Company also shows a large pair of marine engines, and Messrs. R. and W. Hawthorn exhibit two high-speed engines for gunboats, which are at present being built for the Danish Navy. Steel shafts up to a length of 48ft. are also to be found in number, and Mr. Wasteneys Smith shows an unusually large anchor, in addition to many other interesting productions from the steel of which he is so fond. The Darlington and Leeds Forge Companies have also very large exhibits, and in the boiler room may be noticed the curious old engine of William Hedley, of Wylam, which bears the date 1813. The workmen were engaged up to the arrival of the procession in clearing up and decorating the various stands. At noon the men were engaged in glazing the erection in which the luncheon had to be held after the opening ceremony, and bricklayers and joiners were closing up the openings that had been made in the walls of the Rink and wooden erection to admit of the exhibits, some of which were arriving at that time.

WATER GAS.—St. Louis is to be supplied with water gas for fuel purposes, made by the Lowe process. The laying of pipes is progressing, with ten miles under contract.

TUNIS.

THE question whether Tunis is really so rich as the ancients supposed gives rise, even in Tunis itself, to great controversies. Can history have deceived us? and did the Granary of Rome really only contain a very small number of harvests? Must we regard the pictures which have been represented to us of its astonishing prosperity as a sort of African mirage? At first sight this is by no means easy to say. It is quite certain that to-day Tunis is a very dried-up country, entirely destitute of water in the central and southern parts, whose productiveness consequently depends entirely on the winter rains. When the winter is a wet one the harvests are superabundant, when it is not there is no harvest; and out of four or five winters one only is wet. Was the climate the same formerly? Nothing goes to prove the contrary. In travelling in Tunis one is struck by the great number of cisterns and ancient water-ducts one meets with. Like the French, the Romans experienced the necessity of counteracting, by means of great public works, the dryness of the country. They succeeded admirably if we may believe their own account, for all who have written on Tunis are unanimous in declaring that they drew immense products out of the country; and visiting the Regency in a good year, such as the present, it is not difficult to believe that the ancient writers exaggerated nothing. Some of the provinces are of a fertility of which it is difficult to give an adequate idea. All the coast, the Sahil, and the oases of the south, are covered with luxuriant vegetation; one fancies oneself continually in a most beautiful garden. The Medjerda Plain is hardly less fertile, and the country of the Kroumirs is being equally favoured by nature. It is covered by forests of cork trees and evergreens, the cultivation of which would be productive of the best results, and its valleys, watered by innumerable streams, are not subjected to the unhappy influences which the rest of the country suffers from in dry years.

Thus the historic reputation of Tunis has not been overwrought. Under an intelligent and honest administration it would become again one of the granaries of the Mediterranean, and her riches would be as varied as they would be extensive. The oases of the south and the province of Djérid produce, perhaps, the finest dates in the world, but unhappily at the present time the cultivation of the date tree is in a state of decadence truly deplorable.

The old works for collecting water are falling into ruins. It would be necessary to restore them, and at the same time to see whether the process, practised with so much success in the province of Constantine for increasing the water supply—namely, the boring of artesian wells, which create new oases each day—might not be equally applicable to Djérid. Besides the dates, a new source of prosperity has sprung up during the last few years, in the centre and south of Tunis, namely, that of the *alfa*, which is, it appears, of a finer quality than that of Algeria, and which has already initiated a very important commerce, and one which would be easily developed. Along the east coast extends a sort of ribbon of olive trees, some miles in depth, the product of which in good years suffices to make the fortune of almost the whole country. Certainly, the olive trees form the greatest riches of Tunis. Now, there is nothing to prevent the actual plantations being doubled and tripled, for the soil situated behind them is of the same nature and subject to the same climatic influences as that which they occupy, and if this is not done, it is only because the weight of the taxes is so crushing as to absolutely discourage the culture of them. In consequence, their cultivation has almost been given up; it will begin afresh when the fiscal reform has been accomplished. The great plateaux, the immense plains situated beyond the sea coast, are now only used as pasturage for flocks and herds. If water could be commanded it would doubtless be possible to create veritable oases there. The plain Kairouan, for instance, rivals Egypt; it is formed of a layer of alluvial deposited by numerous watercourses which lose themselves in its sands, leaving behind them a soil capable of yielding the most splendid harvests. It is a sort of delta which does not communicate with the sea, and which has consequently no outlet. In rainy winters it forms a gigantic pond; then comes the dryness when it is again burnt up like a desert. But in the interval the inhabitants are able to reap an abundant harvest. Having only inferior ploughs, they scratch the surface of the earth; but the fecundity of the soil makes up for the want of culture.

The pastoral industry which prevails over all the central districts of Tunis, produces, and *might* produce to a much greater extent, such results as would largely compensate for the insufficiency of the other industries. Every year Tunis might easily export millions of sheep to Europe. All the northern parts, and particularly the Medjerda plain, grow abundance of wheat, barley, and sorgho. The vine might readily be acclimatised; it would succeed as well in Algeria, and would in a few years double the revenue of these countries.

There are two causes at present operating to produce sterility in a country so fertile by nature. The first is the weight of the taxes, which completely crushes the cultivator. But this is only a small part of what the taxpayer has to bear. The Tunisians pay at least half as much again as their Algerian neighbours. Only to cite a few examples. In Algeria the tribes which pay tithes pay no personal tax; in Tunis, besides tithes and the expenses of collecting them, every inhabitant above fifteen years, excepting old, blind, and lame people, has to pay the Medjeba, a poll-tax of 45 reals per head—a real is worth sixpence—and 5 kharoubes—the kharoube is about a twelfth part of a real. Soldiers, zapties, spahers, and zouaves are exempt, but their children pay. Upon the value of food sold 1 kharoube per piastre is exacted—the kharoube is the sixteenth part of the piastre. There is a stamp duty of 1 per cent. upon the transfers of property, without taking into account the charges of registration, which are also much heavier in Tunis than in France or Algeria.

The second cause of the sterility of Tunis is the entire absence of public works. It is well known that the Regency, whose area at most is only equal to that of an average Algerian province, nevertheless possesses a much greater expanse of sea-coast. This is a most important geographical advantage, for it allows local productions to get to the port of embarkation at a very trifling cost; but unhappily this natural advantage is counteracted by the insufficiency of ports and by the almost entire absence of roads. The coast of Tunis is flat and the approaches very shallow, so that vessels cannot easily approach the shore at any point. There is good anchorage, especially at Sousse, for instance, where the ground is excellent; but there are neither roadsteads nor any natural shelters. At Sfax, boats anchor a considerable distance from the shore, as also at Garbes, Djerba, and Zarzis. The island of Djerba, whose fertility is extraordinary, and whose geographical position south of Tunis, and a short distance from Tripoli, is admirable, alike from a military and a political point of view, would be one of the jewels of the Mediterranean if only it had a port. But it would be useless to think of making one; it would be a work of immense cost,

and one which would have continually to be done over again, for the softness of the ground under the sea all round Djerba is such that it would be quite impossible to dig a durable canal in a soil so wanting in consistency and stability.

In the northern districts Tunis is better off. Every one knows that the lake of Bizerte forms a magnificent basin, which might hold several fleets without difficulty if only the entrance to it were rendered easier and it were protected from the wind by a dyke.

Some maintain that this would be an easy and inexpensive enterprise, others contend that it would be a most costly work, likely to engulf millions. Whichever opinion be the correct one, however, there is one thing certain, namely, that Bizerte could never be anything but a military port. As a port of commerce it would have no future, though it would certainly be the most beautiful, and, after Malta, the most important port in the Mediterranean. It would be an African Toulon to the French; but Tunis might become their Marseilles.

The construction and working of the port of Tunis were confided to the Société des Batignolles, and very careful consideration was given to it on that occasion by the chief engineer of embankments and bridges—M. Laroche—who estimated the cost of the works at 11,000,000 francs. If the lake of Tunis were opened it would allow ships which now anchor off Goulette to approach the town. The tonnage of the merchant ships which entered the roadstead in 1881 exceeded 320,000 tons; from this the importance of Tunis may be judged, and there is abundant evidence that this importance might be greatly increased if the French were to establish their rule more firmly and to increase the number of public works.

All the produce of the Medjerda plain, Sahil, and the neighbouring countries, would gravitate towards Tunis, where also would be sent the largest quantity of imported articles.

It would, no doubt, be necessary to impose very heavy duties on merchandise, in order to defray the expenses of construction of the port; but these would never be so onerous as those to which it is now subjected. Merchandise at Goulette must first be landed, and then carried by the famous Italian railway to Tunis. This costs on an average 3f. to 4f. per ton. If the port at Tunis were ever made, this expense would be saved, and the little railway from Goulette which Italy carried off from France with so much *éclat*, would become what it ought to be, a mere suburban railway. North of Tunis, Bizerte, is not the only point worthy of notice. The importance of Tabarka is also very great—firstly, because through it, the country of the Kroumirs—where there must now always be military occupation—is accessible; and, secondly, because Calle being so insecure, and the efforts to construct a port there having proved so fruitless, there is no possibility of rivalry. The region bordering on Tabarka is one of those where colonisation for agricultural and industrial purposes will increase the most rapidly, and its temperate climate will allow numbers of Europeans to settle there.

Forests of cork and evergreens are met with. There is plenty of pasturage and abundance of water at all seasons of the year; but the working of the mines and forests, and the utilisation of water as a motive power, could not be carried on without the aid of European capital. Perhaps private enterprise may undertake the construction of a port at Tabarka. In the districts inhabited by the Mecknas and Nezas there are appearances of iron which encourage the hope that much iron may exist. The Algerian Company of Mokta-el-Habid undertook to explore them, and if their researches are crowned with success—as everything seems to show that they will be—the working of the iron mines would necessitate the construction of a port which would allow of the annual embarkation of two to three hundred thousand tons. In this case nothing would be more natural than to put into the hands of the mining director both the construction of a port at Tabarka and the establishment of a railway which would bring the produce of the mine to the point of embarkation. The unhappy Kroumirs, the immediate cause of the war, would thus be the first to profit by conquest. Their country would be transformed, and would become extremely rich. It seems that the explorations of the Mokta-el-Hamid Company rather alarmed them at first, and it was impossible to convince them that the earth was only being explored for iron. A number of their sheiks had to be conducted into the mines in the province of Constantine in order to show them that they were not being deceived. The sheiks returned convinced, and convinced their fellow countrymen, and now many Kroumirs are employed as workmen by the company. They are very active and very gentle, and certainly have not the least idea that many Europeans look upon them as intractable barbarians incapable of submitting to the slightest discipline.

On the east coast of Tunis there is not a single point where the traffic is of sufficient importance to justify the creation of a port. At Hammamet, Sousse, Monastir, Mehdiya, Sfax, Gabes, Hount-Souk, and Zarzis, ships anchor in the roadsteads; embarkations and disembarkations are performed by means of barges. This service might be improved by the construction of stockades, and the improvements of the quays, especially at those places where the alfa commerce, one of the chief sources of revenue to the Regency, has come into, or is likely to come into play. It is unnecessary to touch upon the establishment of new lighthouses, which might be continually kept in repair by the French Marine, which in future must be often coasting along Tunis. On this subject there cannot be any doubt. The question of railways is a more complicated one; the military importance of them is very great. Railways alone can import European civilisation into the Regency, suppress insurrections there, and definitively establish European rule.

There is no doubt that from a French point of view capital could not be laid out to better advantage than in the construction of railways. For a long time the receipts would be inconsiderable, but at the same time the saving which would be effected in the reduction of the number of troops, and in the expense of warlike expeditions, would be enormous as soon as strategic and commercial railways were made. For example, in Algeria, no insurrection has ever been known to take place in a district crossed by a railway, and it is not too much to affirm that when railways run everywhere insurrection will cease. Locomotives are of more use in pacifying an Arab country than flying columns, and the more money expended over them the less will be spent over the army. So that a saving would be effected not only in gold, but in what is of greater importance, in human life. Three railways are of immediate importance for the occupation of Tunis, namely, one from Bône to Gafsa by Tebessa, from Tunis to Sousse, and from Djedeida to Bizerte. The first would assure to the French an admirable base of operations in the south of the Regency. Bône is at the same distance as Tunis from the oasis of Gafsa, which commands Djérid and Nezaoua, and is looked upon as the citadel of the south. Thus a railway from Bône to Gafsa would be a link between the south of the Regency and the great Algerian port of the French, and would admit of a large force being brought in two days on to the line of retreat of such tribes as had the imprudence to revolt. The Bey has already conceded the line from Tunis to Sousse to the Bône-Guelma Company, and the

first section of it, comprised between Tunis and Hamman-el-Enf, is nearly completed. From Hamman-el-Enf to Sousse there are about 125 kilometres, and as the soil offers no obstruction, the construction of the remainder of the railway will be easy and inexpensive. It might be very quickly accomplished by working at both ends at once. This railway will cross through very rich countries, tributary to Tunis, at any rate that part comprised between Hamman-el-Enf and the capital, and this will insure goods coming to the port of Tunis. From a military point of view it will be valuable as allowing the French to get rapidly into the heart of the Regency, an advantage not to be despised, as disembarkation at Sousse is always risky.

The line from Djedrida to Bizerte has also been conceded, like that from Tunis to Sousse, to the Bône-Guelma Company. Its length will be about 75 kilometres, and it would be easily made. It would be a bond of union between Tunis and Bizerte, and better still, it would traverse the region of Mateur, which is very fertile, and would bring traffic to the principal line from Tunis to the Algerian frontier, a length of 25 kilometres. This last line is of considerable importance, for it forms a branch of the great artery which will some day cross the whole of the northern districts of the States of Barbary.

Actually, this branch is attached to nothing, being isolated by the sea on one side and by Algeria on the other, so the deplorable insufficiency of its revenues is scarcely to be wondered at, and that the French Treasury should have rebelled against the excessively heavy expenses demanded of it in consequence was only natural. But, because it cost France much more than it ought to have done, is no reason for condemning, as the French do, the making of it. They paid much too heavily for it, but it was necessary to make it. If affairs in Tunis had been managed with more order and method, and if in politics personal interest had not been so often allowed to take the place of the public good, the State might have made much less rigorous conditions with the Bône-Guelma Company.

Recrimination, however, is useless, and when the port of Tunis is made and the line from Gardimaou to Souk-Ahras established, the railway from Tunis to the Algerian frontier will find its traffic doubled, and its strategic importance increase in the same proportion, while demands upon the Exchequer will diminish. It would be a great misfortune if this first experience disgusted France with Tunisian railways. It is further remarked that the grants made by the Bey have a particular character which does not seem to be taken into account, and which might help to relieve the French Exchequer. In France, at the expiration of the grant, a railway reverts wholly and entirely to the State, so that its net annual revenue should represent both the capital sunk in the enterprise and the interest upon it. In Tunis it is otherwise. By the terms of this grant the Government is obliged to buy back the line, in default of which the grant becomes perpetual.

Excepting in the environs of Tunis and about 30 kilometres in the direction of Bardo, Monouba and Hamman-el-Enf, there are in Tunis only imperfectly made roads, which can be used only in fine weather and by light carts, but which are impassable for all vehicles in the winter, when they are obliged to go at random over fields and meadows. If the French wish to insure military communication and to open large paths for commerce, it is indispensable that they should make proper carriage roads. Nothing would be more dangerous, however, than to amuse themselves by trying mischievous experiments, as for example from Sousse to Kairouan, where at great cost a sort of tramway was established, known by the name of the "Decauville Railway," which cost over £40,000 and sacrificed the lives of more men and horses than perished in all the battles fought in the province of Tunis. It was a fad of the Minister of War against which everyone in Tunis protested, but which Paris nevertheless imposed in spite of wind and swamps. Everytime it rains the "Decauville Railway" is destroyed, for the marshy ground through which it runs is incapable of supporting it. It is so inadequate, indeed, that 500 horses are obliged to be sent every day with supplies of food for Kairouan! What Tunis wants is good ordinary roads, and these could be easily made, as in the greatest part of the country the ground offers no great difficulties. In the mountainous regions the obstacles would be greater. For instance, in the country of the Kroumirs well engineered roads are being made which will make the French masters of the country.

The roads which will be of the greatest service are those which penetrate from Algeria into the Regency, notably those from Calle to Ain-Draham from Souk-Ahras to Kef, by Gardimaou, also those which would constitute the great country network, particularly those which would unite Gafsa to Gabes, Gafsa to Tunis, and Sousse by Kairouan. In the northern districts the roads will be as tributaries to the railway, and by augmenting its receipts will lessen the demand upon the French Exchequer. The telegraphic and postal service will also greatly facilitate communications, and is already organised in a very remarkable manner. In a few months the country has been covered with telegraph wires which work very well indeed; perhaps France herself is not better off in this respect than Tunis. Still, accidents are always to be feared, and it only requires one man to cut a telegraph wire. In order to avoid surprise from acts of spite from the natives, it would be well to have an electric cable from Tunis to Gabes and Djerba all along the coast. It would not be costly and would be of immense service. The establishment of a flashing telegraph, such as the one already in use from Tunis to Zaghouan and from Zaghouan to Kairouan, would complete the advantages of a maritime cable, and would be a safeguard against the dangers which the absence of means of communication threatens to generate.

In short, from an agricultural, industrial, and military point of view alike, Tunis requires a certain number of public works, which could be easily executed and be comparatively inexpensive. The Director of Public Works, M. Grand, has drawn up a programme, which includes all the essential undertakings, and the cost of which does not exceed 79,000,000f. The largest part of the expense would, of course, be borne by the country, and those who would have personal interest in it, for all the works proposed would be immediately remunerative. If M. Grand's programme could be carried out, not only would Tunis be pacified definitively, but she would be transformed. Her latent riches, which have slept since the days of the Romans, would once again be brought to light. This country, once so celebrated for her fertility, would return to her former prosperity; and even admitting—what is possible—that ancient writers exaggerated her productive power, she would still, without coming up to their descriptions, deserve to be regarded as one of the most beautiful provinces of Africa. Tunis is better adapted for colonisation than Algeria. The inhabitants are milder in character, population is smaller, the climate less changeable, and territory generally easier to govern and defend. Being bounded on the north and east by the sea, she is easily and quickly accessible, and fresh, health-giving breezes from the sea temper the heat of the climate.

Tunis, indeed, is scarcely known. She is possessed of large mineral resources—there are lead mines at Djebel-Rezas and at

Djelha, and the beds of iron in the region of Tabarka are already well known. They are seven miles in extent in the districts inhabited by the Nefzas.

A Franco-Belgian Society has undertaken the working of the quarries of Ghentou in the hope of finding the Numidian marble—yellow veined with purple—so sought after by the Romans, and this is likely greatly to increase the traffic of the railway from Tunis to the Algerian frontier.

Private enterprise will undoubtedly find in Tunis a rich field for its activity, provided that matters cease to be conducted, as hitherto, in oriental fashion, and work is carried on in a slower and less immediately productive fashion, but in such a way as to bring a solid and lasting return. If things are better managed, Tunis may still gain the popularity it so well deserves, and which would already have been very great if the French had understood the country, and how much it is worth to them.

HALPIN'S COMPOUND CONDENSING ENGINE.

On page 178 we give the first of several engravings illustrating a new form of compound condensing engine designed by Mr. Druitt Halpin, of 9, Victoria-chambers, and constructed by Messrs. Manlove, Allott, Fryer, and Co., Nottingham. The engravings on page 178 shows the general construction of the engine; its construction in detail we shall describe in another impression with further engravings.

ON THE ELECTRIC FURNACE.*

By C. W. SIEMENS, D.C.L., F.R.S., and A. K. HUNTINGTON, Professor of Metallurgy, King's College, London.

THE electric furnace has previously been described in the Journal of the Society of Telegraph Engineers, June, 1880. It has since been found advisable to surround the furnace with a coil. By this means the direction of the arc can be regulated at will, and the tendency which it has to fly to the sides of the crucible be checked.

The furnace consists of a crucible of any convenient size, in the bottom of which is pierced a hole to receive the positive electrode, the negative electrode, which passes through a hole in the lid of the crucible, being suspended from one end of a beam, the other end of which is attached to a hollow cylinder of soft iron free to move vertically within a solenoid coil of wire. The force with which the cylinder is drawn into the coil can be counterpoised by a sliding weight on the beam. One end of the solenoid coil is connected with the positive, and the other with the negative pole. The coil having a high resistance, its attractive force on the cylinder is proportional to the electromotive force between the electrodes, *i.e.*, to the resistance of the arc. The length of the arc is therefore regulated automatically. This is a point of great importance, as, were it not so, the resistance of the arc would rapidly diminish as the temperature of the atmosphere within the crucible increased, and the result would be that heat would be developed in the dynamo-machine. The extinction of the arc by sudden change in its resistance or by the sinking of the material in the crucible is thus also avoided. The crucible is surrounded with some infusible substance which is also a bad conductor of heat. Gas retort carbon or sand answers well for the purpose. The electrodes may be of such carbon as is used in electric lighting or of any other convenient conducting substance. They may, if desired, be cooled by circulating water through or round them, or by exposing them as far as possible to the air. For example, in one experiment a $\frac{1}{2}$ in. nickel positive pole was employed, the lower end being inserted into a solid rod of copper about 1 in. square by 6 in. long. With this pole, no other means of keeping it cool being adopted, 1 lb. of grain nickel was fused in a clay crucible and poured in eight minutes, starting with all cold. The electrode was but little attacked, and no leakage occurred.

There are two great advantages possessed by the electric furnace, *viz.*, that the temperature attainable is practically only limited by the refractoriness of the materials of which the furnace is constructed, and that the heat is developed immediately in the material to be fused, instead of first having to pass through the containing vessel. The temperature to be obtained by the use of fuel is limited by dissociation. Deville has shown that carbonic acid undergoes dissociation at the ordinary atmospheric pressure at about 2600 deg. Cent.—4700 deg. Fah.

In the experiments made by the authors, five D 2 machines driven by a Marshall's 12-horse power engine were employed; one being used as an exciter. The current ranged between 250 and 300 Amperes. The most refractory clay crucibles supplied by the Patent Plumbago Crucible Company were invariably cut through in a few minutes, and, except for experiments of short duration, were useless. Plumbago crucibles stood exceedingly well. Obviously, however, they could not be employed for all purposes, owing to their tendency to cause carburisation of the metal experimented with. In some experiments the fusion of metal was effected in a bed of lime, sand, or electric light carbon dust. The latter is a very bad conductor, and, as in the case of lime and sand, allows the arc when once formed to maintain a passage through it to the metal beneath.

Wrought Iron.—Six pounds of wrought iron were kept under the action of the arc for twenty minutes, and the metal then poured into a mould. It was found to be crystalline, and could not be forged. This is the result which has always been obtained when iron, nickel, or cobalt have been fused. Although the remedy, *viz.*, the addition of a little manganese just before pouring, is well known, the cause remains still unexplained.

Steel.—As much as 20 lb of steel files have been melted in one charge, the time required being about one hour, starting with the furnace hot. With such large quantities the metal has invariably been full of blowholes.

White iron, fused in a clay crucible for thirty minutes, when fractured did not appear to have undergone any change. White iron and coke were introduced into the furnace; the resultant metal was slightly grayer than the original. When, however, retort carbon was substituted for the coke a good gray iron, soft and easily workable, was readily obtained in fifteen minutes, starting with the crucible hot. On another occasion, starting all cold, at the end of thirty minutes the metal, although it had been well fused, had not been rendered grayer. The difference between these two results was possibly due to the temperature being somewhat higher in the one case than in the other. This is a point of considerable practical interest. Four pounds of white iron, fused with carbon dust for three-quarters of an hour, yielded a very gray crystalline iron. In another experiment, in which 8 oz. of gray iron, produced in the electric furnace from white iron, were remelted in carbon dust for ten minutes a very gray metal was obtained, from which on slow cooling a large quantity of graphite separated.

Cast iron, fused and kept under the action of the arc for forty-five minutes in carbon dust, was not materially changed as to grayness, and the general character of the metal as to the way in which it worked under the tool was not materially altered. The object of the experiment was to ascertain the maximum amount of carbon iron is capable of taking up under circumstances presumably the most favourable. The result is hardly that which would have been anticipated. Some of the same cast iron was fused for fifteen minutes under lime, which nearly covered it. The character of the fracture of the metal was but little altered by this treatment, when slight differences, due to the rate of cooling, are taken into account. A strong smell of phosphoretted hydrogen or of a phosphide was perceived—probably the latter. This was only observed in the experiment in which lime was used. The lime employed still retains a very offensive odour.

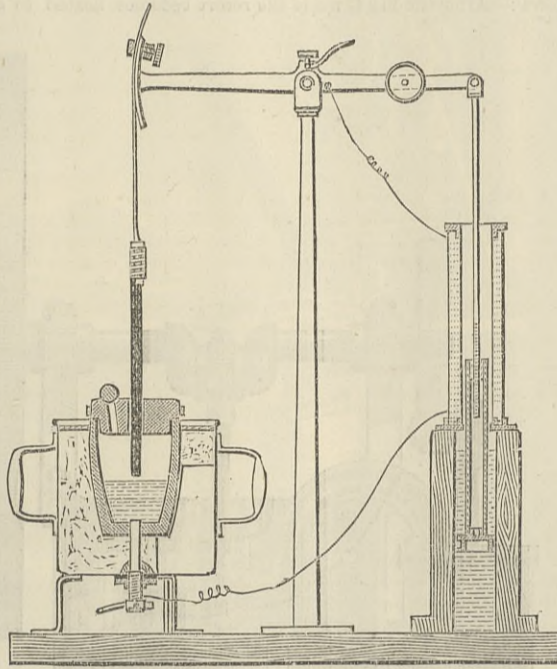
When *spiegeleisen* was fused in a plumbago or a clay crucible graphite separated as the metal cooled.

Siliceous pig iron containing about 10 per cent. silicon was fused by itself, it showed but little change, except that some graphite separated. A similar result was obtained when 5 lb. of the siliceous pig were fused for one hour in carbon dust. On fracturing the ingot obtained, a large quantity of scales of graphite was found in a hollow which traversed nearly the whole length of the ingot at its centre. The fracture of the metal was still that so characteristic of highly siliceous iron, and was practically the same as that of the original pig iron.

A series of experiments was made to determine the maximum amount of carbon pig iron is capable of taking up in the presence of a given quantity of silicon. Gray cast iron and pig iron containing 10 per cent. of silicon were fused together in carbon dust, the ratio between them being varied so as to yield metal with from $\frac{1}{4}$ per cent. to 9 per cent. of silicon.

A similar series was made, only substituting sulphur for silicon. No odour of sulphurous acid was perceived; therefore, presumably, no sulphur was volatilised. This is somewhat remarkable, considering the nature of the experiment. It was thought that investigations of this kind might have an important practical as well as more purely scientific interest—admitting, for the sake of argument, that any such distinction really exists—in assisting to determine the conditions in the blast furnace, &c.

Nickel.—A positive pole of this metal—cast malleable by Wiggin and Co.'s process $\frac{1}{2}$ in. in diameter, was passed through a hole in the bottom of a clay crucible. A carbon negative pole was used, but soon after the commencement of the experiment a deposit of nickel formed on the end of it, so that practically it was a nickel pole. This deposition of metal on the negative pole was also observed with some other metals—notably with tungsten. Whilst disclaiming any special knowledge on the point, Professor Huntington suggested whether this phenomenon—which is the reverse of that generally recognised as taking place—might not depend on the relative volatility of the matter composing the poles. In the furnace arranged as just described, 1 lb. of grain nickel was fused and poured in eight minutes. The fused metal had a brilliant granular fracture. It could not be cut properly in the shaping machine, shearing off under the tool. One pound of grain nickel fused in carbon dust for twenty-five minutes yielded a dark gray carburised metal, which worked well under the tool. On another occasion an equal quantity of nickel, similarly treated, gave a "blowy" metal, which could not be worked. Some carburised nickel, made as described above, was fused in a clay crucible for twelve minutes, and allowed to cool gradually in the furnace; the fracture became whiter, and the grain closer.



Copper.—Three quarters of a pound of copper were fused for about half an hour in carbon dust. On examining the result, it was found that all but about $\frac{1}{2}$ oz. had been vapourised. Those who were present during the experiments suffered no ill effects from the atmosphere charged with copper, which they must have breathed.

Platinum.—Eight pounds of platinum were rendered perfectly liquid in about a quarter of an hour.

Tungsten.—Half a pound of tungsten in powder was subjected to the action of the arc in a clay crucible. Dense fumes were evolved, a cavity about $\frac{1}{4}$ in. across the top being formed. The furnace was allowed to cool down slowly. When the crucible was removed, it was found to have been very much attacked below the point to which the arc extended. The inference is that the crucible had been attacked by the metal at the temperature of the experiment. The metal was fused only to an inappreciable depth beneath the cavity formed by the arc. The unfused metal underneath was covered with very beautiful iridescent crystals of tungsten, which under the microscope appeared to be well-formed prisms. They have not yet been measured. The crystals had evidently been formed by the slow cooling of the vapour distilled down from the surface.

A very large number of experiments was made with tungsten, the results of which showed that it could not be fused, except in very small quantities at a time. It was possible to build up a small ingot by fusing a little of the tungsten, and then adding little by little gradually. Even then the pieces obtained were for the most part spongy and unsatisfactory. The best results arrived at were when tungsten which had already been fused was employed in the building-up process. Once the metal had been fused, it did not fuse much in melting, doubtless owing to the greatly reduced surface exposed.

Tungsten fused in the electric furnace is, when untarnished, pure white, and brittle, the grain being very close. Tungsten hitherto has only been obtained as a gray powder, by reducing the oxide with carbon or hydrogen, or in minute globules in the ordinary small electric arc. Tungsten has its fusing point lowered by the addition to it of carbon. Under these conditions a solid piece of moderate size can, without much difficulty, be obtained. From 1000 grains of powder fused in carbon dust 650 grains were recovered, the remainder having been volatilised, and from 450 grains of the fused metal 410 grains were obtained on refusion. One piece of tungsten which had been treated under the conditions most likely to cause it to be highly carburised was analysed. It contained 1.8 per cent. of carbon. The metal was very white, close in grain, and brittle.

From the foregoing experiments it is clear that the amount of any given metal which can be successfully fused in the electric furnace, and the time required in effecting the fusion, are dependent on (a) the relation between the volatilising point and the fusing point, *i.e.*, the extent to which the volatilising point is higher than the fusing point; (b) the conductivity of the metal for heat.

It thus happens that platinum can be more readily melted than steel, and in greater quantity for a given expenditure of energy.

* See paper on "Nickel and Cobalt," by A. K. Huntington, in July number of the Journal of the Society of Chemical Industry.

This inference is believed by Professor Huntington to be justified by the observations and experiments so far made.

It still remains to examine chemically the specimens referred to in this paper.

In the discussion on the communication made by Professor Huntington, Dr. Siemens remarked that the limit of the temperature producible by means of the electric furnace is as yet unknown, for although the heat would probably increase the resistance of the arc, that in itself would only cause a further development of heat. The results obtained with copper, although apparently pointing to a drawback in the use of the furnace for melting purposes, yet might prove of importance in dealing with metals in the vaporous condition. He could not agree with Professor Huntington's suggestion as to the cause of the deposition of metal on the negative pole. He thought it was due to the negative pole being much cooler than the positive.

Dr. Gladstone inquired whether the deposit was crystalline or in fused globules.

Prof. Huntington replied that it was in the latter condition.

Mr. Terrill (Swansea) remarked that the loss of copper by volatilisation in smelting was much greater than it was generally supposed. During an accidental escape of sulphuretted hydrogen in the works he had observed a thick deposit of sulphide of copper extending over a large area. He had detected copper deposited even on the zinc counter of the refreshment bar at the railway station some distance from the works. The discussion was continued by Mr. Maxwell Lyte, Prof. Vernon Harcourt, and the president, Prof. Liveing, who thought that such experiments as had been made might be of great service in the study of metals.

EMERY IN THE UNITED STATES.—In our last impression we stated on the authority of the *American Manufacturer* that emery had been found in Lehigh County. There is reason to believe that the statement is not accurate, and that the prospectors have mistaken magnetic iron ore for emery.

A NEW TELEPHONE.—It is well known to be advantageous to utilise both poles of a magnet in the telephone. How should the wire be placed, relatively to the magnet, to give the best effect? is an important question. M. D'Arsonval has lately become convinced by experiment that in the two-pole telephones—as those of Gower, Siemens, Ader, &c.—the really active part of the wire is that lodged between the magnetic poles. The rest of the wire may be regarded as mere useless resistance. The point, then, is to have the whole coil between the poles. M. d'Arsonval accordingly makes a telephone with a bent bar magnet, one pole of which terminates in a short cylindrical piece, with a coil round it, while the other terminates in a ring piece surrounding the coil. These two poles are in the same plane and very near the plate. The complete instrument is very light, yet it is said to transmit the voice with extreme distinctness, and with such force that, if a trumpet mouthpiece be added, one can easily hear throughout a room.

ROYAL COMMISSION ON TECHNICAL INSTRUCTION.—The members of this Commission have not been idle during the past month. Considerable progress has been made in the collation and arrangement of the vast amount of information collected by the Commissioners during their visit to France, Germany, Austria, Switzerland, and Italy. They have recently been engaged in pursuing their investigations here and abroad. Professor Roscoe and Mr. Swire Smith are occupied in reporting on the industry and schools in the neighbourhood of Kendal and Barrow. Mr. Woodall, M.P., and Mr. Redgrave are at present travelling in the Black Forest, where they are collecting information with respect to the native home industries of the district, principally with the view of ascertaining if similar industries, under necessarily altered circumstances, might advantageously be introduced into any part of the United Kingdom. Mr. B. Samuelson, M.P., and Mr. Philip Magnus have been spending some little time in Ireland, where they have been instituting inquiries into the possibility of improving the material condition of the labouring classes by the establishment of trade schools, and the introduction of new means of livelihood among the agriculturists of the poorer districts of the country.

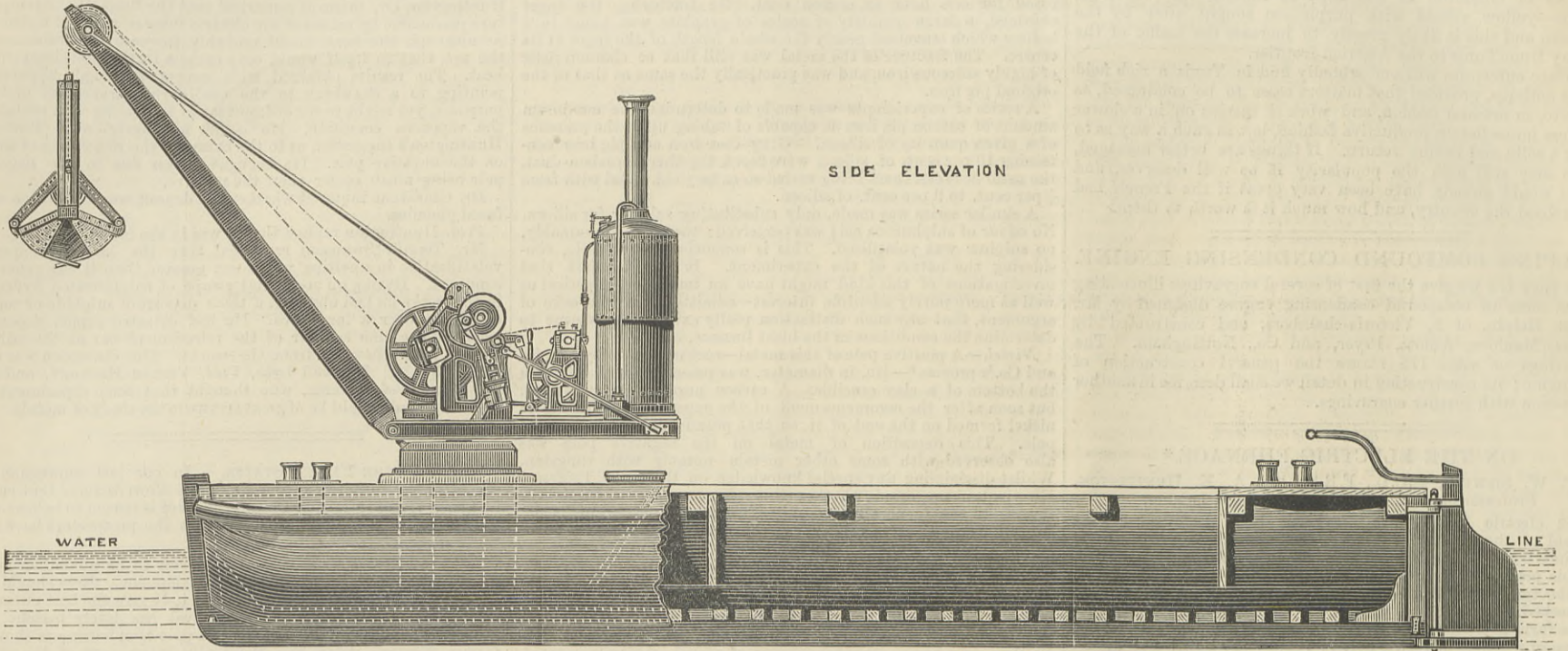
BORING OPERATIONS WITH BORT.—A correspondent of the *Times* writes:—"In the course of some boring operations, which have recently been carried on by the Government of the Cape of Good Hope in the search for coal, it occurred to the geologist in charge to make trial of native bort in lieu of the Brazilian carbonado, which had, until then, been employed. The experiment proved a complete success. The last six crowns used were of 3 in. diameter, set with bort. It was found that these bored through 1100 ft. of sandstone and shale, part of it exceedingly hard, being indurated by contact with intrusive rock. The average boring per crown was therefore 183 ft., and the last crown is nearly as good as new. Of the above six crowns, one bored through 322 ft. 7 in. and was still usable; while another bored through 350 ft. In precisely the same class of country, eight crowns supplied from London and set with carbonado, bored only 30 ft. each. The boring effected with the latter cost at the rate of 27s. 6d. per foot; while the work done with bort, in the same class of rock, cost less than 2s. per foot bored. The advantage in the use of bort is increased by the fact that, owing to the greater depth bored by a single crown, there is less delay caused by the resetting of the stones. Great care is, however, necessary in the selection of bort for the purpose, as a very large percentage of the ordinary bort of commerce is unsuitable." Bort, we may explain, is a form of the diamond, black in colour, very imperfectly crystalline, and unsaleable for ornamental use.

AN AMERICAN EXPRESS TRAIN.—A train of new cars for the fast New York express line has just been completed at the Allston shops of the Boston and Albany Railroad, under the supervision of Mr. F. D. Adams, the master car-builder. The train consists of a baggage car, smoker, two passenger coaches, and two parlour cars, and will be drawn by a new engine, also built by the Boston and Albany Company. The exterior of the cars is painted olive, and the marking is in plain but handsome letters. The interior finish of the smoker is mahogany; of the coaches and drawing-rooms, ash and cherry, with bronze trimmings, racks, and lamp fixtures. The seats in the smoker are of rattan; in the coaches of dark drab leather, and in the drawing-room cars of rattan with dark drab leather cushions and head-rests. The cars are lighted by full-length windows, which are provided with spring-roller shades. There are eight lamps in each car in handsomely ornamented chandeliers. The floor of the drawing-room cars is covered with Wilton carpeting, and a strip of carpet is laid in the aisles of the passenger coaches. The whole aspect of the interior finish and furnishing of the cars is light, airy, and pleasing to the eye. There are thirty-three seats in each drawing-room car and sixty-eight in the others. One of the novelties in arrangement of the drawing-room is that the whole car, except, of course, the saloon, wash-room, and stove-room, is in one open apartment. Instead of the ordinary compartment there are four seats, similar to those in a sleeper, at one corner of the car. These are for the convenience of a card party, or a party of friends who may wish to sit close together. They can also be turned into a bed, the bedding being always kept ready, and shut out from the rest of the car by heavy draperies, so that a sick person can be carried comfortably and in seclusion. The weight of each car is about 45,000 lb. The body being comparatively light, 27,000 lb., the great weight is near the rail, thus adding to the element of safety. The pair of trucks weigh, in round numbers, 18,000 lb. The wheels are of paper, 42 in. in diameter, which is 9 in. more than the standard. The journals are $\frac{3}{4}$ in. in diameter and 7 in. long. The engine was built under the supervision of Mr. A. B. Underhill, superintendent of motive power. The boiler is made of steel, $\frac{1}{4}$ in. thick, instead of $\frac{1}{2}$ in. iron, which is commonly put into locomotives. There are 221 tubes instead of 160, the usual number. The boiler is tested at 400 lb. of steam, and will be run at 160 lb. pressure. The train is equipped with the Westinghouse automatic brake.—*Boston Advertiser.*

* Read before Section B of the British Association at Southampton.

ONE-TON BUCKET DREDGER.

MESSRS. ROSE, DOWNS, AND THOMPSON, HULL, ENGINEERS.

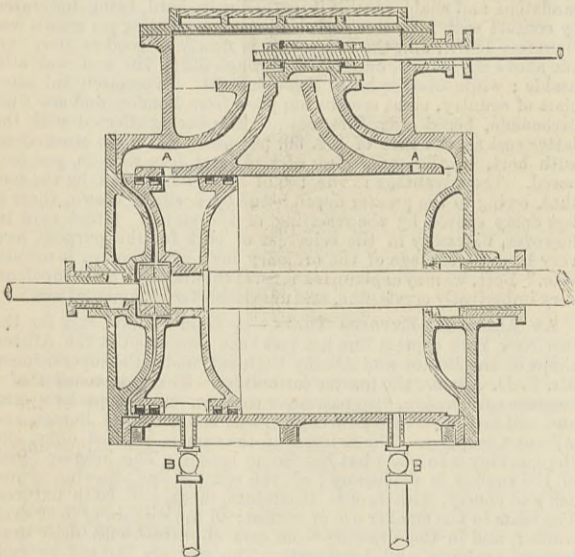


We illustrate above a dredger of simple construction, well calculated for doing useful work on shallow streams. The barge is 54ft. long, 22ft. beam, and 6ft. deep. Her draught of water is under 4ft.

Our drawing explains itself. It will be seen that we have here a swivelling crane and grab bucket, and that the stuff dredged can be loaded into the barge and conveyed where necessary. The lifting power of the crane is one ton, and in suitable material such a dredger can get through a great deal of work in a comparatively short time.

GEOGHEGAN AND STURGEON'S PATENT PISTON.

The accompanying engraving illustrates a piston now being introduced by Mr. T. Sturgeon, of Westminster-chambers. The object had in view is to jacket the piston and also use it as a heater to raise the temperature of the cylinder. This object it is claimed is fully accomplished by the use of a divided piston with an arrangement for admitting live steam into the wide space between the two sets of rings, so that the steam is brought into direct contact with the interior surface of the cylinder, which it heats in advance of the incoming and expanding steam. This body of live steam, carried along between the walls of the piston, and in direct contact with the inner surface of the cylinder, will, it is urged by the inventor, heat the cylinder far more effectively than the external jacket could do, and will also present a hot surface of the piston to the steam, while the exhaust is not interfered with or acted upon by the hot steam except the part immediately in front of the piston. The breadth of the piston rings will prevent the live steam coming in direct contact with the cylinder at the extreme end of the stroke, but this little portion has the same chance of being heated by conduction as in



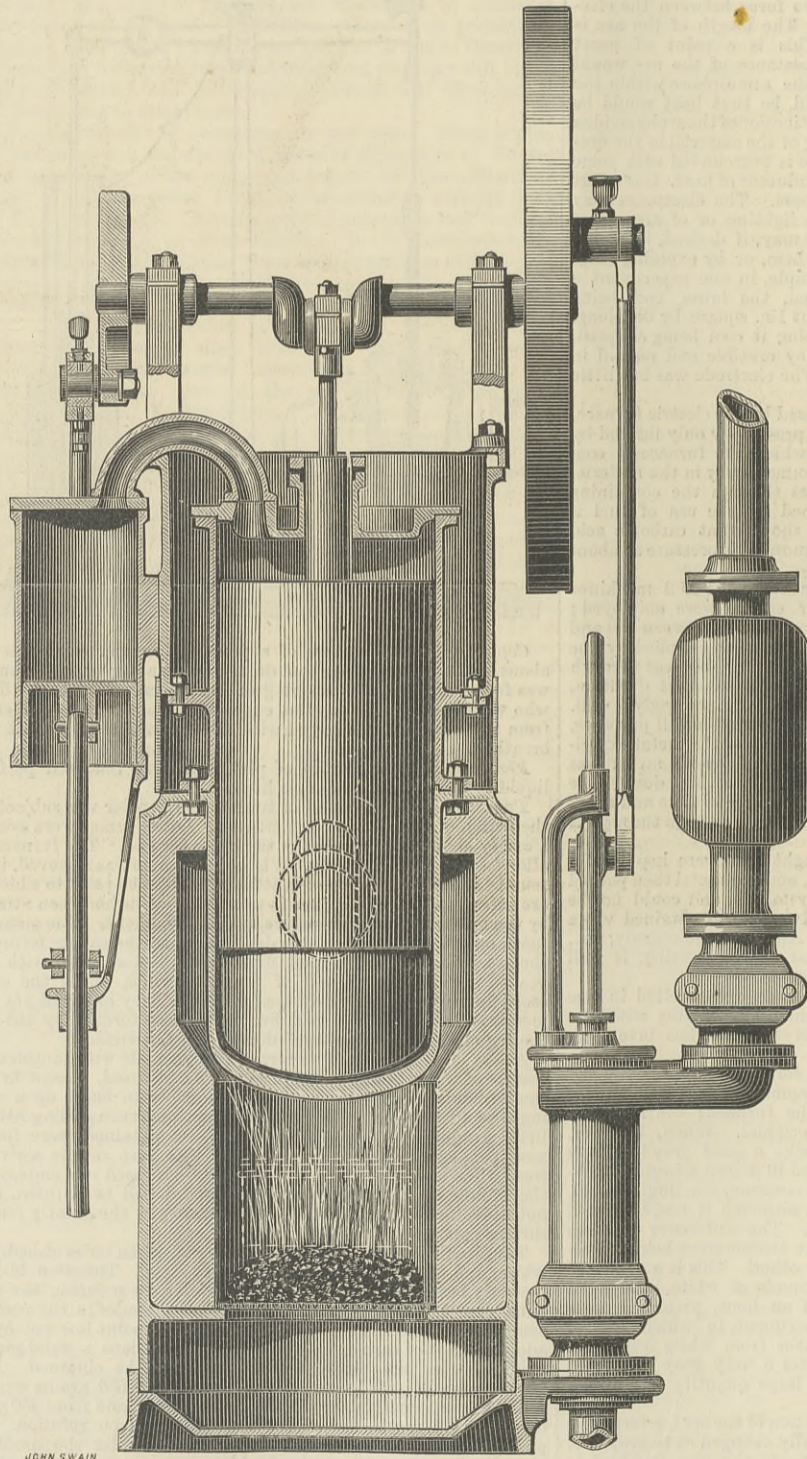
the case of the external jacket, while it has the additional advantage of the heated surface of the piston presented to the, at first, thin body of entering steam. Moreover, the advantage of the hot steam will be of more importance later on in the stroke, where expansion begins. It might at first appear that this arrangement of piston would involve a longer cylinder, but this is avoided by the arrangement shown in the illustration, in which only the chase of the cylinder is lengthened, and the cover recessed to the form of the piston, so that the length in the centre, from gland to gland or boss to gland, remains unaltered. In the engraving A A are small holes drilled through from the cylinder into the steam ports in such a position that, when the piston is at the end of its stroke, and the steam port open, the live steam may pass into the interior of the piston, and thus enable it to recover at the end of each stroke whatever it may have lost by condensation during the stroke; and B B are drain cocks. These are so placed as to enable them to drain the interior of the piston when at the end of its stroke.

BAILEY'S VERTICAL HOT AIR ENGINES.

The "vertical" hot air engines, it will be observed, differ from hot air engines that have already been introduced into the market in the arrangement of the cylinders. The air cylinder is placed outside the casing, offering thereby greater facilities for

cleansing and lubricating, also for examining the different parts. This cylinder is fitted with a metallic piston, and the shape of the cylinder enables this type of engine to be made as compact as possible. The action of the engine may be described as follows:—After the fire is made the retort becomes heated to a

through any defect in packing; so that it will be seen that not only is it automatic in receiving the proper supply of air for expansion, but it is also automatic in its lubrication, for wherever this down stroke is made a small amount of oil is drawn into the cylinder for lubricating the metallic piston. The manufacturers claim in this type of hot air engine that the design admits of the engine being made much cheaper, as well as affording great facilities for examining, lubricating, and repairing, than is the case with any other hot air engine. It is being made in considerable numbers by Messrs. Bailey and Co., Salford.



dull red heat. This rise of temperature expands the small amount of air inside, which then forces the piston in the air cylinder downwards. After this expanded air has done duty, the displacer, which is actuated from the crank, forces the air which has been condensed against the cold sides of the top part of the cylinder back to the hot end of the retort. As the piston performs its stroke, due to the expanded air in the cylinder, a small air valve is kept closed by the pressure, but as the piston makes the return stroke a small valve on the top of the cylinder opens for a sufficient length of time to permit air to enter the cylinder to replace any which has been permitted to escape

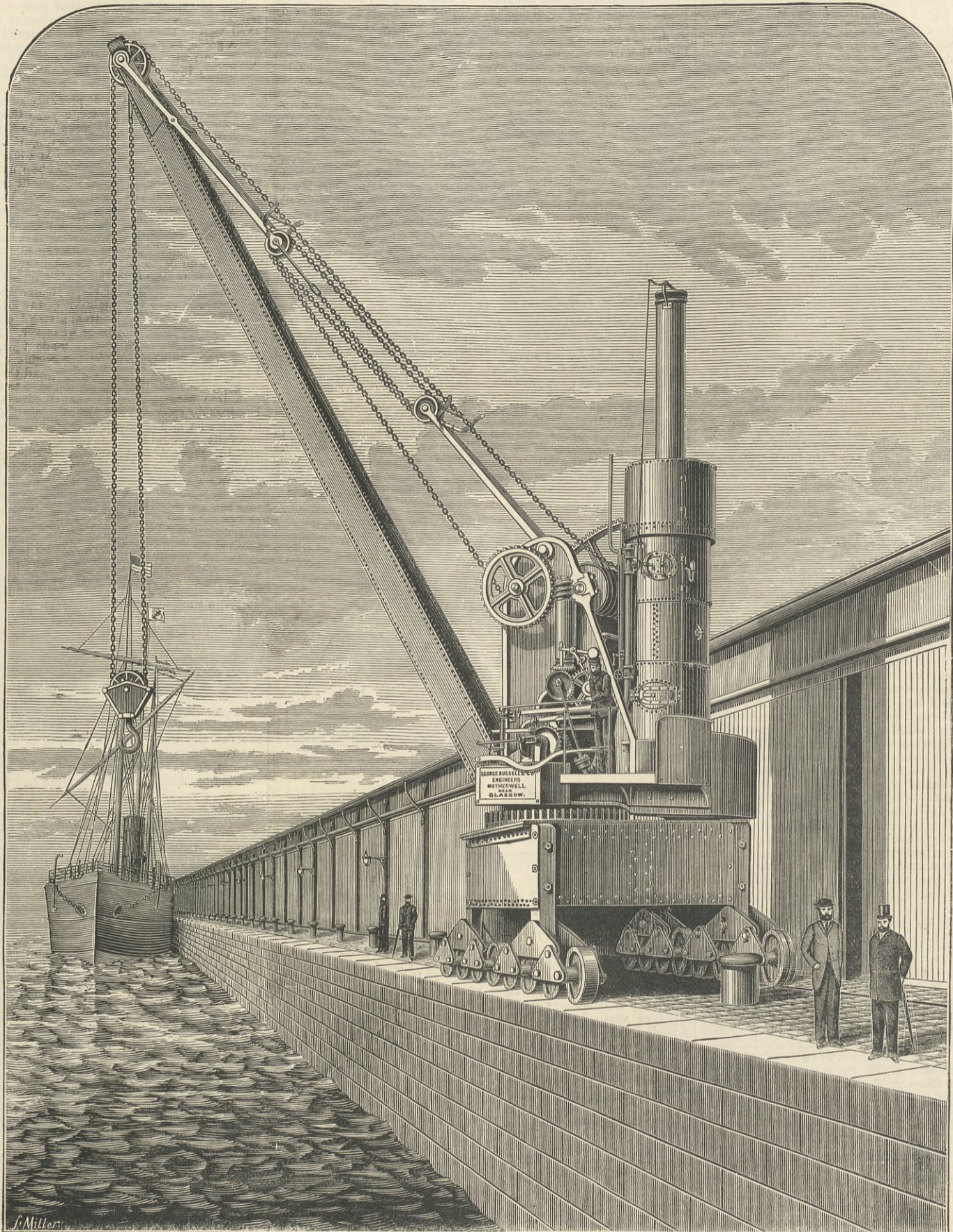
of which is numbered and labelled. When distributed it slides through by gravitation and falls into the pouches on the other side. In the rear section there are 500 boxes of uniform size, arranged in a semicircle for distributing letters. Each of the cars is lighted by ten polished brass Argand lamps, and heated by Baker heaters. The carriages and under gear are painted black and light brown. Loughridge air brakes are attached to each car. The five will soon be finished, when three more will be commenced for service between Baltimore and Chicago. The white and blue coats of the cars have a very pleasing effect in their new state, but railroad men think the colour will not remain so bright after a short season on the road.—Baltimore Sun.

WEIGHT OF A MILLION DOLLARS.—Mr. E. B. Elliott, the Government actuary, has computed the weight of a million dollars in gold and silver coin, as follows:—The standard gold dollar of the United States contains of gold of nine-tenths fineness, 25.8 grains, and the standard silver dollar contains of silver of nine-tenths fineness, 412.5 grains. One million standard gold dollars, consequently, weigh 25,800,000 grains, or 53,750 oz. troy, or 4479½ lb. troy of 5760 grains each, or 3685.71 lb. avoirdupois of 7000 grains each, or 1 843-1000 "short" tons of 2000 lb. avoirdupois each, or 1 645-1000 "long" tons of 2240 lb. avoirdupois each. One million standard silver dollars weigh 412,500,000 grains, or 859,375 oz. troy, or 71,614.58 lb. troy, or 58,928.57 lb. avoirdupois, or 29 464-1000 "short" tons of 2000 lb. avoirdupois each, or 26 307-1000 "long" tons of 2240 lb. avoirdupois each. In round numbers the following table represents the weight of a million dollars in the coins named: Standard gold coin, 1½ tons; standard silver coin, 26½ tons; subsidiary silver coin, 25 tons; minor coin, five-cent nickel, 100 tons.

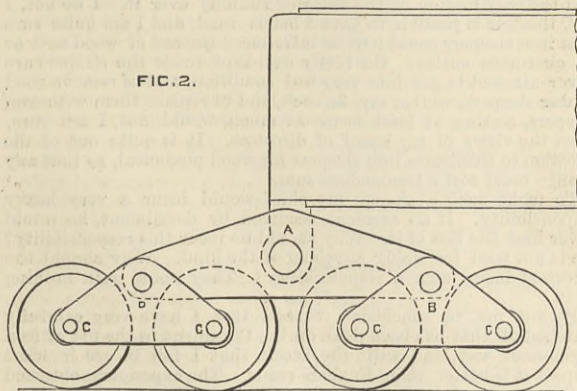
AMERICAN POST-OFFICE CARS.—Five new railway post-office cars, for the first mail service on the Baltimore and Ohio Railroad, between Baltimore and St. Louis, are now being completed at the Mount Clare shops. The cars are built by the company upon designs furnished by the Government, and are unique specimens of their kind. The exterior of the cars is white, with ultramarine blue borders and gold lettering. They are numbered from one to five, and are inscribed on the sides, "Baltimore—Fast Mail—St. Louis," and "United States Post-office." In the interior the cars are finished in ash and cherry, oiled to show the natural grain. The ceilings are white. The forward section is fitted with stalls for mail bags. The centre is taken up with a series of eighty inclined shutles for distributing newspapers. The matter for distribution is placed upon a long table in front of the shutles, each

20-TON PORTABLE STEAM CRANE, GLASGOW HARBOUR.

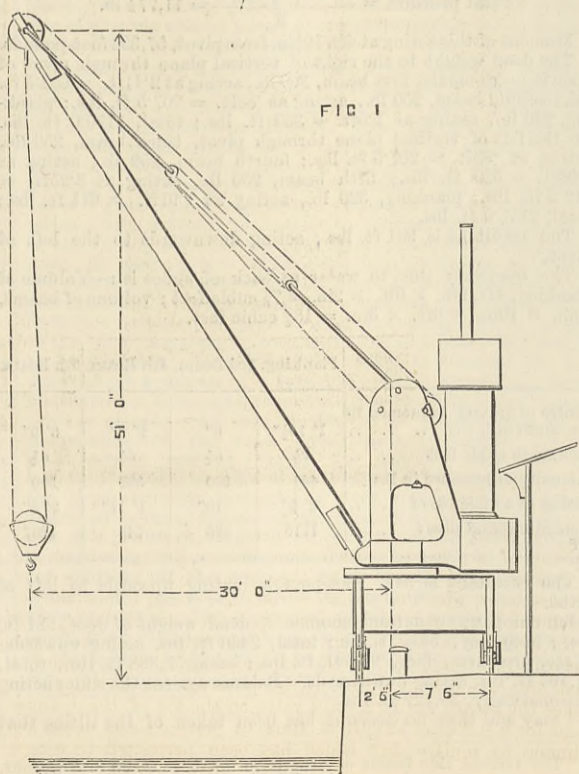
MESSRS. GEORGE RUSSELL AND CO., MOTHERWELL, NEAR GLASGOW, ENGINEERS.



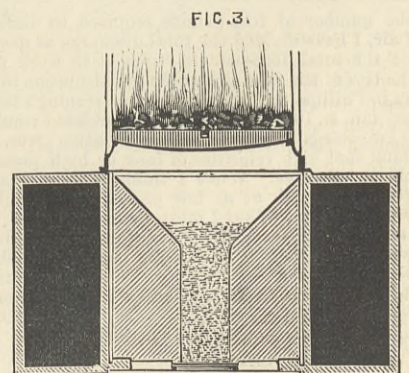
THE very fine crane which we illustrate above, has been erected on the Stobercross Wharf, near Queen's Dock, for the service of Messrs. Henderson Brothers' Anchor Line steamers. For some years four cranes have been in use for loading and discharging these vessels, two of which have a lifting power of 5 tons, and two of 3 tons, at a radius of 30ft. It was found with these cranes, that although quite competent for nearly all the work required, there occasionally were pieces above their lifting capa-



city, which necessitated removing the steamer to another part of the harbour to get the use of one of the fixed public cranes. In order to obviate this inconvenience, the crane we illustrate was constructed by Messrs. George Russell and Co., of Motherwell, near Glasgow. Its leading features are patented by Mr. Russell, of that firm, by whom this special crane has been designed. Fig. 1 shows an outline of the crane, and the extremely limited space between the edge of quay wall and sheds. The gauge of the wheels



is 10ft. centre to centre, but in order to clear the eaves of the shed the central post is only 2ft. 6in. from the centre of the outside wheels. In order to distribute the weight equally on the quay wall and grooved rail near the shed, eight supporting wheels are fitted on each side of the carriage. Fig. 2 is an elevation of a corner of the carriage, showing the wheels and levers for distributing the weight equally. There are on each corner a pair of main levers with fulcrum A, at each end of these



are fulcra B B, with shorter levers carrying the axle pins of the wheels C C C C. The levers being free to adjust themselves, it will be evident that the pressure at A is equally distributed over the four wheels, notwithstanding any irregularities in the quay surface. The outer wheels bear directly on the granite kerb, and the inner in a grooved rail. The carriage is of malleable iron plates 1½in. thick, 4ft. deep; the eight wheels on each side being 3ft. centre to centre, give a wheel base of 21ft. The central post is of malleable iron 2ft. diameter; the jib is 50ft.

long, of malleable iron plates of box section, and its radius is variable by steam; the chain barrel is 2ft. 3in. diameter, screw grooved for the chain, and there are double and single purchase gears. The engines have a pair of 9in. cylinders by 13in. stroke, with steel link motion. The boiler is vertical, with three cross tubes, and a large cylindrical feed-water tank is placed above it, through which the heat passes to the chimney; the exhaust steam is also led into it. Fig. 3 shows a section of the combined ash-box and balance weight; the ashes drop from the fire-bars into a conical space terminating in a door at the bottom; when this door is opened the ashes are at once emptied into any convenient receptacle. The crane is moved along the quay by gearing fitted under the carriage, grasping by means of a capped pulley a pitch chain made fast to any of the mooring blocks. The maximum working load is 20 tons at a radius of 30ft., and 16 tons at 35ft. Besides ordinary lifts, it is fitted with tipping gear for lifting coal wagons, and will shortly be used for coaling the vessels. The crane weighs 103 tons, and there are about 12 tons of iron ballast in the tank under the boiler, and 35 tons in the land side of the carriage; so that the total weight is 150 tons. Although of such large capacity it is found to work with extreme ease under control of one man.

This is a very favourable example of thoughtful designing, the conditions under which the crane has to work being very exceptional. Messrs. Russell's reputation is an ample guarantee for the quality of the material and workmanship.

LETTERS TO THE EDITOR.

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

FAN TRIALS AT READING.

SIR,—I was surprised to see in your last week's paper a letter from Mr. E. O. Greening, on the competitive trials of harvest fans, also at the conclusions he had come to from the figures given in yours of July 28th. You then said you had been able to take the figures by the courtesy of the judges, that you were only able to go briefly into the matter, but purposed to return to it again. This I understood to be after the judges had given their award.

I was, therefore, surprised that he being one of the competitors should appear in print before the judges' report came out, and also that he should arrive at such conclusions. I have no doubt you would have noticed the errors in the table—if you have not done so—and have corrected them when you were able to go into the subject. But as Mr. Greening's conclusions may be an injustice to others, I hope you will favour me with space for a few lines.

As you say, further trials should have been made, and of course were made; but when Mr. Greening produced his figures I again examined your table, and I have come to the conclusion that there was something wrong with the dynamometer, also there are one or two errors in the air column.

With reference to the dynamometer we will take the two trials of Mr. Phillips' common hand fan. In the first trial it was driven at 400 revolutions or 2512ft. at tips of fan. The water column was 0.47in., and on the dynamometer lever was 4 lb. when the fan was working closed, and 6 lb. when working open and discharging air—giving 4592 foot-pounds, and 6888 foot-pounds work done respectively—or an increase of about 50 per cent. in the latter case.

Now, taking the next trial of this same fan run at 600 revolutions, or an increase of velocity of 50 per cent. and an increase of column of 100 per cent. or resistance, yet we have only 4.25in. on the dynamometer lever when working closed, or an increase of weight of 6 per cent.; but we have 15in. when working open, or 250 per cent. more than when working closed. Of course all this cannot be accounted by any unsuitableness of the fan to pass the 50 per cent. extra air; and from this case and some others, I have come to the conclusion the dynamometer was not properly adjusted for this first trial.

Going into Mr. Greening's argument that small fans and high pressure of air or great velocity of fans are best for this purpose, take first Mr. Greening's small hand fan. The velocity at the tips was 6784ft. per minute. Mr. Phillips' velocity was 3768ft. per minute, or nearly 50 per cent. less in speed. Mr. Greening's gives a column of 1.3in., and Mr. Phillips' 0.95in., or only 25 per cent. Then the dynamometer has 9 lb. on the lever for Mr. Greening's trial, and 4.25 lb. for Mr. Phillips'. Thus Mr. Greening takes twice the power and only gets 1.3in. of column of water to Mr. Phillips' 0.95in. This does not prove Mr. Greening's conclusions.

But in further figures of the table referred to he has not got the correct figures. In the column giving the quantity of air discharged by calculation, Mr. Greening's small fan has a discharge of 1445 cubic feet per minute. But taking the area of $\frac{1}{2}$ dia. = 30 square inches, and the velocity given as 984ft., we find the cubic feet of air discharged to be 208ft., and agreeing very nearly with the result given by air meter. Take again the next recorded trial of Mr. Greening's fan. The area of discharge is given at 64 square inches, the velocity at 2858ft. per minute, giving 1270 cubic feet per minute instead of 2631 cubic feet, as given in the table. The column by air meter gives 1237 cubic feet. Mr. Greening having taken the larger figures, may come to the conclusions he has respecting small fans being most suitable.

If we take the usual formula and apply it to the figures giving the velocity of the tips of the fans and the inches of water column, we get results as given below:—

	Velocity of fan tips.	Water column.	H.P. required by fan.	Total ft. lb. required by fan.	Ft. lb. required to discharge 1c. ft. of air
Mr. Phillips	3760	0.95in.	0.196	6468	61lb.
Mr. Greening	6784	1.3in.	0.27	8910	421lb.

To obtain the number of foot-pounds required to discharge one cubic foot of air, I have divided the total discharge as measured by air meter into the total foot-pounds required to work fan. The velocity of the tips of the fans also ought by calculation to raise the water column in Phillips' fan 1.08in., and in Greening's fan 3.57in.; thus Phillips' fan is 10 per cent. below calculated results, while Greening's is two-thirds below what the calculation gives.

I do not think that high velocities of fans or high pressures will be economical or effective. What I think is wanted is to get as much air through the stack at as low pressure as possible, and as economically as possible. What I mean by low pressure is, not to have the exhausting power such as to cause quick passage of the air in the stack, but to draw from more than one place, and so get a large volume of air at a low velocity. This will cause the air passing to be of greater effect, and allow it to permeate more thoroughly in the stack.
JNO. HODGSON.
118, Commercial-street, Newport, Mon., Sept. 6th.

SIR,—With reference to Mr. E. Owen Greening's letter in your last issue, as I am still in competition for the hundred guinea prize I cannot fairly, at the present moment, enter into details as to his statement, although I must state that some of his figures, with regard to my improved harvest fan, are seriously erroneous; and I venture to remark that it would have been wiser policy on the part of Mr. Greening to wait until the judges' award and report had been published before endeavouring to prove results which the judges themselves will no doubt do in an exhaustive manner in due course.
NEWPORT, MON., SEPTEMBER 6TH.

SEWAGE AND AIR.

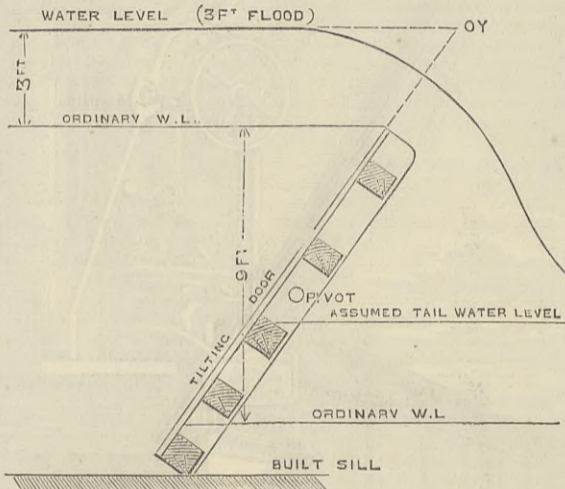
SIR,—Those interested in the subject of the disposal of sewage will feel greatly obliged to Mr. Hughes for his letter in your last impression. As regards the immediate point, however, to which my previous letters have called attention, the information given by Mr. Hughes leaves us pretty much where we were. He states that in the case cited by him the result of separating the urine from the fœces has been successful; but it appears that in that instance no covering material was used. The large number of men using the latrine no doubt gave rise to constant fresh deposits, which, covering those below them, remained innocuous for a period of some hours. Certainly, a walk recently through a narrow lane which appeared to be the resort for natural purposes of the builders' men engaged in the neighbourhood, did not serve to prove to me that drying fœces unmixd with urine was productive of no offence. It does not seem to me, therefore, that my hypothesis as to reactionary principle is as yet shaken by the evidence afforded by your correspondents.

In such an instance as that referred to by Mr. Hughes, separation of urine may be effected; but we know that it cannot be so when closets are indiscriminately used, as in the generality of households. For municipal purposes, therefore, the principle could not be carried out, and need scarcely be discussed, and further information as to the conditions of the matters removed from the latrine when separation was effected, would enable those who are interested in this question to form more conclusive opinions.
St. James's-street, S.W., September 4th. A. F.

WISWALL'S TILTING WEIR.

SIR,—With reference to a paper in your last issue on "New Sluices in course of Erection on the River Irwell, near Manchester," Mr. Wiswall, C.E., says, page 153, "the gates retain their inclined position until the water of the river rises to 2ft. 9in. above its ordinary level, when they automatically tilt and release the impounded water."

I cannot see how these gates would be automatic with a flood of 3ft. say. Having calculated approximately what the effect would be, I find they would not be self-acting; but I may be wrong in this, and if Mr. Wiswall would indicate the method by which he has arrived at that result, he would confer a great benefit on your readers, considering the importance of the subject. I have appended the figures by which I have arrived at this conclusion:—



Assume that a flood of 3ft. causes the tail water to rise to a similar amount, and that the difference in the water levels is 9ft. Let y = breadth of door, say = 9ft.; x_2 = depth below water level of top of door = 3.7ft.; x_1 = depth below water level of bottom of door = 16.5ft.; θ = angle at which sluice door stands = $54^\circ 40'$; O Y = axis at intersection of water level and production of plane of sluice door; oak beams at 50 lb., and pine planking at 40 lb. per cubic foot; weight of beam, 10in. by 10in. by 7ft. long, say 5 cubic feet = 250 lb.; weight of 2in. planking to the right of vertical plane through pivot 5.25ft. by 7ft. wide, say 6 cubic feet = 240 lb.; weight of 2in. planking to the left of vertical plane through pivot 6.75ft. by 7ft., say 8 cubic feet = 320 lb.*

The water pressure on the face of the door will be found thus:—
Distance from O Y of the centre of pressure $= \frac{2}{3} \frac{x_1^3 - x_2^3}{x_1^2 - x_2^2} = \frac{2}{3} \times \frac{4441}{259} = 11.47$ ft.
Mean intensity of pressure $= \frac{62.4}{2} (x_1 + x_2) \sin. \theta = 513.5$ lb.

Area of surface $= (x_1 - x_2) y = 115.2$ square feet.
Total pressure $= \frac{62.4}{2} (x_1^2 - x_2^2) y \sin. \theta = 59,155$ lb.

Moment of this acting at 1ft. 8in. from pivot = 98,591 foot-pounds, and on the back of the door $x_1^1 = 5$ ft. 2in., $x_2^1 = 0$. Distance from tail water level to centre of pressure $= \frac{2}{3} x_1^1 = 3$ ft. 5in.

Total pressure $= \frac{62.4}{2} x_1^2 y \sin. \theta = 11,774$ lb.

Moment of this acting at 4ft. 10in. from pivot, 57,398 foot-pounds. The dead weight to the right of vertical plane through pivot of door is:—Moments, first beam, 250 lb., acting at 2.41ft. = 602.5 ft. lbs.; second beam, 250 lb., acting at .83ft. = 207.5 ft. lbs.; planking, 240 lb., acting at 1.5ft. = 360 ft. lbs.; total, 1170.0 ft. lbs. To the left of vertical plane through pivot, third beam, 250 lb., acting at .83ft. = 207.5 ft. lbs.; fourth beam, 250 lb., acting at 2.08ft. = 520 ft. lbs.; fifth beam, 250 lb., acting at 3.25ft. = 812.5 ft. lbs.; planking, 320 lb., acting at 1.91ft. = 611 ft. lbs.; total, 2151.0 ft. lbs.

The resultant is 981 ft. lbs., acting downwards to the left of pivot.

The buoyancy due to water at back of sluice is:—Volume of planking, 4ft. 9in. \times 9ft. \times 2in. = $7\frac{1}{2}$ cubic feet; volume of beams, 10in. \times 10in. \times 9ft. \times 3in. = $18\frac{3}{4}$ cubic feet.

	Planking.	3rd Beam.	4th Beam.	5th Beam.
Centre of gravity immersed to a depth of	1' 10 $\frac{1}{2}$ "	6"	2' 2"	3' 9"
Volume in cubic feet	7 $\frac{1}{2}$	6 $\frac{1}{4}$	6 $\frac{1}{4}$	6 $\frac{1}{4}$
Intensity of pressure in lbs.	444	390	390	390
Acting at a distance of	2' 6"	10"	1' 11"	3' 3"
Moments round pivot	1110	325	745	1267

The resultant is 3447 foot-pounds acting upwards to left of pivot.

Summing up—resultant moments, dead weight of door, 981 ft. lbs.; buoyancy, 3447 ft. lbs.; total, 2466 ft. lbs. acting upwards. Water pressures, face, 98,591 ft. lbs.; back, 57,398 ft. lbs.; total, 41,193 ft. lbs. acting downwards. Balance against the sluice acting automatically, 38,727 ft. lbs.

I may add that no account has been taken of the silting that

* The vertical side beams of door have not been taken into account, as they are practically balanced on pivot.

would take place, and of the fact that in a short time the timber would become waterlogged, both of which would act powerfully against its tilting.

WILLIAM T. OLIVE,
Didsbury, September 5th. Assoc. M. Inst. C.E.

EARLE'S SHIPBUILDING AND ENGINEERING COMPANY.

SIR,—I regret very much that your correspondent who accompanied the members of the Institution of Mechanical Engineers on their visit to Hull, should have wandered through our works without a guide, as he would then have avoided publishing what is not quite correct, and he might possibly have felt a little more charitably towards us than he shows by his account of our engine shops.

All our engines are not precisely of one type, as, in various stages of erection, there were, beyond those noticed by your correspondent, two sets of twin screw engines and a single screw engine without "cast iron pipes supporting the cylinders." I rejoice to find he owns "the workmanship is sound and strong," but since there was no single engine in the shop finished, and only one even approaching that stage, it is hardly fair criticism to say "but not of high finish." We were sorry not to have had some finished engines in our shops to show the visitors, but circumstances had compelled us to take down three sets of engines to fit into ships which were awaiting them only shortly before.

It is not our general practice to make the crank shaft bearings of cast iron with white metal liners, although we have the example of some of the most eminent of Clyde builders to follow in doing so. Those your correspondent saw were made so at the special request of the engineer of the firm for whom the engines were building, and so far from giving trouble at sea, the reverse is the case, for they give none whatever. I may mention that the first ship so fitted by us has made upwards of eight voyages to New York and back, and the engineer reports—"I have never known the chill off the bearings, and they give us every satisfaction." The engineer of the sister ship to the one with which these cast iron bearings are to be fitted reports—"The crank shaft bearings do splendidly. I have never had occasion to use a drop of water on any of them." If your correspondent had examined carefully he would have found "very adequate means" were provided to prevent the brasses from turning. He is also equally mistaken in supposing that for "the sake of saving a few sovereigns" we run any risk of damaging our reputation or of losing a ship. He is likewise equally wrong in his statement as to the cylinders he saw being "ruined in less than three years by the injurious action of the steam."

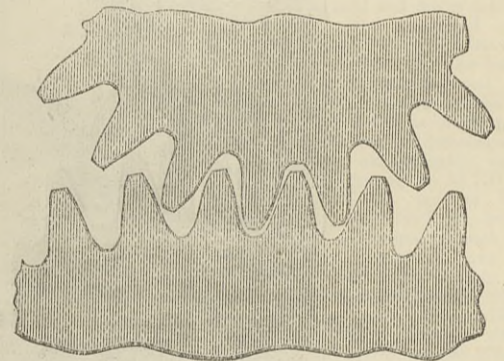
Again, Sir, I assure you of the regret I feel that your correspondent did not have a guide who could give him proper information, and thus have prevented the necessity—which is painful to me—of contradicting so much of his account. I also regret that, being absent from home, I have not had his statement under my notice in time to answer before.

A. E. SEATON,
Chief Engineer of Earle's Shipbuilding and Engineering Company.
Hull, Sept. 6th.

TOOTHED GEARING.

SIR,—I enclose you a rubbing of part of toothed wheel and pinion I have in use here. I read with great interest your remarks on wheel teeth in this week's number on p. 152.

The advantages of this system are:—(1) Great strength at the roots of the teeth; (2) three teeth in contact; (3) the motion of one tooth on another is a rolling one, and the whole surface of contact, in this case the whole tooth, is equally rolled over, as may be tried by cutting out the diagram and turning round as in actual



use; (4) impossibility of bedding the teeth too deeply—in fact they work with just clearance; (5) owing to this their tendency is to clean themselves; (6) quietness in work; when a heavy cut is on they are almost silent. I shall be pleased to hear opinions of them. Any further information is at your service.

W. T. FARQUHAR,
Pitscandly, Forfar, N.B., September 5th.

THE IMPROVEMENT OF PERMANENT WAY.

SIR,—I, and I am sure many others, have read with attention and carefully considered the article on permanent way which appeared in your last impression. In it you blame railway men for not doing something, precisely what you do not indicate, to improve permanent way. Will you, with your invariable fairness to both sides in a controversy, permit me to point out very succinctly that there is another side to the whole question?

I understand you to advocate the use of iron permanent way in lieu of wood. May I ask what I should, for one, gain by the exchange? The section of road of which I have charge is now, and has been from the beginning years ago, in excellent condition, although it has to stand a very fast and heavy traffic. I do not believe it would be possible to make a better road, as is proved by the small consumption of coal by the engines hauling trains on it, and the easy motion of the vehicles running over it. I do not, I say, think it is possible to have a better road, and I am quite sure that iron sleepers could not be introduced instead of wood save at an enormous outlay. On really well-kept roads the sleepers are never allowed to get into very bad condition, and to remove good timber sleepers, worth, say, 3s. each, and to replace them with iron sleepers, costing at least twice as much, would not, I am sure, meet the views of my board of directors. It is quite out of the question to substitute iron sleepers for wood piecemeal, so that any change must cost a tremendous sum.

To make such a change my chief would incur a very heavy responsibility. If an accident occurred by derailment, he would never hear the last of it. Why should he incur this responsibility? He is not paid for doing anything of the kind. Why should the directors incur such a responsibility? They would gain nothing by it.

Permit me, in conclusion, to add that I have very carefully watched all that has been done on the Continent in the use of iron permanent way, and with the result that I fail to see in what respect it is better than English roads. The experience obtained with it in Germany, for example, is quite useless in this country, for the speeds are so much slower. If any of your readers could stand beside me, and see a locomotive with a single pair of driving wheels carrying 19 tons flying round a curve at sixty to sixty-five miles an hour—a daily experience with me—they would think twice before advocating a change on a system of construction which has borne the test of years, and given the greatest satisfaction. On the Continent permanent way has to stand up under slow speeds and light loads. If the contrary is the case, perhaps some of your readers can give me information concerning the exceptions.
DONCASTER, SEPTEMBER 5TH. WOODEN SLEEPER.

RAILWAY MATTERS.

AN addition has been made to the list of long bridges in the bridge of the Pensacola and Atlantic Railroad across Escambia Bay, Florida. It is five miles and a-quarter long, and was opened for use August 15th.

THE new branch of the Manchester, Sheffield, and Lincolnshire Railway, connecting Barnsley with Nostell, was opened on the 1st September. By this means the communication between Leeds and Barnsley is much improved.

THE Fontaine Locomotive Company has been organised in Detroit with a nominal capital of 1,000,000 dols. to build locomotives under the Fontaine patents. The officers are: president and treasurer, D. M. Ferry; vice-president, O. W. Shipman; secretary, Anson Waring.

THE promontory of Posillipo, to the West of Naples, has, for the second time, been pierced by a tunnel to accommodate a steam tramway between Naples and Pozzuoli. The first tunnel, 765 yards long, and passing under Virgil's tomb, was, if not natural, made at a very remote period, having been enlarged by the ancient Romans.

THE blacksmith shop of the Pittsburgh, Fort Wayne and Chicago, at Pittsburgh, has been much troubled by the unsettling of the brick forges by the jar of the steam hammers. Necessity has, however, proved the mother of invention. Forges of asbestos paper have, it is said, proved a decidedly successful method of overcoming all difficulties.

THE Statistical Society has published a table showing the railway mileage of the different countries of Europe, from which it appears that Germany comes first with 21,500 miles, followed by Great Britain, 18,200; France, 17,200; Russia, 14,000; Austria, 12,000; Italy, 5500; Spain, 4900; Sweden, 4600; Belgium, 2500; Switzerland, 1565; Holland, 1435; Denmark, 1160; Roumania, 920; Turkey, 870; Portugal, 660; and Greece six miles.

IT is said that iron express cars have been put on the Southern Pacific-road. They are described as being very strong and bullet proof, and as containing two compartments, one for treasure and one for expressmen and guards. There are side doors, and also loopholes in the sides for picking off train robbers who may approach from outside. Besides the necessary quantity of arms and ammunition and other modern improvements, each car has four Siberian blood-hounds, costing 250 dols. a-piece. One of these cars will go with each train.

THE Midland Railway Company has notified to several leading collieries in the South Yorkshire district a reduction of from 2d. to 3d. per ton in the conveyance of coal and "slack" to stations on the Lancashire and Yorkshire line. In addition a "slack" rate is now granted to Huddersfield and other important towns. This is a point of consequence, as there is a large demand for slack in manufacturing districts around Huddersfield, Bradford, Halifax, Keighley, &c. The Great Northern has also revised the rate to Wakefield for forward delivery.

THE daily papers have made our readers aware of the wrecking of a German excursion train, which ran off an embankment near Hugstetten, it was said, because a telegraph pole had been blown across the track. The latest reports state, however, that the cause of the accident is, according to a statement of the Reichseisenbahnamt—Central Railway Office of the Empire—not yet explained. The Commissary of the Government, who has been sent to the spot, states that the dead number fifty-six, the severely wounded twenty-two, less severely wounded thirty-one, not severely fifty. Though the train, being behind time, was going at double speed—25 miles an hour—the twenty-six carriages full of passengers were served by only six brakemen.

THE large elevator A, of the New York Central Railway, at the foot of West 65th-street, was seriously imperilled, August 1, by the breaking of a shaft on the top floor. The elevator is 350ft. long, and 145ft. high. It is operated by two powerful engines in the basement, the power being transmitted by a rubber belt—300ft. long and weighing three tons—which connects the driving wheel of the engine with a shafting wheel on the top floor. The shafting wheel weighs four tons, and connects with a horizontal steel shaft, 7in. in diameter, running the whole length of the building. This shaft broke close to the wheel, which was thrown out of place with great violence. The shaft was bent and twisted. The friction of the displaced belt against the sides of the openings in the floors caused a burst of flame at each point of contact, but fortunately the belt slipped from the wheel, and its furious motion was stopped before the flames got beyond control.

FROM a return recently issued it appears that twenty-seven orders were applied for in December, 1881, from the Board of Trade by tramway companies for the ensuing session, and they proposed the construction of 123 miles of tramway, of which thirty-two were double, at an estimated cost of £517,611, or equal to about £42,000 per mile. Eleven of these companies applied for extensions of existing or authorised systems, thirteen were for new tramways, two for authority to use mechanical power on existing lines. Altogether nineteen orders sought authority to use steam or other mechanical power. Only three orders were refused. There has been an increase in the number of long tramways; that is to say, of schemes connecting various towns, or traversing populous districts, as distinguished from those which are confined to the streets of one town, four having an aggregate length of sixty-four miles. In each of these cases the use of mechanical power was authorised.

ON the 1st inst. was opened a service of express trains between Liverpool-street and Doncaster, the long-projected new route, connecting the Great Eastern Railway with the northern counties, and forming a fresh means of communication between the metropolis and the north. The line begins at Huntingdon on the Great Eastern, and ends at Black Carr Junction, near Doncaster, on the Great Northern system, a distance of 117 miles, and is jointly owned by the two companies. By means of this line the Great Eastern Railway is now enabled to book through from London to the north, *via* Cambridge, Ely, March, Lincoln, and Doncaster, with a corresponding service from Cambridge, Ely, Norwich, Ipswich, Bury St. Edmunds, Lynn, Newmarket, and the East Coast ports and watering places. At Doncaster the eastern counties are connected by means of the Great Northern, Lancashire and Yorkshire, and North-Eastern systems directly with Bradford, Leeds, Halifax, York, Hull, and the other important centres. The trains from Doncaster to London will carry through carriages for the Royal Albert Docks, for the convenience of passengers leaving England by vessels starting from those docks.

THE reduced scale for the conveyance of parcels by passenger train on the Great Northern, the Great Western, the London and North-Western, the London and South-Western, and the Midland Railways is now in operation. The companies' scale is as follows:—One mile and up to thirty miles: 1lb., 4d.; above 1lb., and not exceeding 24lb., 6d. Thirty-one miles, and not exceeding fifty miles: 1lb., 4d.; above 1lb., and not exceeding 6lb., 6d.; above 6lb., and not exceeding 16lb., 8d. Fifty-one miles, and not exceeding 100 miles: 2lb. and under, 6d.; 3lb., 8d.; 5lb., 9d.; 7lb., 10d.; not exceeding 16lb., 1s. 101 miles, and not exceeding 200 miles: 2lb. and under, 6d.; 3lb., 8d.; 4lb., 9d.; 5lb., 10d.; 7lb., 1s.; 10lb., 1s. 3d.; not exceeding 18lb., 1s. 6d. 201 miles, and not exceeding 300 miles: 2lb. and under, 6d.; 3lb., 8d.; 4lb., 9d.; 5lb., 10d.; 6lb., 1s.; 7lb., 1s. 3d.; 10lb., 1s. 6d.; not exceeding 14lb., 1s. 9d. 301 miles, and not exceeding 400 miles: 2lb. and under, 6d.; 3lb., 8d.; 4lb., 9d.; 5lb., 10d.; 6lb., 1s.; 7lb., 1s. 3d.; 10lb., 1s. 6d.; not exceeding 16lb., 2s. Above 400 miles: 2lb. and under, 6d.; 3lb., 8d.; 4lb., 9d.; 5lb., 10d.; 6lb., 1s.; 7lb., 1s. 6d.; 10lb., 2s.; not exceeding 15lb., 2s. 6d. There are special rates for parcels of greater weight, and for light parcels of large size. This scale of charges, unlike the new postal parcels rates, varies with distance, and is in some cases cheaper for short distances.

NOTES AND MEMORANDA.

PLASTER of Paris is made hard enough for a mould for metal castings by the use of 10 per cent. of alum in the water used for mixing the plaster.

A NEW explosive compound, to which the name of Pandastite is given, has been invented by Mr. E. Turpin; it is composed of two liquids which are harmless before being mixed. It is said to be less liable to spontaneous combustion than dynamite and to produce far more striking results.

AN Italian journal recommends the use of methylaniline violet, also called Hofmann's purple and Paris violet, for detecting free mineral acids in vinegar. A solution of this dye, although containing but 0.1 per cent. of it, will be changed to an ultramarine blue by mineral acids, even when they are very dilute, while organic acids do not affect the colour.

THE return of Dr. Webster, the American Consul at Sheffield, of the exports to the States for the month of August last, is a distinct disappointment in every item except steel. The gross value of Sheffield exports to the States is £85,265, as compared with £120,789 for August, 1881, the decrease being no less than £35,528. Steel has been exported to the value of £32,847, and cutlery to the value of £21,607—an increase in steel of nearly £13,000, and a decrease in cutlery of £6575.

CAPTAIN BING, of Paris, has devised an ingenious method of making a positive on glass from a negative, and on the same glass. The back of the negative is covered with soluble bitumen or asphalt and then illuminated through the negative. After an exposure sufficient to render the light portion insoluble, the remainder of the asphalt is dissolved off with any of the usual solvents, leaving a positive. The silver negative is then dissolved off with the chloride of copper and a fixing agent, such as cyanide or hypo.

THE American Government method prescribed for cleaning brass, and in use at all the United States arsenals, consists in the use of a mixture of one part common nitric acid and one-half part sulphuric acid in a stone jar. The articles to be treated are dipped into the acid, then removed into clean water, and finally rubbed with sawdust. This immediately changes them to a bright colour. If the brass has become greasy, it is first dipped in a strong solution of potash and soda in warm water: this breaks the grease, so that the acid has free power to act.

ANHYDRO-SULPHAMIN-BENZOIC acid, the recent addition to the list of chemical products, is described as a white crystalline substance, very soluble in alcohol, but sparingly soluble in water, and characterised by a sweetness so great that the merest trace of the alcoholic solution in water gives it a distinctly sweet taste. Its discoverer, Dr. Constantine Falberg, estimates that it has from twenty to thirty times the sweetness of cane sugar. Should it prove wholesome and producible in quantity, with comparative cheapness, it may play an important part in the future social and industrial history of the world.

MM. SAINTE-CLAIRE DEVILLE and H. Debray state that osmium is the only one of the platinum metals which does not retain zinc when its alloy with a large excess of zinc is treated with an acid capable of dissolving this metal. The others retain obstinately about 10 to 12 per cent., and the metals insoluble in *aqua regia*—rhodium, iridium, and ruthenium—remain in the state of peculiar products, without metallic lustre, which seems to be an allotropic modification of the true alloys. It is impossible to comminute the osmides by mechanical action. A triple alloy of osmium, iridium, and zinc, if heated to about 300 deg., takes fire suddenly, almost with explosion, diffusing fumes of zinc and of osmic acid.

THE Council of the Parkes Museum have just acquired new premises in Margaret-street, Cavendish-square, to which the museum is to be removed from University College as soon as the alterations and additions which are now being made under the direction of Mr. Mark H. Judge, A.R.I.B.A., are completed. The new museum will consist of a central hall, suitable for meetings and lectures, a library and corridors, all lighted from the top, and well suited for exhibition purposes. The meetings and lectures on sanitary and other matters connected with the health of the people, which were only occasional while the museum was at University College, will form a permanent feature of the institution when it is reopened in Margaret-street.

LIGHT nickel plating may, it is said, be effected by boiling. Dr. R. Kaizer, according to the Bavarian *Gewerbe Zeitung*, prepares a bath of pure granulated tin, argols, and water, heats it to boiling, and then adds a small quantity of red-hot nickel oxide. A portion of the nickel, as is shown by the green colour which the solution assumes—that is, above the grains of tin—is immediately dissolved. If a copper or brass article be now immersed in this solution, it almost immediately becomes covered with a silver-like coating, which consists of almost pure nickel. If a little cobalt carbonate or cobalt tartrate be added to the bath, a bluish tint is produced, which may be made lighter or darker according to the quantity added. When the article is rubbed with dry sawdust or chalk, a very brilliant polish is obtained.

L. LIEBERMANN gives the following as the most delicate test for sulphurous acid in wine, cider, and other liquors: A portion of the wine is distilled off, about 15 or 20 c.c.—one-half ounce—and diluted with an equal volume of distilled water and a few drops of an iodic acid solution added. If sulphurous acid is present the acid acquires a yellowish-brown colour; chloroform shaken with it becomes pink in colour. If the liquid contains one part acid in 500,000 parts, 2 c.c. is sufficient to detect it. Or some of the wine is distilled, chloride of barium and hydrochloric acid added. The liquid remains clear until concentrated nitric acid is added and heated, when a white precipitate forms. It can also be converted into sulphydric acid by means of sodium amalgam and hydrochloric acid and then detected by lead paper.

A SELF-ACTING fire alarm, which is an ingenious contrivance invented by Mr. W. T. Braham, a watchmaker of Manchester, has been specially exhibited during the past week at the central station of the Manchester Fire Brigade. The apparatus consists of a clockwork arrangement, set in motion by the expansion of air when it becomes heated beyond a fixed point, causing a column of mercury to rise until it liberates a spring. The inventor makes use of a glass vessel containing a small quantity of mercury, into which a tube is fitted, the bottom end almost touching the bottom of the vessel, and the top end being hermetically sealed to the neck. In the tube is a hollow glass float, which rises as the air in the vessels expand with the heat, which an outbreak of fire would generate, until it lifts a lever which liberates a coiled spring held back by a notch in the barrel in which the spring is fixed. Attached to the barrel is a chain or cord connected to a heavy key fixed to a tap or stop-cock. Thus when the spring is liberated the key is drawn down a quarter of a turn and water is turned on, which is distributed in a fine spray over the apartment in which the apparatus is placed. As soon as the fire is extinguished and the temperature of the room again cools, a similar apparatus in a reverse position causes the key to drop the other quarter of a turn, and the water is shut off. In addition to this the apparatus sets in motion a clock arrangement by which an alarm bell is rung, detonators are fired off at intervals, and in the case of a fire on the stage of a theatre would let down an asbestos curtain, or a similar arrangement might be made in any building for shutting off the part in which the fire had broken out. Attachments can also be made for telegraphing messages to any place as desired. The apparatus, which is contained in comparatively small compass so as to be readily fitted up in any apartment, is also capable of application as a burglar alarm, and the principle can be applied for automatically regulating the ventilation of ships, storerooms, &c. The practical experiments made with the apparatus were very satisfactory, and although the mechanism is somewhat complicated, the invention displays a considerable amount of ingenuity, and no doubt in many cases might be applied with good results.

MISCELLANEA.

NEGOTIATIONS are in progress for the establishment of an additional shipbuilding yard at Dumbarton for the construction of vessels mainly of light draught.

SINCE June 1st Mr. Edison has filed fifty-one applications for patents upon electric lighting devices, and has recently received twenty-eight patents, making 109 in all upon his system of electric lighting.

HAMMOND'S ELECTRIC LIGHT COMPANY has applied to the Corporations of Hanley and Stafford for permission to solicit the Board of Trade for licences to light those towns by electricity. Both Corporations have referred the applications to committees.

THE Fylde Union Sanitary Authority have obtained designs from several civil engineers for sewerage the town of Poulton, and the districts of Breck, Skippool and Little Poulton, and the scheme of Mr. Alfred M. Fowler, Manchester, has been accepted.

THE Admiralty contract for Staffordshire boiler-plates for a term of three years has again fallen to Messrs. E. T. Wright and Sons, of Wolverhampton, the producers of the "Monmoor" brand. The same firm held the contract for a similar term which has just run out.

MR. ROBERT BRIGGS, a well-known American mechanical engineer, died in Dedham, Mass., on the 24th of July, at the age of fifty-five years. He was for a long time identified with some of the largest Philadelphia machine works, and was an active member of the Franklin Institute.

ON Thursday last a number of gentlemen interested in the Manchester ship canal project made an inspection of the waterway from Throstle Nest, Manchester, to Howley Quay, Warrington, and appear to have been thoroughly satisfied with the practicability of the scheme so far as the above portion of the proposed route is concerned.

THE Sanitary Committee of the Hanley Town Council have decided upon a new departure in the efforts which they have been making to minimise the smoke nuisance. They have determined that in future both masters and workmen shall be summoned, not, it is explained, with a view of pressing the penalties against both, but in order to find out which party is really responsible.

ON the 5th inst. a special meeting of the shareholders of the Union Steamship Company, called by requisition, was held at the Cannon-street Hotel, for the purpose of considering the decision of the directors to change their shipping port from Southampton to London. The result was that the decision was overruled and the company will still use Southampton as its shipping port.

THE Jablochhoff Electric Light Company has taken large premises on the Albert Embankment, to be used as a manufactory for its carbon candles, and warehouse, and as a lighting centre. It is also about erecting a building on the Victoria Embankment for the purpose of more effectually carrying out the contract with the Metropolitan Board of Works. It is stated that numerous applications have been received for the supply of the Jablochhoff light, to meet the demand for which several power centres for the necessary machinery are about to be established.

THE South Staffordshire and East Worcestershire Trades' Council, which has been recently formed to watch over the interests of operatives employed in the local trades, have just held a meeting at Cradley Heath, at which the "truck system," which still prevails in the hand nail-making districts, was discussed. The system was loudly condemned, and it was resolved, "That this council recommends the executive of the Nail-makers' Association to devise some means which will tend to destroy the nefarious practice of trucking which prevails so extensively in their trade, and this council will render all the assistance they can in the matter."

THIS week experiments have taken place in some of the collieries on Cannock Chase with the new lime process of getting coal, which was discussed at the recent Miners' Conference in Manchester, and so far the trials have been entirely successful. In the mines of the Cannock Chase Colliery Company the men chose a fair specimen of the shallow seam, and after the lime cartridges had been put in and the expansion had taken place, some 40 or 45 tons came down in a solid block without making scarcely any slack. When the trials at Cannock Chase have been concluded the hard coal of the Sandwell Park Colliery is to be experimented upon.

THE Magazine Gun Board now in session at the Armoury Building, in New York, decided not to receive any models of guns for examination test after July 15th, at which time the supplementary tests of the guns already received began, and the real work of selecting one or more guns for trial in the service was inaugurated. It is understood that thirty-three different models have been tested by the Board, and there are five or six more still on the dock, and there seems to be a fair prospect of getting a good arm for the service. The U.S. Army and Navy Journal states that the Board, as the result of their experiments, have reached the conclusion that a carbine cartridge with 50 grains of powder will shoot a bullet farther than a cartridge with 70 grains of powder.

AN invention, which seems likely to have an important future before it, has just been patented by Messrs. Enson and Thomas iron braziers, Ettingshall, near Wolverhampton. It is a cask or barrel made wholly of sheet steel, and is intended for use in the conveyance of oils and varnishes in place of the wooden barrels and metal drums now employed for such purposes. In shape the new article is an exact imitation of a well-made wooden cask, and it is rendered seamless by the two edges of the sheet of steel out of which it is made being securely brazed where they join each other. The inventors claim for this new cask that it is superior to the wooden ones, alike in lightness, durability, prevention of absorption, and evaporation of the contents, and handiness in use; yet its price is less than that of the ordinary barrels.

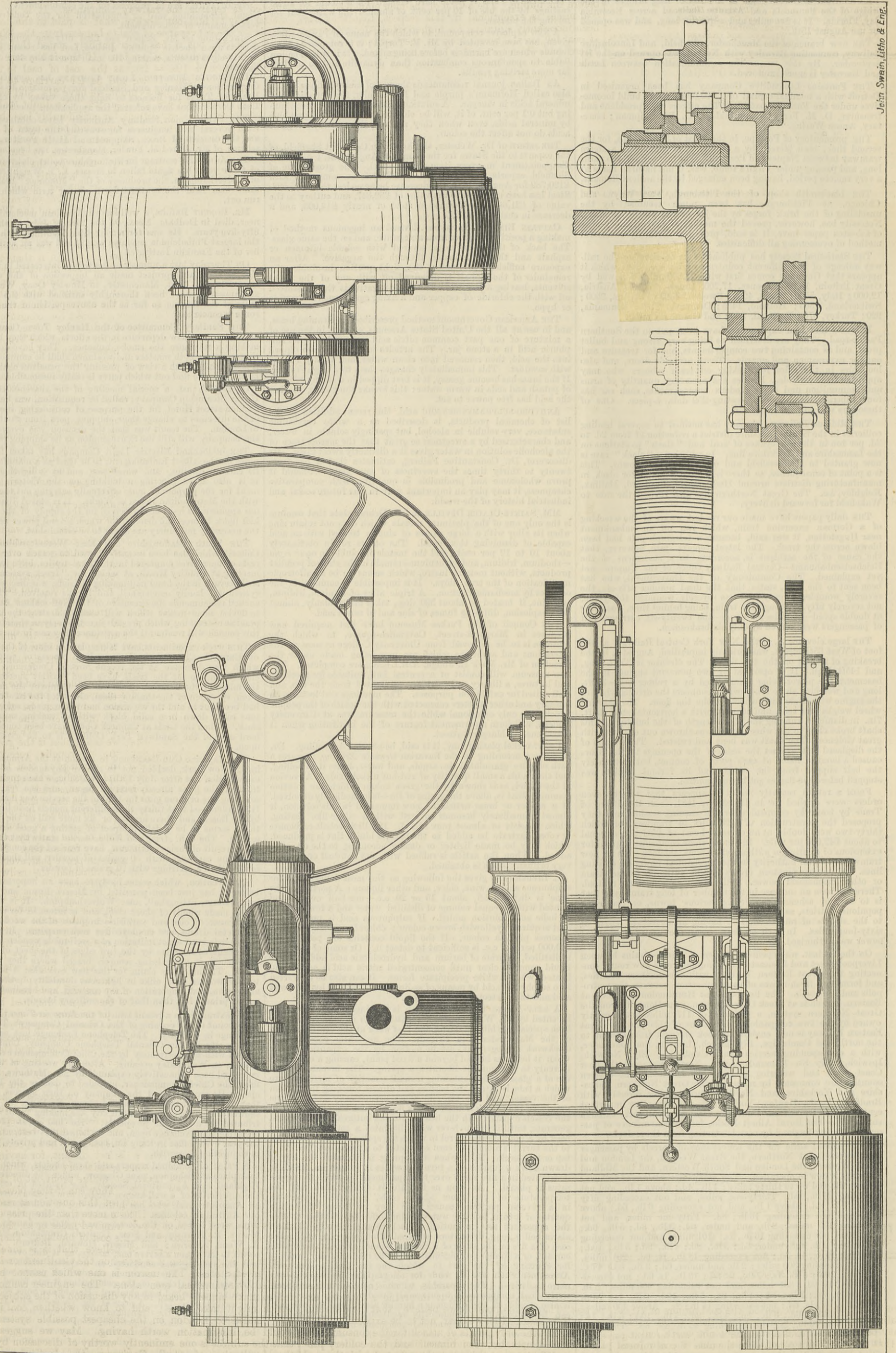
WE extract from a recent issue of the *Rangoon Times* the following account of the opening of the Oriental Company's Telephonic Exchange in that city. The Telephone Exchange just established in this city by the Oriental Telephone Company, Limited, was opened with some ceremony by the Chief Commissioner of British Burma, on Wednesday evening. After the working of the apparatus had been exhaustively explained by Mr. Mathews, Mr. Bernard, the Chief Commissioner, proceeded to declare the Exchange open. He congratulated the company on their success, and said that the establishment of a Telephone Exchange in Rangoon showed what rapid advances this city was making in all that contributed to mercantile prosperity. He had great pleasure in declaring the Exchange open, and he hoped that before the end of the year every office in Rangoon, both public and private, would be in connection therewith.

A TRIAL of combined reapers and sheaf-binders, which recently took place at Bishopston, near Glasgow, under the direction of the Highland and Agricultural Society, has resulted in establishing the superiority of a well-known English firm's patent over that of an American rival, who has hitherto driven an immense trade in our Australian colonies. The machines of three manufacturing firms were tested on the occasion under notice—namely, those of Messrs. R. Hornsby and Sons, Limited, Grantham; Mr. Walter A. Wood, America; and Messrs. Howard, Bedford. The trial seems to have been a severe one, lasting, as it did, over two days; and the judging was conducted on a system which secured the greatest nicety. The maximum standard of points was fixed at 1000, and at the close of the competition it was found that the following results had been obtained: Hornsby and Sons, 833; Wood, 789; and Howard, 770. A prize of the value of £100 fell, therefore, to the lot of the Grantham firm, £50 went to the American, and £25 to the third competitor. Considerable importance may be attached to the decision arrived at, because the superiority of the English-made machine will probably secure for this country orders which have hitherto found their way from our own colonies to the United States.

COMPOUND CONDENSING ENGINE, HALPIN'S PATENT.

MESSRS. MANLOVE, ALLIOTT, FRYER, AND CO., NOTTINGHAM, ENGINEERS.

(For description see page 173.)



John Swain, Litho & Eng.

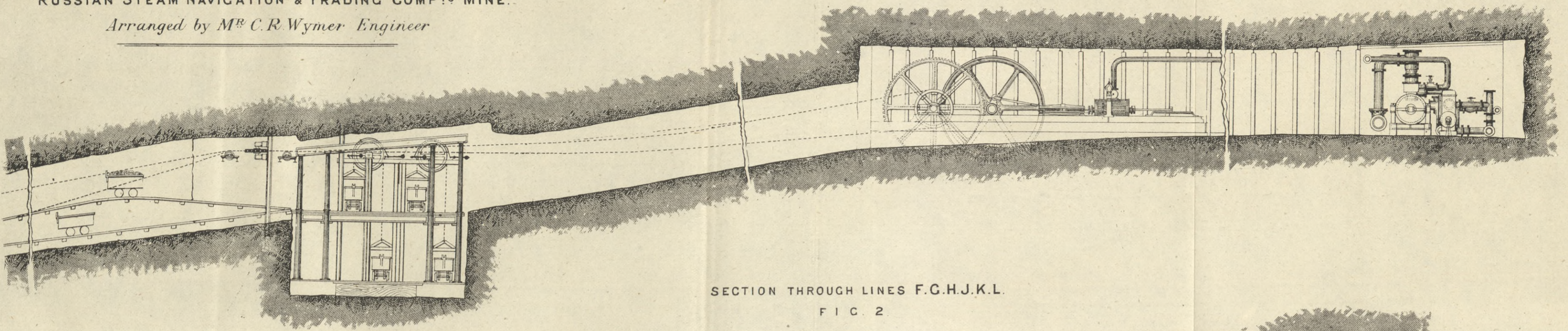
UNDERGROUND PUMPING MACHINERY AND ENDLESS CHAIN HAULAGE

AT THE
RUSSIAN STEAM NAVIGATION & TRADING COMPANY'S MINE.

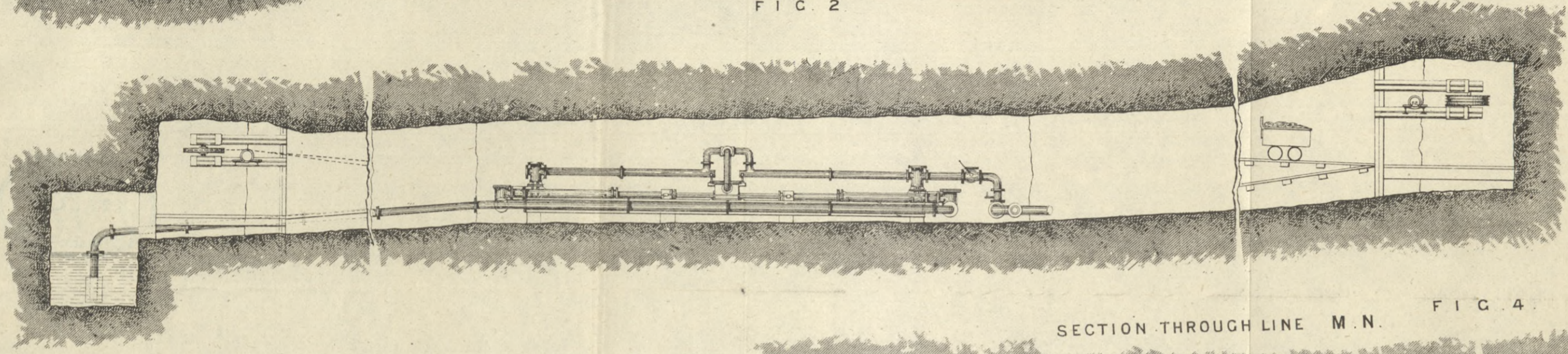
Arranged by *M^{rs} C.R. Wymer* Engineer

SUPPLEMENT TO THE ENGINEER, FRIDAY SEPT^r 8th 1882

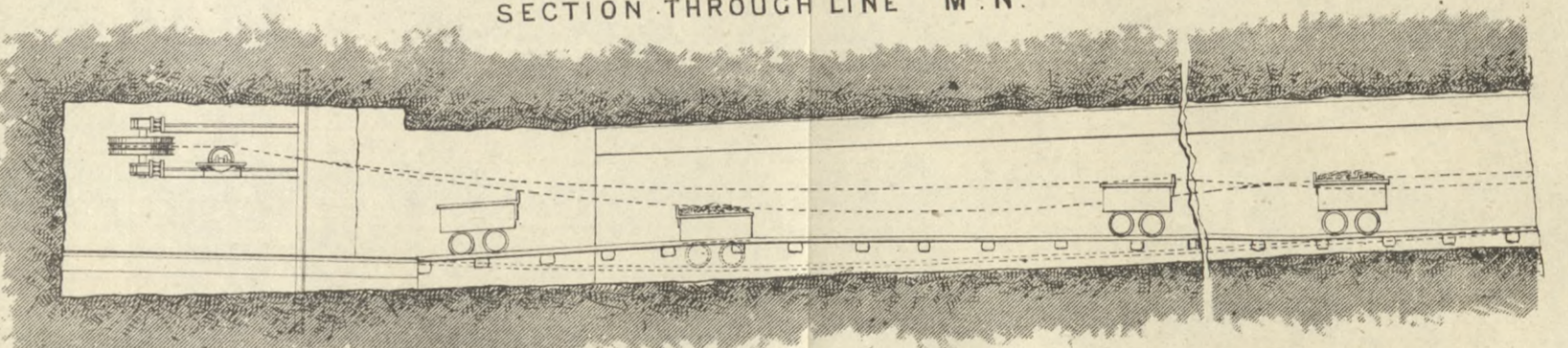
SECTION THROUGH LINES A.B.C.D.E.
FIG 1



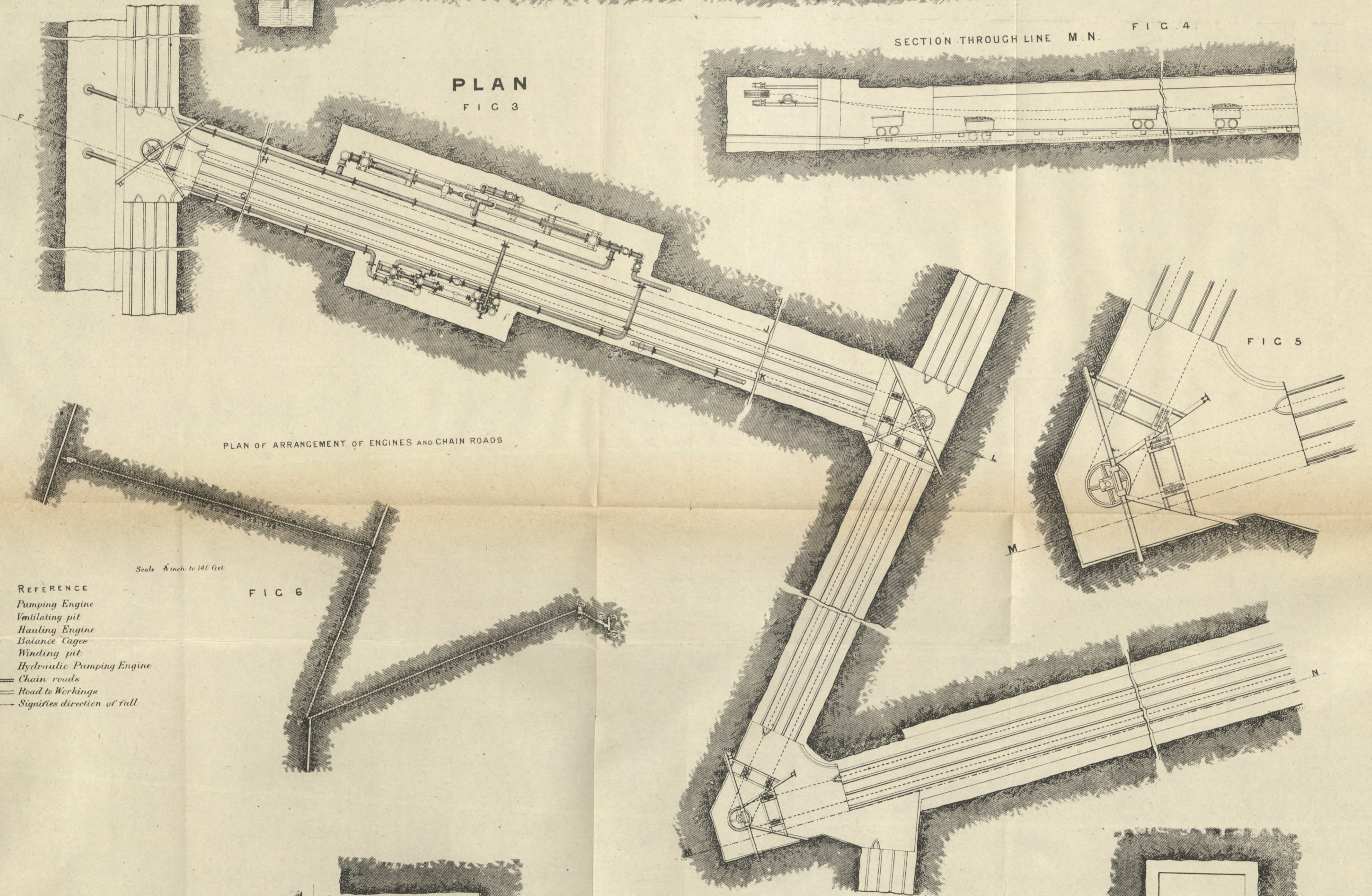
SECTION THROUGH LINES F.G.H.J.K.L.
FIG 2



SECTION THROUGH LINE M.N.
FIG 4



PLAN
FIG 3



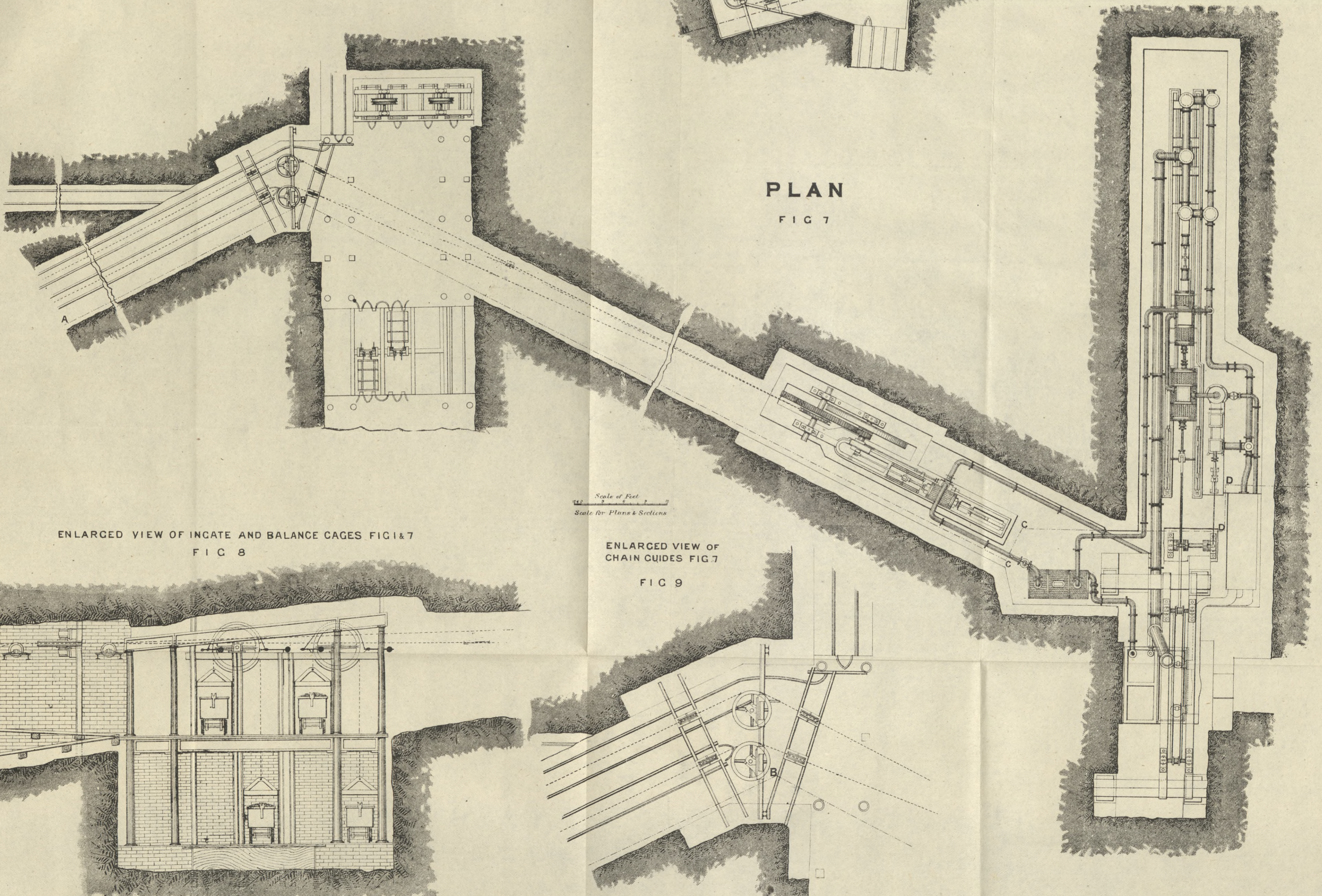
PLAN OF ARRANGEMENT OF ENGINES AND CHAIN ROADS

Scale 1/4 inch to 100 feet

FIG 6

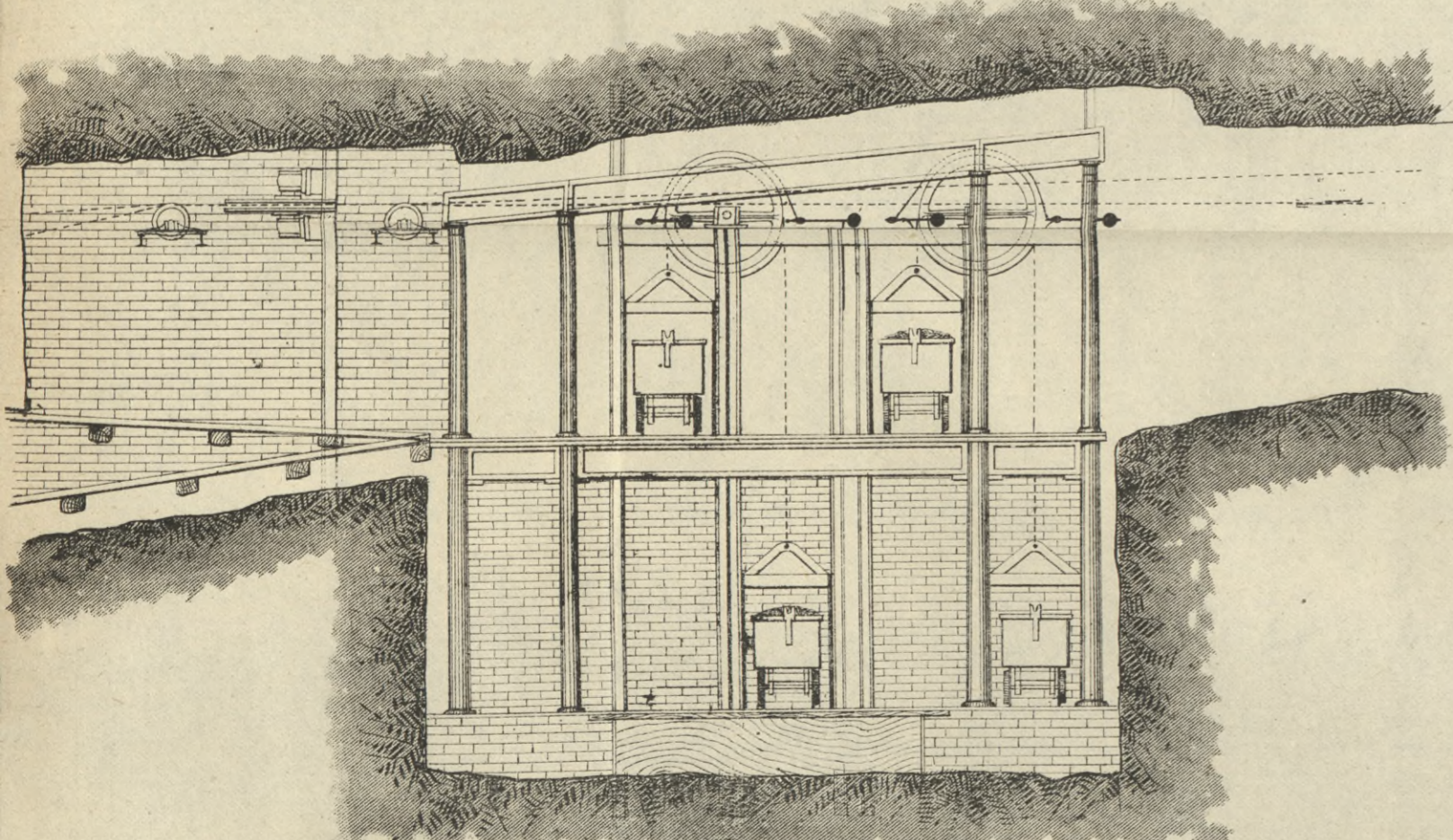
- REFERENCE
- a Pumping Engine
 - b Ventilating pit
 - c Hauling Engine
 - d Balance Cages
 - e Winding pit
 - f Hydraulic Pumping Engine
 - Chain roads
 - Road to Workings
 - Signifies direction of fall

PLAN
FIG 7

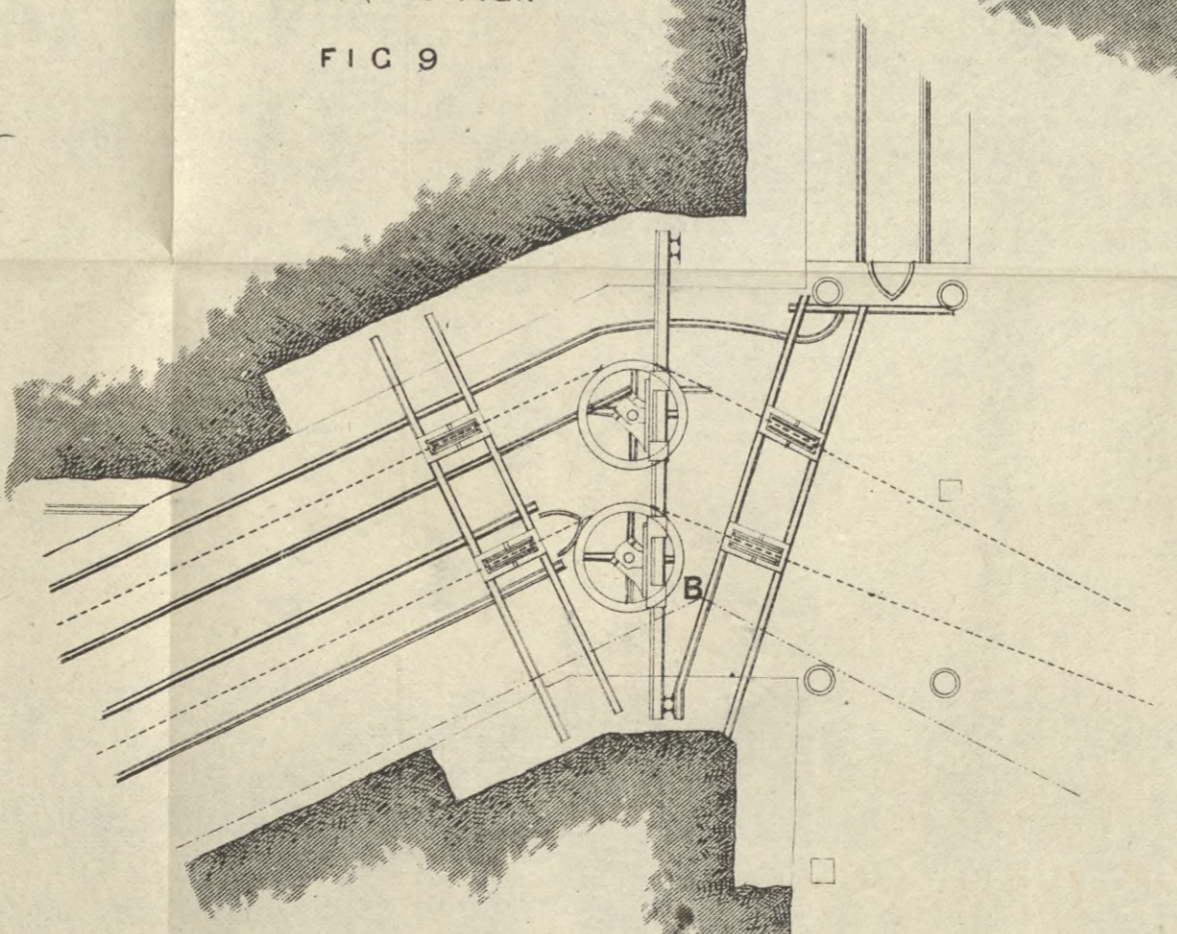


Scale of Feet
Scale for Plans & Sections

ENLARGED VIEW OF INCATE AND BALANCE CAGES FIG 1 & 7
FIG 8



ENLARGED VIEW OF CHAIN GUIDES FIG 7
FIG 9



Scale of Feet
Scale for Enlarged Plans & Sections Figs 8 & 9

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* * With this week's number is issued as a Supplement, the Underground Pumping Machinery and Endless Chain Haulage at the Russian Steam Navigation and Trading Company's Mine. Every copy as issued by the Publisher contains this Supplement, and subscribers are requested to notify the fact should they not receive it.

TO CORRESPONDENTS.

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

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

WATER.—Cullen "On the Turbine." Spon, Charing-cross.
G. P.—We do not know of any good treatise on blacksmiths work. Ede "On the Management of Steel," you will find very useful.
BUNSEN BURNER.—Clamond, Noe, and others, have thermo-electric batteries, but so far as we know these batteries have not been largely used. There is but little new information within the last twelve months.
STUDENT.—The best method of detecting the presence of salt in sand is to wash a little in distilled water. If the salt is found in quantity it can be detected by the taste; if not, the water is to be well filtered and evaporated, when the salt will be deposited in crystals in the evaporating pan. To detect very minute quantities add a few drops of solution of nitrate of silver, when a cloudy deposit will form. It is very difficult to wash the last trace of salt out of sea sand.

ENGINEERS FOR CANADA.

(To the Editor of The Engineer.)

SIR,—Would any correspondent kindly inform me through the medium of your journal who has the appointing of engineers and surveyors to the colony of Canada? CANADA.
Dublin, September 6th.

FELL LOCOMOTIVES.

(To the Editor of The Engineer.)

SIR,—Can any of your correspondents give me information through your columns as to locomotives for roadways capable of taking 12 or 14 tons up hill with a gradient of 1 in 15—to be on the Fell system? London, September 6th. C. E.

TESTING CHAIN CABLES.

(To the Editor of The Engineer.)

SIR,—On reading the Acts for the testing of chain cables and anchors, is it the opinion of any of your readers that it is intended to be understood that a fracture means any small fire crack that may be in the iron when rolled, or does it only mean that the fracture must be the result of weakness in not sustaining the required strain, and thus a fracture is produced, or is the fire crack clearly a flaw in the iron, but not a fracture in the meaning of the Act? VULCAN.
Chester, September 4th.

PHOSPHOR-BRONZE.

(To the Editor of The Engineer.)

SIR,—In your issue of the 18th ult., you give a report of an application before Mr. Justice North for an interim injunction in a case of the Phosphor-Bronze Company v. ourselves, which is altogether incorrect, misleading, and calculated to do us serious harm. We therefore ask you to correct same in your next issue. The action in question is not to restrain us making phosphor-bronze, but to stop us using two numbers—VII. and XI.—which the Phosphor-Bronze Company say we have no right to use, and the arrangement come to between the opposing counsel in court was as follows:—"Motion to stand to trial, the defendants undertaking not to advertise or issue circulars that they manufacture or sell phosphor-bronze Nos. VII. or XII., and to keep an account of all phosphor-bronze manufactured or sold by them in the mean time. This order to be without prejudice to any question." BILLINGTON AND NEWTON.
Vulcan Brass Works, Longport, September 4th.

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Remittance by Bill in London.—Austria, Buenos Ayres, and Algeria, Greece, Ionian Islands, Norway, Panama, Peru, Russia, Spain, Sweden, Chili, £1 16s. Borneo, Ceylon, Java, and Singapore, £2 0s. 6d. Manilla, Mauritius, Sandwich Isles, £2 5s.

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Advertisements cannot be inserted unless Delivered before Six o'clock on Thursday Evening in each Week.

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

THE ENGINEER.

SEPTEMBER 8, 1882.

THE PRICE OF COAL.

For a very considerable period the coal miners of Great Britain have been endeavouring to get their wages raised. It may be said that this is a statement not worth making; and that the fact is not confined to the case of coal miners. It is quite true that all recipients of wages would gladly get

higher pay than they actually receive; but it by no means follows that they are continuously bringing their desires before the public. The action of the men employed in our coal mines is exceptional in this respect, that they have been incessantly agitating for higher wages since the price of coal fell, on the termination of the fuel famine of 1873. There have been strikes in abundance, most of which ended disastrously for the strikers; but apart from such energetic manifestations of their wishes, the coal miners and their mouthpieces have hardly for a single week ceased to demand, in one way or another, increased pay. The demand has fluctuated in intensity; at one time a great strike has been threatened in some special district; at another little is heard of the movement save muttered grumbings. Within the last few years the better informed of the men have perceived that unless the consumer could be made to pay higher prices for coal, the mer could not get larger wages; therefore reduction of output has been preached systematically. It has been argued that this could not possibly do the collier good even if it took effect; but this view of the matter is, we do not hesitate to say, erroneous. If coal was scarcer than it now is, longer prices would be paid for it than are now obtained. We do not assert that the nation would gain by a reduction in output; but there is no doubt that the collier would reap a substantial advantage. He knows this very well. He has not forgotten his experiences of 1873. But, as a matter of fact we need not go back to 1873 to obtain information concerning the result on the coal miners' wages of a scarcity of coal. It is not, we believe, generally known, but it is none the less true, that to a not inconsiderable extent the men in large districts have succeeded in reducing the output. The effects have been a long time in making themselves felt, but they are beginning to become manifest, and coal is rising in price, stocks are diminishing, and orders are not so eagerly snapped up as they were a little while since. It must not be imagined, however, that this statement is universally true. There are certain districts where stocks are accumulating instead of diminishing. Thus, for example, in the South Yorkshire district, where many of the coal-owners have lost vast sums of money, and are capable of raising in an ordinary day's work from 1200 to 1500 tons, at the present time the pits are nothing like fully taxed, and complaints are general that they are far too crowded with men. Although the house-coal trade has of late improved, there can be no denying the fact that, if needed, a third more coal could be raised without any extra hands. For the moment we need say nothing concerning the effects which may be produced on our iron trade by a rise in the price of coal. There is an enormous consumption of coal in the metropolis, not only for house fires but for gas making and for factories, and we have every reason to believe that the price of fuel will be considerably higher in London this winter than it has been for some years past. But why? More wages are, it is true, being paid in some districts to coal miners, and at this very moment the recrudescence of agitation among them is very manifest. Thus we have coal rising in price, and the men on whom we depend for our supply doing all they can to make it still dearer; but the rise in price is not due to the action of the miners exclusively, or even principally.

What it is worth while for the miner to do it may be worth while for the London consumer to do also. The price of house coal in London now varies between about 18s. and 26s. per ton, according to quality. The colliery proprietor receives for the first about 8s. per ton, for the second, at most, 10s. per ton. The coal miners' wages are based of necessity on the receipts of the mineowner, not on the disbursements of the consumer. It is well that the London householder should understand why it is that he pays so much more than the colliery proprietor receives. The difference is expended in various ways. In the first place, there is a coal tax to be paid in the metropolis, amounting to about 1s. 8d. per ton; in the second place, there is the cost of carrying coal from the railway station to the consumer; in the third place, there is the coal merchant's profit to be paid; and lastly, there is the cost of carriage to be paid to the railway companies or the steamship owners. Now, it is assumed that under all manner of conditions of the coal trade certain of the items we have named are unvarying in amount. The coal tax does not vary; the railway companies give the world to understand that they do not alter their tariffs; the coal merchant calls all his gods to witness that he never, at the best of times, makes more than a bare subsistence, and that his profits never fluctuate. The colliery owner in turn asserts that he is not a gainer, but a loser by a rise in price. It follows, of course, if all these be true, that the men reap all the advantage, those standing between the miner and the consumer gaining nothing whatever. But it is very well known that an increase of 1s. per ton in a hewer's wages would represent a very considerable sum indeed to him. The quantity a hewer can send to bank per day of course varies, but three tons is not an over estimate. A rise of 3s. per day would nearly double the pay in a great many pits. In a word, a rise of 1s. per ton at the pit mouth would represent a great augmentation in the wages of all hands, not alone of the hewers, but of the banksmen, screeners, engine drivers, &c. If we admit that the colliery owner ought to have some share in the increased value of his coals, we may say that a rise of 2s. per ton on coal at 8s., and a proportionate increase on the dearer fuel, would be regarded as meeting the wishes of all connected with mines. Are any of our readers rash enough to suppose that a rise of 2s. in coal at the pit's mouth would be attended by a similar rise and no more in London? Is it not, on the contrary, certain that the augmentation would be more nearly 5s. than 2s?

The question with which the people of London have then to do is this—Is it possible to let the coal miner have a little more pay without incurring a ruinous expense? That this is possible we believe; that the desirable end will be attained is, we fear, not to be expected. It is obvious that the only points of attack for the consumer are the intermediaries between himself and the colliery proprietor. Whether anything can be effected with the coal

merchant or broker, we are not prepared to say; but we are quite prepared to say that something ought to be effected as regards the railway companies. It is by no means easy to find out always what is paid to the companies for the conveyance of coal to London from the West or the North, but it has been publicly stated that the charge is as much as 10s. per ton. If this is the case we have at once 8s. + 10s. = 18s. as the cost of coal to the merchant in London. If we add 3s. for carriage to the consumer and for merchant's profit, we have 21s., and with the coal dues added we get near 23s. No doubt coal is carried, under certain conditions, for considerably less than 10s. per ton. If it were not, it could not be bought at all in London for 18s., as we have seen; but there is very little reason to doubt that the best coals are by far the most heavily taxed in some way, either by the railway companies or by the coal merchants. It is highly desirable that full information on the whole subject should be available in London. The Great Western Railway rate at this moment from Wales to Paddington and the West London Gasworks is 8s. 5d. per ton for fully loaded trucks. The Midland and Great Northern Companies charge from the Sheffield district 8s. per ton, and from the Barnsley district 8s. 3d. per ton. Our own conviction is that the railway companies charge much more for the carriage of coal than they ought. We have never heard a really noteworthy complaint made by any railway company that carrying coal did not pay. On the contrary, the carriage of very large quantities is always a subject for congratulation on the part of chairmen and directors. In a word, we hold that both the colliery proprietor and the London consumer should make common cause against the railway companies in this matter, and either obtain a substantial reduction in the tariff, or such a public statement of facts by the chairmen and directors of the London and North-Western, Midland, Great Western, Great Northern, and Great Eastern Railway Companies as will satisfy the consumer that only a reasonable sum is now charged.

It may be worth while to state the actual cost of hauling a ton of coals 100 miles. Let us take the case of a coal train of 300 tons. This train will consist of thirty wagons, a brake van, and an engine and tender. The value of the train will be about as follows:—Engine and tender, £2300; thirty wagons, at £70, £2100; brake van, £120; total, £4520. Interest and wear and tear may be taken at 20 per cent.—say, in round numbers, £900 a year. In a year such a train will run about 15,000 miles. The wagons may do a great deal more, but we prefer to under-estimate rather than the reverse. The cost of running such a train 100 miles will be £6, for interest, &c. The engine will burn, let us say, 50 lb. of coal per mile, representing a cost for the 100 miles of about 16s. Wages of stoker, driver, and guard will come to about the same sum. We thus have a total of £7 12s. If we add 8s. for grease, oil, water, and sundries, we have a total of £8 for the conveyance of 300 tons of coal 100 miles, or 6'4d. per ton per 100 miles. Of course to this must be added a not inconsiderable sum for the maintenance of the permanent way, the signalmen, rent, taxes, and "general charges." But on the other hand we have made a very liberal allowance indeed for the outlay on mere haulage, and it remains to be proved that the other charges which we have named can be three times that for haulage; even if they were, the total sum would not reach 5s. per ton for 300 miles. We speak not without due reflection when we assert that if the great railway companies supplying the metropolis received 2s. per ton per 100 miles for the carriage of coal they would make large profits on this kind of traffic, which profits come entirely out of the pockets of the consumer. Their actual rates are double this; the public can draw their own conclusions. In the North it is well known the great ironmasters and others interested have ere now made a vigorous stand against the exactions of the railway companies, and with, in many instances, very fair success. Nor have we ever seen any attempt made to prove that, even at the reduced tariff insisted on and obtained, the railway companies did not still earn a very fair profit.

It is not, we fear, likely that much direct advantage can accrue to any of our readers in the sense that a reduction in the price of coal will follow the publication of this article; but it is just as well that the metropolitan public should clearly understand the position in which they stand with regard to the railway companies. We are not surprised that the coal miners should ask for higher wages than they are getting, considering the nature of their work and the risks they run. They are and have been for a long time past underpaid. The fact is not disputed by colliery proprietors; but colliery proprietors are simply powerless in the matter. They have been staving off ruin from day to day for years past with but indifferent success. Very large sums are lying idle, seeking investment, and this being the case, it is not remarkable that new collieries are being established. But on the other hand, many old and valuable mines are just now unsaleable. On every side we hear complaints that the cost of transport is so excessive that it cannot be incurred. The complaints to which we refer do not come from London alone. Indeed, from the metropolis they are least heard. From north, east, west, and south the same tale reaches us. This seems to be a specially favourable time, when winter is not distant, for having the question at issue put on some satisfactory basis. Either the railway companies make an undue profit out of the carriage of coal, or they do not. They can if they please, as we have already pointed out, set this question at rest. But if it can be proved that it costs more than the price of the raw material to haul it two hundred miles or so, then steps should be taken to reduce the cost of haulage. There is very good reason indeed to believe that it is much greater in England than it is either on the Continent or in the United States. The matter is one which cannot be decided by commercial men alone. The engineer cannot fail to make himself heard in any discussion of the subject which might take place; and to know whether coal is now hauled to London on the cheapest possible system would be information worth having. May we suggest that the subject is one eminently worthy of discussion by the Institution of Civil Engineers, the Institute of

Mechanical Engineers, and the Iron and Steel Institute. In the multitude of counsellors is wisdom, and it might be dealt with from three different points of view, which will no doubt suggest themselves to our readers, by the three bodies we have named.

THE SEA AT HASTINGS.

FOUR weeks ago we drew attention to the perilous state of a portion of the foreshore at Hastings. In the brief period which has followed there has occurred an irruption of the sea at the point indicated sufficient to justify all the anxiety to which we had previously given expression. It does not appear that the wind was at all phenomenal in its violence. The Channel is described as having been "very full of water," but the wind, although blowing a gale, is said to have been "comparatively moderate," by which we understand that the force of the storm was moderate compared with the mischief that was done. In our remarks we mentioned that instead of the sloping mass of shingle which formerly lay in front of the Fish Market at Hastings, protecting it effectually from the sea, there was now a precipitous gradient, bristling with stakes and faggots, the shingle having to a large extent disappeared, leaving a species of basin where formerly there was a shelving shore. We observed that the faggots were by no means secure in their place, and that if they were to be carried away by a high tide, "the sea would attack the solid earth and cut its way into the foundation of the road which runs parallel with the shore." "In such a case," we considered, "the adjacent property would be in imminent danger, and could scarcely escape destruction in the event of a high tide, such as occasionally visits this part of the coast." The history of that which happened little more than a fortnight afterwards reads almost like a reproduction of our statements. A local paper, describing the scene, says:—"The sea rushed in, eating away the road and sea defences in huge mouthfuls." Another account says:—"The mixture of stakes and faggots, a form of sea defence which had been adopted at the east end, disappeared like so much chaff, and huge pieces were swept out by single waves, leaving immense caverns in the shade, which were rapidly raked out by the waves until nearly the whole roadway was gone." Wooden structures, some of them three or four stories high, in which the fishermen keep their nets and ropes, were overturned, and in some cases washed away or shattered to pieces. In more than one instance there was a narrow escape from the sacrifice of human life. As the sea continued its ravages, gas and water mains were broken, and underground telegraph wires deranged; heavy capstans were upset, valuable boats were damaged, and nets and ropes were entwined among such of the faggots as were not swept out to sea. Altogether, "the quarters of the fishing folks" are said to have exhibited "a most lamentable scene of confusion and loss." The damage is estimated as between £1000 and £2000. This, in fact, is a very mild way of putting the case, for the danger to this part of the shore is so evident that a much larger outlay than the above amount must be incurred if anything like security is to be enjoyed. It was feared that the sea might even undermine one of the brick-built houses on the inner edge of the road, and preparations were made for clearing out the property which it contained.

This is not all the harm which Hastings sustained from the recent gale. Other parts, westward of the Fish Market, suffered to some extent, though in a lesser degree. Happily there was warning given, a previous tide having admonished the inhabitants of their peril. A large number of houses along the front were therefore barricaded before the sea made its severer onslaught. The most ominous feature in this melancholy business is the fact that Hastings is certain to be exposed, at some time or other, to a fiercer attack from the sea than that which has caused all this havoc. Had this particular storm been such as now and then visits that part of the coast, the tale to be told would, in all probability, be a terrible one. If the sea had palpably done its worst on this occasion, there would be something consolatory in the fact. But the truth is otherwise, and, with the winter drawing on, the outlook is by no means comforting. Our correspondent, Mr. W. H. Thorpe, whose letter we published last week, wrote before the storm came and defended the reputation of the "paltry wooden" groyne, which the fishermen complained had been substituted for one of the concrete groynes recommended by Sir John Coode. While agreeing with us that to permit the carting away of beach from the foreshore was a serious oversight, Mr. Thorpe passed by the question as to how far there might be some natural action going on to account for the denudation of the foreshore. We carefully pointed out, in dwelling on this part of the subject, that "if the sea, independently of groynes and building operations, is really threatening a portion of the southern coast, there is the more reason for the exercise of sound judgment in meeting the difficulty." Without saying that a natural encroachment of the sea is the cause of all this mischief, we may yet contend that something of the kind is actually going forward. We have admitted that "as the Hastings Fish Market occupies the extreme east of the sea front, the formidable array of groynes studding the whole foreshore of the borough to the westward is evidently calculated to deprive the fishermen's quarter of its natural protection." Mr. Thorpe states that there are as many as thirty groynes to the westward of the Fish Market, and he considers that for this reason "any fears entertained are not ill founded." But he offers the consolatory suggestion that "the natural protection is, however, slowly advancing to the rescue." We confess we are not quite so well satisfied on this point as our correspondent appears to be, although we have admitted that "the beach shows some signs of creeping along from the western groynes to the eastern." All depends on whether or not we include the idea of a natural encroachment. The Hastings people appear to hold the notion that if they admit the theory of such an encroachment they will not be able to bring the same amount of pressure to bear on the Town Council. The sufferers by the inroads of the sea wish to lay all the blame on the Corporation. They

are not even universally anxious to demonstrate that the carting away of the beach for roads and buildings is an injurious procedure. Their cry is for "more groynes," and it will be seen that Mr. Thorpe espouses this policy. "Groyning," he says, "must be continued." He advises the erection of one, or at the most two large groynes, to the eastward of the spot where the sea has just broken in.

There is much in Mr. Thorpe's letter which indicates knowledge of the facts, and ability to deal with them. But there is a certain handwriting on the wall which he appears not to have read, nor even to have looked at. He states that "about five or six years since there was a great poverty of shingle along the western front of the towns of Hastings and St. Leonards." Why was this? The blame of it could not be laid on "thirty groynes" to the westward, comprising "two miles and a-quarter of shore defences." It would seem from this statement that "the great poverty of shingle" first showed itself in the western part of the sea front. The sea first attacked the western wing and the centre of the front line. It was subsequently that the sea proved so troublesome at the eastern end. The latter phenomenon is attributed to the westerly groynes. But why did the beach first of all disappear from the western extremity of the borough? The groynes designed to protect St. Leonards and the central part of Hastings are gathering beach, and it is thought that another groyne or two, or one huge groyne, in addition to such as already exist eastward of the Fish Market, would make that part of the front line as safe as the rest. But we are not quite sure yet that all is safe between the Fish Market and St. Leonards. We would ask whether there is the same total quantity of beach in front of Hastings and St. Leonards now as formerly? We venture to say there is not, nor yet so much sand. There is a greater depth of water, the waves are of greater magnitude, and the aspect of affairs is not satisfactory.

The Hastings Corporation, if we rightly understand the chaos of resolutions and amendments into which they plunged at their last meeting, do not appear disposed to adopt Mr. Thorpe's remedy. Instead of putting up another groyne, they purpose extending their sea wall farther eastward, so as to furnish a barrier of masonry against the attacks of the sea at the Fish Market. Although the structure to be reared in front of that spot is to be carried at a low level, the arrangement is not a very pleasant one for the unfortunate fishermen. Practically it drives them further to the east, and it seems as if they would be pushed out of the borough altogether. Looking back to the history of the south-eastern coast line, we confess to a considerable amount of apprehension with regard to the position of Hastings, and parts to the westward of it. Certainly the subject is one which is worthy of careful consideration, both as a matter of scientific study and of practical concern. Property is at stake, and perhaps life. Should all go well, there are still lessons to be learned concerning the action of the sea and the movements of the shingle, which it is desirable should be rightly understood.

NORTH-EASTERN RAILWAY WORKS.

ONE of the costliest works that the North-Eastern Railway Company has undertaken is now so close to completion that it may be expected to be opened in the course of a few weeks. It is that line which, commenced by an independent company, has dragged along so many years; the line that, starting from Saltburn, passes near the coast through Cleveland to Whitby. Commenced by the Whitby, Redcar, and Middlesbrough Union Railway Company, much progress was made with the line in that period of prosperity that the iron trade knew a decade ago—progress so great, that it was hoped that before the middle of the year 1874 the line would have been opened at its southern end to as far as Hinderwell. Its route is northwards from Whitby, near the coast by Eastrow and Sandsend, creeping near Runswick and Hinderwell, and on to Staithes, where a noble viaduct crosses the Sale, and thence by heavy cuttings on to Easington and Loftus, to which point it was a few years ago opened by the North-Eastern Railway Company, which had bought up a mineral line traversing a good part of the distance from that place to Saltburn, and who converted it into a passenger line. After the year we have named, the remaining part of the line lay idle for years, until the North-Eastern Railway Company agreed to complete it. That completion is at hand. The North-Eastern has expended on the completing works no less than £229,785 up to the middle of this year; it is estimated that in the half-year that is now current there would be an expenditure of not less than £15,000, and a similar sum in a future period; so that the cost of the line is about £260,000 to the North-Eastern, as well as the £4500 that it has paid to the original company for some years as rent. The line is complete now, with the exception of a few works needed to fulfil the "wind requirements" of the Board of Trade; and thus in a few weeks there will be the opening a line through a picturesque country, and the North-Eastern will find some return for the enormous expenditure that it has made; though it remains to be seen what return will be made to the original shareholders on the capital that has been so long idle. Practically this completes the heavy works that the North-Eastern Railway Company began in the period of prosperity. The Alnwick and Cornhill branch authorised last session, which is expected to cost £370,000, has yet to be begun, but it is probable that the company will have to undertake other heavy works to meet the growing demands of its ports. The traffic to and from these inland is continually increasing, and that with some rapidity, so that new lines will be needed to serve them; and the North-Eastern can now devote attention to its sources and its traffic.

WORKMEN'S PATENTS.

DISCUSSION is just now rife in Birmingham touching the patent laws, and the alterations which the rights of inventors call for in any new legislation upon the subject. The advocates of specific alterations of some importance specially desire a reduction in the present scale of fees for provisional protection. Mr. Richard Tangye has come forward with the expression of a "decided opinion that the present scale of fees for provisional protection is much too high," but he disputes the inference of another writer, that it is because of the high fees payable at the various stages in the life of a patent that so vast a proportion "succumb to exhaustion." He has no hesitation in saying that "fully 50 per cent. of the inventions submitted to his firm are either impracticable, worthless, or have been anticipated." In respect of a *bond fide* invention of a working man, he holds that there can be no possible objection to the lowering of the cost of obtain-

ing patent-rights; but he inquires what can be said of an advertisement which is now being widely published, running: "Practical improvements discovered by operatives in their work protected and worked free of cost for share in the result." This Mr. Richard Tangye asserts is a direct incentive to draughtsmen and operatives to take advantage of any improved method, process, or design which they may be employed in carrying out, to patent it in their own names, or, as a blind, in their patent agents' names, behind the backs of their employers, and then to use the patent-rights so acquired to prevent the latter from continuing to use the process in question. Mr. Tangye holds that "it would be much better to abolish patents altogether than that such practices should become general." We trust that Mr. Tangye takes an exaggerated view of the facts, and we venture to think that the inventions pirated in this way are very few in number.

PHOSPHOR BRONZE FOR TELEGRAPH WIRE.

THE cost of a telegraph line depends far more upon the difficulty of laying than on the cost of the wire. In Brussels there are several instances where telephone wires are left unsupported for distances of 300 or 400 metres. These spans would be impossible with galvanised iron, or even steel wire, but are perfectly practical with phosphor bronze. The diameter usually employed is about 16 b.w.g., which affords a resistance of 38 to 44 tons per square inch. Phosphor bronze possesses this great advantage over copper, that it becomes very hard on being drawn into wire. With a slight reduction of sectional area in wire-drawing it becomes half-hard, and takes an elasticity which prevents all danger of elongation on tension, while it can be easily rolled up and unrolled. The experiments made at the Berlin Industrial Academy have proved that phosphor bronze is capable of standing reiterated strains better than any other metal or alloy.

LITERATURE.

A Treatise on the Transit Instrument as Applied to the Determination of Time, for the use of Country Gentlemen. By LATIMER CLARK, M.I.C.E., &c. Westminster. 1882.

THE author has found time in the midst of his labours in his own special line to write a popular work with a view to the introduction of the transit instrument to the notice of gentlemen who have sufficiently clear heads and enough energy to master it; especially we may suppose those who live sufficiently far from a railway station to make the keeping up of correct time an object. The author, we imagine, pictures to himself a country gentleman capable of scientific work, but one who has never been able to give himself to any regular scientific pursuit, who would erect his transit instrument, and perhaps in connection with a good clock, keep correct time for the benefit of the village or neighbouring houses. The book is written in a business-like way, with this distinct object in view. The object is a good one, for besides the direct results obtained, it would be well if some of the more general principles of astronomy were better known. The relations of mean and apparent time, for example, are unknown to many who would not grudge the few minutes that are necessary to apprehend the question if it were brought before them. We are inclined to believe that two or three hundred years ago, when sun dials were many and watches were few, there was more general knowledge on this subject, though apparent time might be kept up in the absence of a system of telegraphs and railways without the violence done to watches in making them conform to it being recognised. We remember this question coming up in an absurd way in Egypt in 1874, during the stay of our expedition to observe the transit of Venus in that country. Egypt from Cairo southwards consists of a narrow strip of land running nearly due north and south. Apparent time was the very thing for such a country and for the Egyptian people. The sun is almost always visible, their prayers take place at sunrise and sunset, and everything worked harmoniously until the presence of ships in Alexandria Harbour and of a European population setting their watches to mean time caused confusion and trouble. It was impossible eventually to keep Alexandria from employing mean time, and hence at certain periods of the year there existed over sixteen minutes of difference between the times of Cairo and Alexandria. This difference caused altercation and trouble on the railway at these periods, and the difficulty at length caused the matter to be investigated, and eventually the revolutionary order was given to adopt mean time at Cairo. The order was given, but the difficulty of getting it carried out may be conceived by those who know the East. Incidentally may be mentioned the fact that an orthodox Mussulman gun at the citadel sounded out at noon every day, being fired by the rays of the sun falling on a lens. Thus, the sun solemnly recorded its daily protest against the mean time movement, forming no bad type of the protest of the old Mahometan authorities against the degenerate followers of Islam who have conformed to Western ideas.

To conclude with our Transit Instrument treatise, however. We have spoken of the business-like way in which instructions are given, illustrated by examples; we should, however, make one distinct change in the plan of such a work. We have ourselves in bygone years experienced the annoyance of converting astronomical time into mean time. This, we would point out, is not merely an operation effected at leisure in the reduction of observation, but one which has to be carried out in order to prepare to take the transit of any star. Consequently, owing to disappointments in weather and other causes, it would often have to be done in vain. It would constantly present itself as a preliminary task, which would prevent a man being tempted to use his instrument suddenly on a fine night. We should rather suggest that a clock or watch should be regulated to go to astronomical time. It is obviously very easy to increase its rate by four minutes a day. The expense is nothing in comparison to that of the transit instrument, and it could always be altered to go mean solar time again when required no longer for astronomy. A clock going to astronomical time would do away with a great part of the calculating to which we object. It would render the Nautical Almanack tables available, and it would be more really scientific. Astronomical and mean solar time might then be kept side by side, as at Greenwich.

ON THE TREATMENT OF STEEL FOR THE CONSTRUCTION OF ORDNANCE AND OTHER PURPOSES.

By Sir W. G. ARMSTRONG, C.B., F.R.S.*

THE improvement which of late years has been effected in the manufacture of steel, and the control which has been attained over the quantity produced, now seems to justify its exclusive employment in the construction of ordnance. We have, therefore, to consider what are the conditions under which it can be most favourably used for that and other purposes.

There is at present much want of a proper definition of steel. The former was formerly confined to iron containing a much higher proportion of combined carbon than is found in the so-called mild steels of the present day. The chief distinction between iron and steel now seems to lie in the process of manufacture, steel being operated upon in a state of fusion, while iron is dealt with in a state of agglutination. But even in the mild state, steel, as thus defined, contains more carbon than is generally to be found in wrought iron, and this excess, small as it is, appears to exercise a very important influence upon its qualities. These qualities have been very distinctly brought out in some investigation which I have recently had occasion to make on the welding, tempering, drawing, and annealing of steel, and the results possess a general interest, independently of gun-making. First, as to the adaptation of steel for welding. As a matter of every-day practice, we know that steel very low in carbon is capable of welding, and it has frequently been maintained that without departing from the system of constructing ordnance known as the "civil system," great advantage would be realised by substituting mild steel for wrought iron in the making of welded coils. Our distinguished President, who has taken such a leading part in the modern development of steel manufacture, and whose knowledge of the metallurgy of the subject is not surpassed by that of any other person, has held this opinion, and a few years ago he supplied to my firm a sample of mild steel specially prepared for this purpose. It was very low in carbon, containing only about 0.10 per cent. A test piece cut from the bar as it came from the maker showed the limit of elasticity, or point at which permanent stretch commenced, to be 13.5 tons per square inch, being not much greater than that of wrought iron, and it broke at 23.3 tons, showing that its ultimate strength was also very similar to that of iron; but its ductility was so great that it stretched to the extent of 37.5 per cent. of a length of 2in. before breaking. A similar test piece tempered in oil had its elastic limit raised to 24 tons per square inch, and it broke at 28.6 tons per square inch, while its ductility remained nearly the same as before, the elongation being 36 per cent. instead of 37.5. It will be perceived, therefore, that the material was of a very fine quality, and if the results attained with the tempered specimen could have been realised in a welded coil, its superiority over wrought iron would have been very marked indeed. Two welded coils of equal dimensions were made from this material, and there was no appearance in either case of defect in the welding. Both of these coils were tempered in oil, and one of them was applied as a jacket to a steel cylinder closed at both ends, and used for the purpose of determining the pressure exerted by different charges of gunpowder fired in confinement. An exact duplicate of this cylinder was jacketed with a coil of wrought iron of the same dimensions as the steel one, and the two cylinders were used in comparison with each other. Much to our surprise, the cylinder with its steel jacket began to stretch laterally under a pressure which produced no change in the wrought iron coil. The experiment was considered conclusive against the use of steel for welded coils, and no further attempt was made to use it for that purpose.

The duplicate of this steel coil was laid aside, and my attention having been lately recalled to the subject, I applied myself to discover the cause of the inferiority displayed after undergoing the process of coiling and welding. I had a test piece cut from the coil in the lengthways direction of the bar of which it was made, and I found the elastic limit was only 12.5 tons per square inch, against 24 tons in the previous tempered test piece, while the breaking point was 19.1, against 28.6 tons in the former case. The loss of ductility was still more decided, the elongation being only 7.5 per cent. instead of 36 per cent. I then had a test piece cut across the welds, and this broke, not at a weld, but through the solid, thus showing that the welding was perfect. In this case the elastic limit was 12 tons per square inch, the breaking point 20.1 tons, and the elongation 6 per cent. To determine whether the deterioration which the material had sustained was permanent, or whether this quality could be restored, a portion of the welded coil was hammered out in length, and reduced from a piece of about 5in. and 2in. thick to a section of about 1in. square. A test piece from this bar showed a complete restoration of the fine qualities of the steel. The limit of elasticity rose to 21 tons, the breaking point to 27 tons, and the elongation to 36.5 per cent. It was remarkable, however, that after this treatment no further increase of strength was obtained by a renewal of the tempering process. The fracture of the test piece from the original bar was slate coloured, and of the character usually called fibrous. The test pieces from the coil shown in coarsely granular fracture, but in the restored state, effected by hammering, the fracture again became slate coloured and fibrous. Thinking it possible that the coil might have been over-heated in the welding process, I had a pile made with a number of small slabs of the restored material, and welded at a somewhat lower heat than had been applied on making the coil; but test pieces cut across the pile invariably failed at the junctions with a very insignificant strain, showing that the welding heat could not be reduced consistently with sound welds.

In order to ascertain whether it was the heating or the hammering that had injured the welded coil, I had a piece of the material cut from the coil and restored to a good condition by drawing under the hammer, and then heated up to the welding point, allowed to cool without being hammered for welding. In this case the fracture showed no change of crystalline structure, nor was there any decided alteration in quality except that the hardening effect of the hammering was removed. It began to stretch at a low limit, viz., 12.5 tons per square inch, but its breaking point was 25.2, which was higher than in the original bar. The elongation remained nearly the same, being 34 per cent., so that the mere heating to a welding temperature without disturbing the particles by hammering had no serious detrimental effect. I then took a piece of the steel in the restored condition, and after heating it to the welding point, delivered upon it in that state a single blow of a hammer sufficient to crush it into half its thickness. The result was that the flattened piece divided into fissures all round the edges. For the purposes of comparison I took a piece of wrought iron, selected at random from a scrap heap, and treated it exactly in the same manner. The result was that the iron bore the blow, flattening it to the same extent as the steel without showing the slightest fissure on its edges. These two pieces are now on the table, and it is impossible to examine them without perceiving that the steel, though differing so little from iron in the amount of its carbonisation, was yet, when heated to the welding point, in a state of friability, while the iron remained perfectly plastic. The conclusion was thus confirmed that it is the disturbance of the particles in this friable state, and not the mere heating, which exercises the injurious effect in the welding process. I was not surprised to find that the coil itself had derived no benefit from the tempering, because although steel so low in carbon as this sample is considerably improved by tempering when the piece subjected to the process is of small dimensions, yet when the bulk is considerable the cooling in the oil is not sufficiently rapid to produce any decided effect.

My next experiments were made upon a block of gun steel, containing 34 per cent. of carbon, and which had been rejected on account of its deficient tensile strength. A test piece, cut from

the block as received from the maker, began to stretch permanently at 11 tons per square inch, breaking at 29.4 tons per square inch with an elongation of 24.25 per cent.; but a piece of the same steel drawn out under the hammer at a red heat from a thickness of 5in. to a thickness of 1.4in. resisted 19 tons instead of 11 without stretch, and a breaking strain of 27.5 against 24.25. A piece of the same steel 5in. long by 4in. thick, having been tempered in oil, gave a test piece showing a further increase of strength with little diminution of ductility. It began to stretch at 23 tons, breaking at 36.5 tons and elongating 21 per cent. Various attempts were made to weld this steel in a pile of slabs, but it was found impossible to make sound joints, and the steel was even more deteriorated than had been the case with the previous sample; but a piece of this material spoiled in the attempt to weld it, having been drawn out into a bar of lin. square, proved to be far stronger than in the original state. It stood 24 tons per square inch before stretching, against 11 tons in the previous untempered state, and 33.6 tons before breaking, against 29.4, but the elongation was reduced from 24.25 per cent. to 15 per cent. The fracture in this case was of the same character as in the original piece, and showed no indication whatever of the previous injury it had sustained by the attempt to weld it. A piece of the same ingot, heated to a welding temperature and allowed to cool without hammering, gave a test piece which, so far from showing any injury by the heating, resisted a considerably higher strain than the sample taken from the block as it came from the maker. Its stretching point was 16 tons per square inch, its breaking point 33.2 tons, and its elongation 20 per cent. Another block of gun steel containing rather more carbon, viz., .41 per cent., gave the following results:—A test piece, cut from block in its original state, began to stretch at 14 tons per square inch, broke at 32.5 tons, and elongated at 23 per cent. The same cut from a thick lump of the same material, which had been tempered in oil, resisted 28 tons before permanent stretch and 43 tons before breaking, with an elongation of 16 per cent., thus showing the much greater effect of the tempering process; the proportion of carbon is increased, but showing also that the loss of ductility by process becomes more considerable.

It being important to ascertain whether steel cylinders which have been tempered in oil could be re-heated sufficiently for the purpose of shrinking upon a gun without destroying the effect of the tempering, a test piece, cut from the same tempered lump of this steel was heated in melted zinc to a temperature of 750 deg., and then allowed to cool naturally in air. Comparing its resistance with the piece which had not been re-heated, it gave 25 tons per square inch, against 28 tons before stretching, 40.2 tons against 43 tons before breaking; but its ductility was increased from 16 per cent. to 20.5 per cent.; so that although rendered slightly inferior in strength, it was rendered more ductile and tougher by the re-heating. Similar experiments made with steel rather lower in carbon showed that the effect of re-heating to this temperature was almost inappreciable either in the way of improvement or the contrary, and no degree of sudden cooling from so low a temperature had any distinct effect. On carrying the re-heating to still higher degrees, the effect of the previous tempering gradually diminished, but was not altogether obliterated, even when the temperature was raised to the bright red heat which the rapid cooling steel had been immersed in the oil. The friability of the steel at a welding temperature became more marked as the percentage of carbon was increased. Of the many examples I tried, the highest in carbon was the block already mentioned, containing 0.41 per cent. of carbon. This steel, like the milder samples, suffered very little from being merely heated to the welding temperature, provided that while so heated it was not disturbed by hammering. But it was so friable at that temperature that it broke into a mass of small crumbs under a moderate blow of the hammer. It was remarkable, however, that the same blow of the hammer which detached them from the block united them in a thin cake on the anvil. Specimens are produced illustrating the effects of this treatment. Whether the friability at a high temperature can be corrected by combining these materials with it is a point upon which my experience casts no light. If it can be so corrected without detriment to the material, the knowledge of how to do it will be an important acquisition to metallurgical science.

Many of my test pieces were taken from rolled steel hoops containing from .22 to .35 per cent. of carbon, and all of these showed much greater tenacity than was exhibited by test pieces taken from forged blocks of similar material. It is one of the characteristics of mild steel that it is enormously increased, both in strength and toughness, by being drawn out either by rolling or hammering, but especially by rolling, which is more uniform in its action than hammering. There can be no doubt that the process of rolling steel tires may be extended to the production of rolled hoops of great width, and the time may not be distant when we may see a realisation of the prediction made many years ago by Sir Frederick Bramwell, that we should eventually be able to produce in this manner continuous unwelded cylinders for boiler-making purposes. Steel cylinders thus made and tempered in oil will be in a highly favourable condition for the construction of ordnance, but in order to make them available for longitudinal as well as for lateral strength, it will be essential to have them in much greater widths than existing machines are competent to produce. All ductile metals derive additional strength by being stretched, but steel does so in a pre-eminent degree. Roughly speaking, its modulus of elasticity may be taken as equal to $\frac{1}{10000}$ th of an inch per foot for every ton per square inch of tension. This measure of elasticity applies equally, or nearly equally, to all kinds of steel, but the range of elasticity becomes greater as the strength is increased. Thus, steel that will bear 20 tons with permanent stretch, will retract $\frac{1}{2500}$ th of an inch per foot of length on being released from its load; while steel that will bear 40 tons without permanent stretch, will recover $\frac{1}{1000}$ th of an inch per foot on the removal of the strain. So, also, if the weaker specimens which recover only $\frac{1}{2500}$ th of an inch be stretched to a point at which it will sustain 40 tons per square inch, it will be exactly in the same condition in regard to elasticity as the stronger specimen which bore that load in the first instance—that is to say, its range of elasticity will be doubled. This is a very valuable quality, enabling steel to gather strength as it yields to an important increase of load. As an illustration of the extraordinary strengthening effect of stretch upon mild steel, I may mention that a sample of the steel taken from the welded coil to which I have adverted, and which in its original state showed a tensile strength very slightly exceeding that of wrought iron, sustained a load of nearly 85 tons per square inch measured on the attenuated section of fracture.

But much as steel gains in strength by the process of rolling, it gains still more by that of wire-drawing. No form of steel is comparable, in respect of strength and toughness, to that which has been drawn into the form of wire or riband; and in the case of its application in that form to the strengthening of a cylinder, it has the additional advantage of admitting of being laid on with a more favourable adjustment of tension than is practicable with a solid hoop of considerable thickness. But even with wire, the best tensional condition for giving strength to a cylinder can only be approximately attained, owing to the fact, which is commonly overlooked, that in bending a wire over a cylinder it is impossible to give the proper degree of stretch to both of its sides. The outer side, having a larger circle to describe, must necessarily undergo greater elongation than the inside; and in fact, unless the wire be laid on at a far higher strain than would be necessary or beneficial in the case of rings, the inside, acting as a fulcrum to stretch the outside, will assume a state of compression, which can only be taken off by expanding the cylinder after the wire has been laid on. The thinner the wire the less will this disadvantage be felt; and for this reason a given area of section is much better in the flat, or ribbon form, than either round or square. Great additional strength is given to steel wire by tempering in manufacture, and the highest strength is attained by passing the wire through the die as a final operation after the tempering process. The effect of this treatment is to put a very hard skin upon the wire,

which, though greatly adding to the strength, is unfavourable for bending, and a very slight injury to the surface greatly conduces to fracture. Ductility is of paramount importance in wire that has to be rolled at a high tension on a cylinder, and, for this reason, wire tempered after instead of before finishing is safer, though not so strong. If the wire be thick, judicious annealing, though it lessens the ultimate strain which the wire will bear, raises in a very marked degree the limit of elasticity. I have found that steel wire of about 0.2in. thick, of great ultimate strength, began to stretch permanently at a tension as low as 25 tons per square inch, while after being properly annealed it would bear 35 tons before permanent movement. The explanation of this curious fact is probably to be found in the removal by the annealing process of the contending state of tension produced by the drawing or tempering on the inner and the outer portions of the wire. This view is enforced by the fact that when the thickness of the riband was reduced to somewhat less than half, this advantage of the annealing process almost wholly disappeared, and the wire was simply softened or rendered more ductile. Castings of steel unhammered are improved by being tempered in oil in much the same degree as the forged material. Test pieces from a cast trunnion of steel gave the following results:—Before tempering the elastic limit was 16 tons, breaking load 27.8 tons, elongation in 2in., 7.5 per cent. After tempering, E.L., 25 tons; B.W., 37.7 tons; Ex., 12.5 per cent.; showing a great improvement under every head. The quantity of combined carbon contained in this specimen was 0.36 per cent. The objection to the use of cast steel in the unhammered form is that it is liable to unsoundness from air bubbles. This I think ought not to exclude its use for trunnion rings, which, from their peculiar form, can only be very imperfectly forged. The unsoundness from this cause would be greatly mitigated by casting under pressure, as advocated by Sir Jos. Whitworth. There is much less sacrifice of ductility or toughness when increase of strength is obtained by tempering than by increase of carbon; and, in fact, the advantage of tempering in oil is so apparent, both in the case of steel castings and of steel which has been either rolled or forged, that there is strong inducement for engineers to avail themselves of the process for increasing the efficiency of the material in nearly all its applications. The saving of the weight of material necessary for a given purpose would amply repay the cost of the tempering, and in the case of bridges of great span, where the strains are chiefly due to the weight of the structure independent of its load, the economy effected would be far more than proportionate to the increase of tensile strength in the material.

My experiments are not sufficiently extended to enable me to speak definitely as to the best proportion of combined carbon for steel, to which the tempering process is to be applied, but excellent results can be obtained with steel containing 0.35 per cent. carbon. If the masses to be dealt with are thin, less will suffice, and if thick more will be required, but it is quite possible that the mode of applying the oil in the tempering process might be improved so as to render it more efficacious where the bulk of the steel is large.

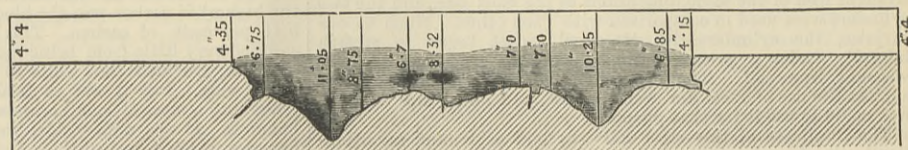
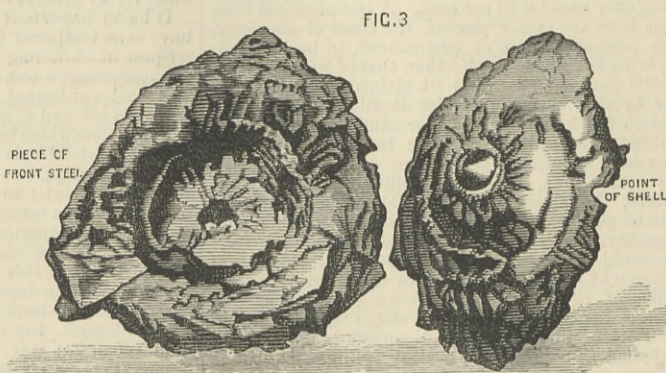
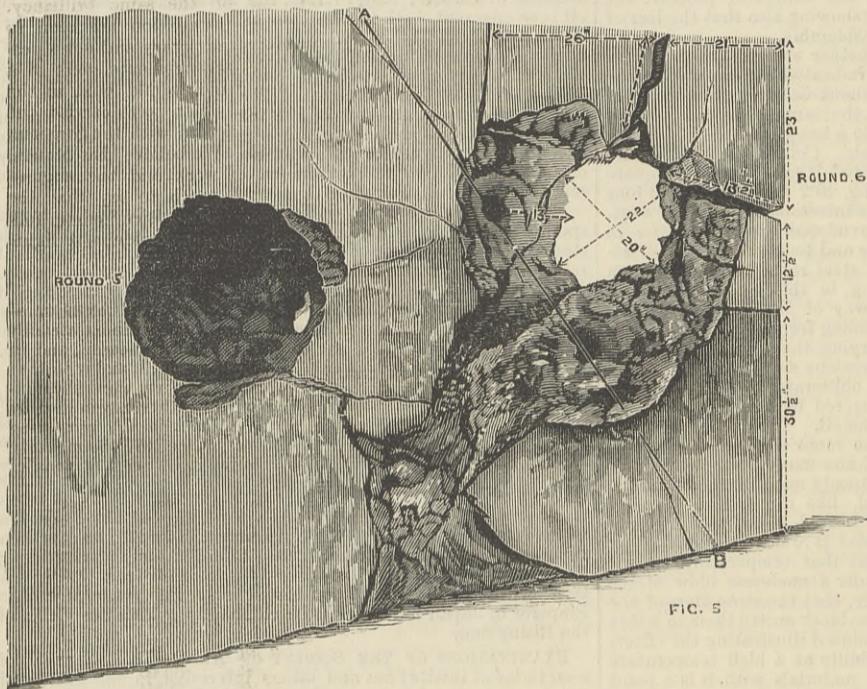
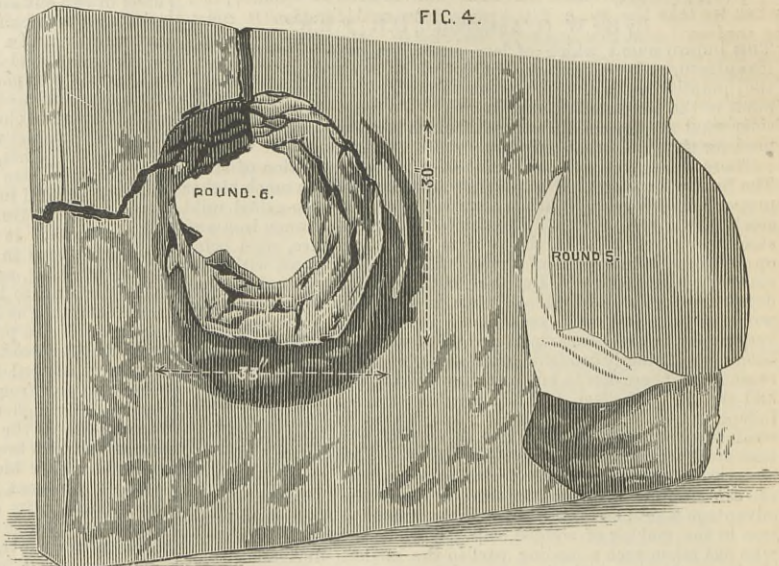
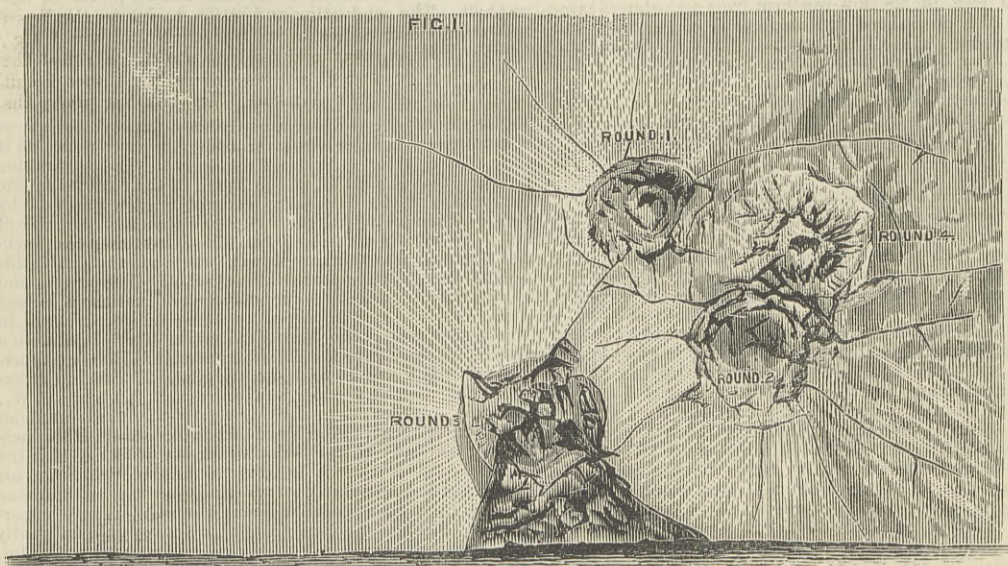
THE ENGINEERING COLLEGE IN JAPAN.—In the beginning of July Mr. Henry Dyer resigned the principalship of the Imperial College of Engineering at Tokio, an office which he held for nine years. He has been succeeded in the principalship by Dr. Divers, who has been Professor of Chemistry since the institution of the College, and his work in the Chair of Engineering is to be taken up by a new English professor. As a testimony of the respect in which Mr. Dyer is held by the Government of Japan, he has been appointed Honorary Principal of the College; and before leaving he was presented with addresses and testimonials from the foreign staff of the College, the graduates, and the students. The Emperor of Japan has also decorated Mr. Dyer with the Order of the Rising Sun.

EXAMINATIONS OF THE SOCIETY OF ARTS.—The attention of secretaries of institutions and others interested in the Society of Arts' examinations is especially drawn to the fact that important alterations have been made in the examination system. The following are the principal points in which changes have been made since the publication of last year's programme:—1. The examinations in subjects of "Commercial Knowledge" have been renewed. 2. The three subjects, "Clothing," "Cookery," "Housekeeping," &c., will be comprised in a single paper, under the head of "Domestic Economy." The examination in "Health" will be continued under the title of "Sanitary Knowledge." 3. A fee of 2s. 6d. will be required from each candidate in each subject, except Practical Music, for which special fees are required. 4. No prizes will be given in any subject. 5. Certificates in three classes will be given. 6. The restriction as to the age of the candidates has been removed. 7. An examination will be held in any subject of "Commercial Knowledge," in addition to those already in the programme, for which 25 candidates offer themselves, provided the Council approve of the subject. The subjects of examination for 1883 will be:—1. Arithmetic. 2. English—including composition and correspondence, and précis writing. 3. Book-keeping. 4. Commercial Geography and History. 5. Shorthand. 6. French. 7. German. 8. Italian. 9. Spanish. 10. Political Economy. 11. Domestic Economy. 12. Sanitary Knowledge. 13. Theory of Music. 14. Practical Music. In addition to the above subjects, the Society will provide for an examination in any other subject which may fairly be comprised in "Commercial Knowledge," and of which the Council approve, provided not less than 25 candidates are guaranteed for such subject. The examinations, in all the subjects, except practical music, will be held on the evenings of Monday, the 9th, Tuesday, the 10th, and Wednesday, the 11th of April. The complete programmes can be had upon application to the Secretary of the Society of Arts, John-street, Adelphi, W.C.

NEW LIVERPOOL STEAMERS.—The new steamer *Hermes*, which has been built to the order of Messrs. R. P. Houston and Co., Drury-buildings, Liverpool, made her trial trip last week, and the result of her preliminary run must have been as satisfactory to the owners as it was creditable to all concerned in the fitting out of the vessel. The *Hermes* is the second ship which has been built for the firm named—the *Hercules* being already on active service—and she will prove a notable addition to the steamers sailing from Liverpool, being intended for the general carrying trade. She was built at Whiteinch, Glasgow, by Messrs. Aitken and Mansel, and is 305ft. long, has 40ft. breadth of beam, and 22ft. depth of hold. She possesses 800 tons water ballast, very powerful pumps, and all the latest improvements in marine architecture, including Messrs. Muir and Caldwell's steam steering gear, and Sir W. Thompson's compasses. The *Hermes* has been fitted with her engines by Messrs. Jones and Sons, of St. George's Engine Works, Liverpool, and the ship has been constructed to carry 3200 tons dead weight, with 20ft. draught. She is remarkably well built, and furnished in a manner which has fully satisfied the requirements of Lloyd's surveyor's special inspection, being classed 100 A 1. She has two boilers and eight furnaces, and is expected to attain a speed of 10 knots an hour. The screw steamer *Benbrack*, of 2047 gross tonnage, was taken out for a six hours' trial trip on Friday, in Liverpool Bay, and proved exceedingly satisfactory to those interested. About three months ago, when this steamer was handed over to the engineers to be refitted with new engines, &c., she was a four-masted vessel, with the engines right aft, and required 400 tons of ballast on board to keep her upright. As she appeared on her trial trip she is a smart-looking schooner-rigged steamer, with funnel amidships, 600 tons of water ballast on board, and clean swept holds. The speed and consumption with the old engines were relatively 7 knots and 24 tons a day; with the new engines they are 10 knots on 17 tons. The steamer was handed over by the managing owner, Mr. Joseph Hault, to the contractors, Messrs. John Jones and Sons, St. George's Engine Works, by whom the whole of the ship and engine work has been effected, the engines having been fitted with all the latest improvements introduced by this firm.

* British Association, Section G.

EFFECTS OF SHOT ON A COMPOUND ARMOUR PLATE.



RECENT EXPERIMENTS WITH AN 11-INCH COMPOUND ARMOUR PLATE AT SHOE-BURYNESS.

MAJOR O'CALLAGHAN, R.A., who under the Commandant of the School of Gunnery, Colonel Hastings, R.A., carries out all experiments, has recently communicated a paper to the Royal Artillery Institution, on some curious features in the behaviour of steel-faced plates under fire, on which he consulted Col. Inglis, R.E. Such a paper is of course most interesting to those who have to do with armour in any form. Without attempting to follow the critical reasons throughout, we give some extracts, observing that there is a curious analogy between this trial of an 11-inch Brown plate by the artillery, by means of 9in. and 12in. guns, and that recently made of a Cammell-Wilson 11in. plate also by 9in. and 12.5in. guns. This plate is described by Major O'Callaghan as follows:—"An 11in. compound, steel-faced, armour plate" has

effected their separation. In this particular instance the usual *modus operandi* was departed from, and the molten steel was poured between the wrought iron backing and a face-plate about 1in. thick of rolled steel. Both steels were precisely the same in composition, and contained the same amount of carbon, *i.e.*, 0.75 per cent."

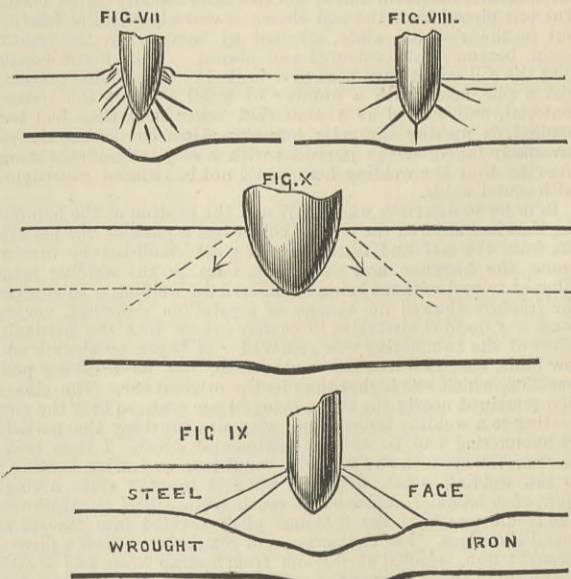
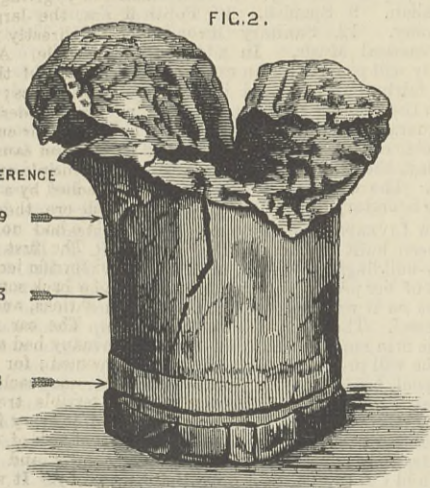
Four rounds were fired at this plate, which was backed with 24in. of oak, from the 9in. gun. The first three were with Palliser chilled projectiles, weight 260 lb., charge 50 lb. of pebble, giving striking velocities of from 1444ft. to 1430ft., and striking energies from 4132 to 4050 foot-tons. The fourth round was with a studless Cammell steel shell weighing 279 lb., striking velocity 1405ft., energy 3822 foot-tons. These projectiles produced indents of from 6.9in. to 5.55in. with some hair cracks in front and bulges in rear of from 1.1in. to 0.68in. Fig. 1 shows the plate at the conclusion of this part of the trial. It had then been struck by a total weight of metal of 1059 lb., with an aggregate striking energy of 14,869 foot-tons, against which it had held its own. Major O'Callaghan terms the damage practically *nil*.

In last October the same plate was set up again in front of an old 12in. compound plate, 12in. of oak backing intervening. In the meantime a star-shaped crack had developed in the face near the end opposite to that which had been fired at, showing how much more extensive is the molecular action developed in a plate by blows than appears at first. This plate was then fired at twice from the 38-ton gun, 12.5in. calibre, range 93 yards, weight of shell 840 lb., firing charge 160 lb. P² powder, striking velocity 1425ft. and 1413ft. successively, the corresponding stroke energies being 11,824 and 11,695 foot-tons. The first round of these two—No. 5 in all—cut through the plate so far as to nearly separate a disc above 20in. in diameter; the rear view is shown in Fig. 4, the body of the shell, which was apparently inferior in quality, opening out and rebounding in the form shown in Fig. 2, while the head flattened out and made a curious impression on the disc of steel which was in front of it, as shown in Fig. 3. The plate battered as it was received the sixth round—the second from the 38-ton gun—which striking near the position of round four, see Fig. 1, made a hole about 21in. in diameter.

We would first point out that this 11in. plate has been subjected to two blows capable of penetrating about 17.5in. of unbacked wrought iron, and that with steel projectiles, such as ought to be capable of giving a good account of a compound plate, though considerable difficulty has been experienced in obtaining such projectiles lately. Previous to this the plate had received three rounds of Palliser shot, which had been declared by the sub-committee almost useless against compound armour, and one of steel, which should be capable of penetrating about 12.5in. of unbacked iron. This plate was well backed though with soft backing, and thus the reference we give to the regular standard may not be as good a measure as desirable. The practical value of this armour, however, is apparent when we point out that any ship capable of carrying 11in. of armour might with it have defied the heaviest guns afloat, except the new type Armstrong guns in the Chinese ships and the 80 and 100-ton guns of the Inflexible and Italian vessels. Yet 11in. is by no means thick armour, two broadside ships carrying that; indeed, the Alexandra carries 12in. and the Temeraire 11in. of iron, and the whole of our first-class turret ships carry more. Such trials are strong incentives to use compound armour. But

this is not the point dwelt on by Major O'Callaghan. He proceeds to investigate the action of impact on steel-faced plates. After reading repeatedly what he has written we think we can hardly curtail his observations, and those of Colonel Inglis, without serious loss, and so give them *verbatim*, with the exception of an apology at the end for length, which it would be a bad compliment to the readers of THE ENGINEER to reproduce in connection with information from the very best sources on such a subject:—

"A large layer of steel was found to have come away from the front in the region of the indents made by the 9in. projectiles, disclosing a very curious configuration of the steel round these depressions. Fig. 5 shows the crater-like form they exhibit, and Fig. 6 is a cross section through A B, showing their depth and the curved form of their sides. This strange phenomenon perhaps throws some light on an appearance which has given rise



recently passed through such a severe ordeal, and has exhibited such curious phenomena in connection with the behaviour of steel when subjected to battering, that perhaps a short account of this battering may prove of general interest. The plate, manufactured by Messrs. Brown and Co., of Sheffield, measured 10ft. by 5.5ft. by 11in., and was composed of about 7in. of iron, faced by about 4in. of steel, welded together by the process known as Ellis's patent. This process may be roughly described by stating that a wrought iron plate, rolled in the usual manner, is brought to a welding heat, and then covered with a layer of molten steel which is poured on to it and retained by a wall of wrought iron surrounding the plate, after the manner of an open mould. When the mass is sufficiently cool, the double plate thus formed is rolled again, and its thickness considerably reduced. By this means a weld between the two metals of extraordinary tenacity is produced; in no instance has firing at the plate

* This is the same plate as the one referred to by Capt. Orde Browne in his Lecture on "Ironclads," which appeared in last number of "Proceedings" of the Artillery Institution.

to much speculation in former rounds fired at steel-faced armour plates. It has always been observed that a wedge-shaped layer of steel is apparently separated radially round the indents, and, in early experiments, it was thought that a thin part of the steel face, the absolute uniformity of which cannot always be guaranteed, had been struck. The frequency of the appearance, however, negated the theory, and the denuding of this plate seems to show what probably happened in other instances; the wedge-shaped layer of steel being, in fact, a portion of the surface or covering of the 'craters,' now removed. It is wonderful to contemplate the intricate molecular movement which must have been going on under the apparently undisturbed surface of the plate, and which was merely indicated by the radial cracks which were developed, some at the time, and some considerably after the shot had struck; difficult, too, to realise the tremendous tension to which this surface was subjected, tightly stretched over

the distorted metal beneath it. Yet, in spite of all this, the plate had still cohesive power left to withstand successfully the shock of the first 38-ton projectile.

"It may be urged that this shell was of inferior quality, but when we take the state of the plate into consideration it must be confessed that it was a very remarkable performance. Including the second 38-ton shell, which, had it struck a sound part, would probably have done little more harm than the first, the weight of metal fired at the plate now amounts to 2744 lb., striking with an aggregate energy of 38,388 foot-tons. The actual causes which have given rise to the peculiar appearance of the surface laid bare by the flaking away of the crust are rather obscure, and one or two authorities have bestowed a considerable amount of thought upon the subject. The theory that is perhaps most worthy of credence is one which is really the outcome of several people's opinions, and may be briefly stated as follows: When a shot strikes and is arrested by a plate, the metal its point or head displaces must go somewhere. In a wrought iron plate, it is, we believe, driven forward in a cone in front of the shot, the 'bulge' at back presenting the well-known features of a pronounced swelling, which, if the point has nearly penetrated, is cleft by star-shaped fissures. In addition to this, there is generally a high lip thrown up round the entrance of the hole. In a steel or steel-faced plate the appearances are very different. There is no lip, and the bulge in rear is scarcely perceptible, or, at all events, much less pronounced; hence it is evident that the metal round the point of impact is more impeded in its efforts to escape when displaced. Now it is clear that the displaced metal must be thrust away normally to the curvature of the head of the shot, and the direction taken by the molecules is represented by diverging rays in the diagrams, Figs. VII., VIII., IX., and X, at all angles between the vertical and horizontal. A bursting strain or thrust will be set up somewhere between these two limits, and along this line will there be a tendency on the part of the metal to separate—in other words, there will be a line of cleavage. We should therefore be prepared to find a portion separated from the rest in the form of a cone bounded by straight lines. But it is not so. The cone is, as we have seen, curved in section. How is this curvature to be accounted for? When any metal is subjected to a crushing strain beyond its power of resistance, it evinces a tendency to buckle or bulge outwards—this is, I take it, the key to the rounded aspect of the exterior of what may be termed the 'craters.' The steel displaced by the advancing point is crushed and yields upwards, or buckles into the cavity caused by its separation, or partial separation, from the rest of the plate; thus presenting the appearance of the rounded, indented cumulus before described.

"On examination of other broken compound plates in which portions of these cumuli are seen in section, it appears that, although it has never been before so favourably displayed, the same phenomenon has been invariably produced to a greater or less degree, and that therefore some law must exist which governs the motion of the particles in the disrupted metal. It remains for further experiments to throw more light on the subject, and to prove whether the theory above enunciated is worthy of adoption; at present it is only put forward as a conjecture fairly supported by facts.

"Since writing this, I have received a letter from one of the greatest authorities on armour plates that we have, Colonel T. Inglis, R.E., in which the writer's views on the subject just discussed are set forth so clearly and vigorously that, with his kind permission, I quote them *in extenso*:—"In the early stages of the entrance of the pointed head of a shot into a steel-faced plate, I imagine that the intense pressure of the shot is mainly borne by a cone, roughly described in the diagrams. In fact, up to the stage shown, very little work can have been done upon the steel lying outside this cone. The pressure upon the material of the cone will be in the direction of the arrows, Fig. X., tending, of course, to compress it, while the adjacent steel outside the cone is not subjected to any great pressure. Hence, it would be natural to expect some separation of the cone from the rest of the steel; and it must be remembered that not only the steel of the cone under compression at this stage, but its base is resting all the time against a bed of soft wrought iron, which must yield more or less under the pressure and so facilitate the separation of the steel. The reason for the cone not being a true figure, but more often, I believe, bounded by curved lines is, I have no doubt, due to the form of the head of the shot—and probably we could, by varying the form of head between a blunt and very sharp cone, alter the form of cone in the armour almost at will. Of course, the steel face outside the cone becomes more or less compressed in later stages of the entrance of the shot, but by that time the main separation has taken place, and although the pressure in those parts is borne more entirely by the steel and conveyed in a less measure to the wrought iron of the armour, yet, if we could more fully examine the effects produced in several of these rounds, I should expect to find the commencement of other cones beside the main one. In a soft, plastic material the action must obviously be very different, and hence the reason for these cones of separation not having been observed before the introduction of steel-faced armour."

A RUSSIAN COAL MINE.

THE mine of the Russian Steam Navigation and Trading Company, of part of the machinery of which we give this week a supplement drawing, is situated at Grouchevka in the district of the Don, South Russia, where the best known seams of Russian anthracite coal are found. A branch line of railway connects this mine to the Kozloff Voronege and Rostoff Railway Company's line, by means of which the coal on being drawn from the pit and loaded into the railway truck is conveyed to whatever part of the empire it may be destined for, without being removed from the railway truck. The machinery and other plant of these mines is arranged for putting out 60,000 poods, or 1000 tons of coal per day; but owing to the scarcity of miners, or the demand for coal being limited, the output seldom exceeds 24,000 poods, or 400 tons, which is about a ninth part of the whole of the various classes of coal worked out in the district of the Don Army.

The sinking of the pits was commenced in the year 1863, and continued until two workable seams of anthracite coal were reached, the first of 35in. and the second of only 28in. thick—of the two seams the second is the better coal, and is about 12 per cent. more valuable in the market than the upper or first workable seam. The seams were reached at a depth of 61 and 71 fathoms from the surface. The sinkings were completed and the working of coal commenced in the year 1871, under the direction of the late Russian mining engineer, Mr. Paul Wagner. In 1872 the management of the mine was transferred to the present manager, Captain N. Skariatine, I.R.N. Owing to the opening out of extensive dip workings, and the prospect of having a large increase of water to contend with in the future, it was deemed necessary to put down the additional underground pumping and hauling machinery as shown by our drawing. The underground pumping engine was supplied by Messrs.

Hathorn Davey and Co., Leeds, and is one of their direct-acting compound and condensing engines, fitted with Davey's patent differential valve gear. The diameter of the high-pressure cylinder is 23in., and that of the low-pressure cylinder 35in., with a stroke of 6ft.; the piston rod at back end is connected direct to two 11in. ram pumps, and connected at the front end of the engine by a wooden connecting rod to the two bell cranks which actuate the spears of the two bucket pumps for raising the water from the sump below the second seam of coal to the tank placed in the engine compartment in the first workable or upper seam of coal, from which the ram pumps take the water and force it to the surface. The engine is capable of raising 306,432 Russian vedros, or about 823,672 gallons per day. Provision is also made for placing another engine of the same power alongside it, should it be found necessary, the steam and main water pipes having been put in of sufficient size for the two engines. Independent of this new pumping machinery there are the old engine and pumps which were placed during the construction of the pit, and consist of an engine at the surface on the Bull system, with a cylinder of 45in. diameter and 9ft. 8in. stroke, actuating a set of 14in. diameter plunger-and-bucket pumps which are capable of raising 200,000 Russian vedros, or 577,617 gallons of water per day. Besides these there is a set of 14in. plunger-and-bucket pumps placed in the winding pit, which can be connected to either of the winding engines in cases of emergency, and are capable of raising 100,000 Russian vedros, or 288,808 gallons per day, making a total of 606,342 Russian vedros, or 1,695,097 gallons per day. This large amount of pumping power is liable to be required at the commencement of the spring of any year after a winter of much snow, which thawing suddenly, causes a large amount of water to penetrate to the workings of this and the numerous small mines in the direction of the rise of the seams, many of which mines are not wrought at that season, and the water from them finds its way to the Russian Steam Navigation and Trading Company's mine, and has to be raised by the machinery described.

The water accumulating in the dip workings is forced up to the pump well of the main pumping machinery by means of water pressure engines, which are situated near the bottom of the dip or lower boundary of the royalty, as marked in the illustration. These engines are driven by water taken down from the surface, and actuate ram pumps, which force the water up the incline through cast iron pipes to the well of the main pumping engine. The traction of the coal from the workings to the cages at the bottom of the pit was formerly done by manual labour and horses, until the workings becoming at such great distances and lower down the dip, a difficulty was encountered in getting out the quantity at a cheaper rate than could be done by machinery. It was then decided to put down endless chain haulage capable of conveying 15,000 Russian poods, or 250 tons, in 8 cwt. tubs in eight hours from the lowest part of the royalty to the cages at the bottom of the winding pit. The chain is driven by a horizontal engine, with a cylinder 18in. diameter and 3ft. stroke. The main sheave for driving the chain is bolted to the arms of the spur wheel, which is driven by a pinion on the crank shaft which makes five revolutions to one of the spur wheel. The branch roads are driven by 3-tier chain sheaves or drums, fitted with soft steel pins projecting out to prevent the chain from slipping. The same size chain is used in all the roadways; this enables the chain from the upper road, when it has become too much worn, to be replaced by the chain from the lower road, where the least work has to be done. The chain was supplied by Messrs. Brown, Lennox, and Co., London, and the spur gearing, chain sheaves, and other castings were made at the engineering works of Mr. William Graham, Rostoff on Don, South Russia. Owing to the quick decay of timber, old rails have been used in the construction of the chain gear.

THE ELECTRIC LIGHT AT BIRMINGHAM.

WHILST a good deal of congratulatory criticism has been lavished over the late musical festival, it may not be out of place to add a little more, but upon a slightly different subject. Birmingham likes to do things well, and one of its citizens thinking it would add to the interest of the festival, suggested and offered to bear the expense of lighting the Town Hall by electricity. The offer of Messrs. Wingfield and Co., of the Cambridge-street Works, was accepted. The speciality of this firm has hitherto been connected with gas fittings, but seeing the possibility of the introduction of the incandescent electric lamp for interior lighting, a good deal of attention has during the past few months been given to electric light fittings. The lighting at Birmingham was carried out at the firm's request by Messrs. R. E. Crompton and Co., under the directions of Mr. Henry Lea. According to all the opinions expressed the lighting was a great success—in fact it is said to have been the most perfect experiment ever carried out in this direction. The lamps employed were those of Mr. Swan, of 20-candle power nominal. Five hundred of these lamps were used upon two circuits. Groups of twelve lights, resembling a bunch of grapes, were placed upon pendants, each lamp having a translucent fluted glass shade to assist in diffusing the light. Sixteen such groups and ten compound groups were arranged in the Hall and orchestra, together with a number of two-light and six-light pendants. The Hall is 135ft. long, 65ft. wide, and 65ft. high, with galleries at the entrance end and sides, with the orchestra and organ facing the entrance. Before describing the arrangements adopted for obtaining the current, it may be well to state that those engaged during the festival were invited to give a written opinion as to the light, and also its effect on the ventilation. Thermometric tests showed that, contrary to the case when gas is used, the coolest part of the room was above, the temperature level with the top of the organ being some 3 deg. or 4 deg. lower than on the floor of the hall. The statements made were altogether in favour of the light, and one lady made the pertinent remark that no fainting had taken place during the festival. Owing to the equal temperature the derangement of tone of the organ was almost nil.

The current was obtained from Birgin machines constructed by Messrs. Crompton, the motor being the steam engine at the Cambridge-street works. The fly-wheel of the engine is about 24ft. diameter and makes some 48 revolutions per minute. Twelve Birgin machines, in four sets of three each, were fixed upon a wood framework, the machines being so arranged as to be movable by means of a screw in one direction to allow the belts to be made tight. One set of three machines was used to excite the field magnets in series of the other machines. Only two of the three machines were used, the third being there in case of accident. Thus the magnetic field of each of these nine machines was practically alike, and as the pulleys were all connected to the same shafting by similar belts and similar pulleys, the speed of the armatures was the same, as was also the electro-motive force and the current. The armatures were connected in multiple arc, and the current delivered into one main. The currents from the brushes were led by means of switches through a Siemens dynamometer to terminal screws upon a heavy brass plate. A similar plate was fixed at the ends of the circuits in

the Hall. The current could be passed direct from plate to plate or through a resistance of iron wire, this resistance being used when it was desirable to lower the candle power of the lamps one half. The conducting and return mains to the Town Hall consisted of eleven cables, each of seven No. 16 wire b.w.g., enclosed in an iron pipe taken under the street. Eight of the dynamos supplied the current to one circuit, the minor circuit being supplied by the ninth dynamo. Mr. Lea has given the following figures:—

Table with 3 columns: Description, Resistance, Current. Includes sections for (A) Exciting Circuit, (B) Working Circuit, and The Minor or (C) Circuit.

The lights ran for several hours together without a perceptible flicker, and so well had the lamps been selected and manufactured that the light from each was of the same brilliancy. Although the success attending this installation has been so great, we must not forget that it was a temporary and not a permanent one, and hence some of the arrangements were of a slightly different character from those which would hold in the case of permanent work. The fittings, which were carried out by Messrs. Wingfield, were designed to accord with the gorgeous fittings of the Hall, and were admirable. We believe that Messrs. Wingfield have taken up this branch of work, and the suggestions of Mr. Crompton, and it is not too much to say that the combined efforts of these firms have given the Birmingham folk a fair idea of the capabilities of the electric incandescent light.

RAIL IMPORTS AND RAILWAY CONSTRUCTION IN AMERICA.

British rail exports to the United States have declined steadily since January, though they usually increase at this season, and in May last they were the smallest since January, 1881, and with that exception the smallest since 1879. Our rail imports were insignificant for several years until August, 1879. In the first seven months of that year they amounted to but 8948 tons; in the remaining five months of 1879 they were 18,840 tons. Since 1879 the monthly exports from Great Britain to this country have been, in tons of 2240 lb.:

Table with 4 columns: Month, 1880, 1881, 1882. Shows monthly rail export data.

Last year in May the exports to the United States were larger than ever before since 1873; this year they were nearly the smallest since 1879; and last year and the year before the exports were comparatively light early in the year, and became heavy in the spring and summer, while this year they were heavy in the winter and have become light since. The Railroad Gazette says:—"If we depended chiefly upon exports for our supply of rails, this would be a certain indication of an approaching reduction in consumption, but our imports are now but a small part of our supply, and the works for producing steel rails in this country probably have nearly 20 per cent. greater capacity than at the same time last year. It is thus possible to keep up consumption while reducing exports. More significant of a decreasing demand, however, is the fall in the price of domestic rails. Steel rails are now about 20 per cent. lower than at the beginning of the year.

A STARTLING RIDE.—Here we were to stop at the village of Torch Lake for some time, to unload machinery, giving us time to visit the Calumet and Hecla Copper Mines, the largest in the world. Two little tracks lead from the wharf directly up over the mountain, a rise of about 500ft. to the quarter mile. A number of us resolved to make a trip up to the mine. One of the foremen kindly rigged a short box-car, by nailing planks across; and we all piled in, and sat waiting in the broiling sun, wondering how we were to be pulled up the hill. After a long time our curiosity was gratified in a way that made us a trifle skeery, and caused some to give up the pleasure of the journey. The principle on which the cars run was very simple. The cars were attached by a long cable, and when they came down the hill laden with ore, they pulled, or rather jerked, the empty cars up the hill. We had no conductor, and there was no particular starting signal. The first intimation we had that we were ready was a sudden and terrific jerk, followed by the grand and unanimous acrobatic feat of a back somersault by the whole company, a chorus of feminine shrieks, and a frantic gesticulation of arms, legs, and umbrellas. The car moved on, and by the time we all got back on our seats many had all the ride they desired. But, alas! they were now doomed; for there was no stopping of this train until the summit was reached, and no getting off without tumbling from that terrible trestle. We plunged along, now swiftly, now slowly, and at every fresh start our heads would fly over backward, at the great risk of dislocating our necks. Soon we began to tear along madly, and sway from side to side. Just then a dark object whizzed by. It was the ore cars on the down track. Their speed was now frightful, and ours was necessarily in the same proportion; for the faster they went down the sooner they reached the top. We finally arrived, more frightened than hurt, over the brow of the hill. The mine was now four miles distant. Our car was hitched to an ore train, and a locomotive drew us the remainder of the distance. If the ride by cable was frightful, the second haul was simply terrific. We had still a deep grade to ascend, and the engineer opened wide the throttle, and let the "old thing just hum." We went ahead ten feet at a jump, often three feet above the rails; but Providence alone brought us down on the track again. We swayed from side to side until the car grazed the trees by the wayside, and when we snapped the whip around sharp curves the train would swing out in a straight line, held fast together by too tenacious couplings. And all this time we were enveloped in a dense cloud of smoke and cinders, which numerous umbrellas could not ward off. When at last we did arrive at the Calumet Mine, we were so changed in appearance that we were taken for a band of striking miners, until the spokesman explained. . . . On the way down the same reckless rate of speed was kept up. An unfortunate cow stepped suddenly from the woods on the track. Our car struck her, and she shot off into the air over the edge of the mountain, and landed on our boat at the wharf beneath.—Correspondence Rochester Democrat and Chronicle.

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

(From our own Correspondent.)

THERE is no falling off in the activity at the finished ironworks throughout South Staffordshire, East Worcestershire, and Shropshire.

Galvanised sheets of good quality are procurable at £8 for singles, £9 for doubles, and £10 for trebles. Working-up sheets, to bear stamping, were priced from 5s. to 10s. in advance of these figures. "Severn" sheets were quoted yesterday £12, B. sheets £13, B.B. £14, and B.B.B. £15. The works of Messrs. E. P. and W. Baldwin, where these are produced, are quite busy.

Plates for girder use are selling at £8 on a good order, though £8 5s. is asked. Boiler plates are firm at £8 10s. for "Wright" quality, and "Monmoor" and "B.B.H." are £9 ordinary and £10 best, with a slowly growing demand.

Scrap bars were quoted to-day at £9 for best qualities, and £10 for double best. Plating bars were £8, and best ditto £9 10s., while best turning bars were £11. Marked T-iron was £8 10s. to £9 10s., and marked rivet iron £9 to £9 10s. per ton. Best chain bars were £9, and marked cable bars £8; but there was a quality of "cable iron" to be got at £6 17s. 6d. and occasionally £6 15s. An excellent smithy bar was offered to-day at £7 easy, and there was no difficulty in getting a fairly good quality from that figure down to £6 10s., but at the last-named price the makers who offered them declined to impress their brand.

Prices were stronger yesterday and to-day because of the resolution passed on Saturday at the conference of miners held in Manchester, to demand a rise of wages in October under threat of a strike; and there was a feeling of insecurity touching ironworkers' wages, which will be regulated in practice by the decision that may be arrived at between the men and the masters in the North of England.

Pigs were in plentiful supply from the local furnaces, and the sales were a slight increase at firm rates. Hot-blast all-mine sorts were £3 5s. to £3 10s.; cinder qualities, £2—quoted £2 2s. 6d.

Coal was firmer alike in Birmingham and Wolverhampton, and the Cannock Chase household qualities were advanced 1s. upon last week's rates, making deep coal at the pits 10s. per ton.

The demand in the wrought iron tube trade has fallen away conspicuously during the last couple of months, and the works are now only partially occupied. There are, however, some noteworthy exceptions where the work in hand for export allows of full time still being run. South Africa is an important customer for water-tubes.

One of the last contracts received in the Birmingham district is for a large quantity of coach ironwork to be used in the construction of ambulance, limber, and provision wagons at Woolwich, to be despatched to the seat of war. The contract has fallen to a Wednesbury firm, and a larger one might have been secured if deliveries could have been made with all the stipulated promptitude.

The Miners' Conference in Manchester is already bearing fruit in this district. A series of meetings have been arranged for in North Staffordshire, with a view of making the miners more united, so as to gain an increase of wages by-and-bye.

NOTES FROM LANCASHIRE.

(From our own Correspondent.)

Manchester.—Both buyers and sellers in the iron market here still show so little anxiety to enter into further transactions—consumers on the one hand running off their contracts, and makers on the other working on with their deliveries—that there is scarcely anything to test values, so far, at least, as pig iron is concerned. There is undoubtedly a large consumption going on throughout the district, which, with a continuance of a healthy state of trade, must before long bring buyers into the market; but for the present there is a general absence of demand, and the tendency would appear to be towards less firmness on the part of sellers. Although actual business cannot be reported at any materially lower figures, offers at under current rates would in many cases be more readily entertained than was the case a week or two back.

I could hear of very few inquiries stirring on the Manchester Exchange on Tuesday. Local makers of pig iron have been doing extremely little for the past week or so, but they are still making good deliveries from the works, and for delivery equal to Manchester their quotations remain firm at the old rates of 46s. less 2½ for both forge and foundry qualities. District brands are, if anything, a trifle easier in some cases. Sales here and there are still reported at full rates, but the average prices for delivery equal to Manchester might now be given at 47s. to 48s. 6d. for Lincolnshire and 48s. to 49s. 6d. for Derbyshire less 2½; g.m.b. Middlesbrough is quoted nominally at about 52s. 6d. per ton net cash.

The forges throughout the district continue well employed; they are, however, kept busy chiefly on orders for shipment, the home demand not being more than moderate. Makers are firm on the basis of £6 7s. 6d. for bars delivered equal to Manchester or Liverpool, but there is some under selling by second hand holders.

With regard to the engineering trades, the information I gather from well-informed sources is that business is not quite so good as it has been; there is a falling off in the number of new inquiries, and even in the shipbuilding trade new orders are coming forward less freely. Inquiries for men are also considerably fewer than they were a short time back.

The new process for getting coal by compressed lime cartridges in the place of blasting by gunpowder came on for discussion at the Miners' Conference during their sitting of Thursday last, but did not meet with unqualified support. The opinions expressed by several delegates only tended to confirm what I pointed out last week, that there is not as yet any basis of results sufficiently reliable to claim for the process an undoubted success. The use of powder was, of course, strongly condemned, but the new system did not seem to have impressed itself at all favourably upon the minds of some of the delegates. Although it was admitted to have given satisfactory results where it had been tried in long-wall workings in several collieries, the opinion was expressed that for some seams and for some methods of getting coal it would not be at all adaptable. One or two of the delegates went so far as to urge that it was no business of the Conference to push forward the system or to ask Government to interfere for its promotion; that if it was really good the system would of itself come to the front without any outside assistance. Ultimately a resolution was passed to urge upon the Home Office the necessity of finding means to test the principle of bringing into use the new system of getting coal with lime. I may add that the opinion of practical mining engineers with whom I have conversed, who are as anxious as anyone to dispense with the undoubted danger attendant upon blasting with powder, is that the slowness of the lime process will interfere with its success in seams where there is a cleavage of soft material in the coal or when the roof or floor is composed of soft material. In such cases it is probable that the gradual expansion of the lime would be taken up and expend itself in the softer material, where a sudden disruption would be effective in bringing down the coal. In good solid seams, with sound roof and floor, the lime process would no doubt be effective, as they would afford a resistance to the smallest amount of expansion; and as the expansive force exerted by the lime is irresistible, it would inevitably bring down the coal.

The coal trade, although improving so far as the demand for house fire qualities is concerned, does not as yet develop sufficient activity to enable any advance in prices to be realised. Supplies are still so plentiful in the market that for current sales colliery proprietors have to take low figures, and when in one or two cases slight advances were talked off with the commencement of the month, no attempt has yet been made to put them into operation.

For iron making and steam purposes the demand shows no material alteration. At the pit mouth prices remain about as under:—Best coal, 8s. to 8s. 6d.; seconds, 6s. to 7s.; common coal, 5s. to 5s. 6d.; burgy, 4s. to 4s. 6d.; good slack, 3s. 6d. to 3s. 6d.; and inferior sorts from 2s. 9d. to 3s. 8d.

Shipping has not been quite so active; for delivery at the high level Liverpool, or the Garston Docks, prices remain at 6s. 6d. to 7s. for steam coal, and 8s. 3d. to 8s. 6d. for seconds house fire qualities.

The strike in the St. Helens district has come to a somewhat abrupt termination; Messrs. Richard Evans and Co. having withdrawn the notice against which the men were fighting, work has been resumed on the old terms. The next feature is the threatened agitation for an advance of wages throughout Lancashire; but as yet it is too early to predict what action this may lead to on the part of the employers or the men.

Barrow.—No new feature of any moment has occurred in the hematite pig iron trade, except that the position has been considerably strengthened by a further influx of orders, some of which are of heavy tonnage. Prices are undisturbed, No. 1 Bessemer being quoted at 59s.; No. 2, 58s.; No. 3, 57s. per ton net f.o.b. Heavy consumers from America have arranged with makers at 58s. 6d. per ton for very large parcels. The demand for hematite pig iron is very actively maintained from all quarters, but especially America, and the expectations of a brisk trade with that country, which were indulged in some time ago, have been fully realised. American buyers are still active, and are making arrangements for placing further orders in the hands of smelters, which are likely to keep them fully employed during the winter months. The deliveries of iron are still very heavy, and as I have previously noted, will continue so till the complete close of the shipping season. Steel makers are very busy in all departments, especially rails. Prices are unchanged. Blooms are in active demand. Iron ore is in large output at late prices. Iron shipbuilders have obtained two or three good orders and are negotiating for others. Engineers, ironfounders, boilermakers, &c., are busy, and have a good supply of work. Shipping active, principally on foreign account.

THE SHEFFIELD DISTRICT.

(From our own Correspondent.)

NEXT month Messrs. Charles Cammell and Co., Limited, expect to transfer the whole of their rail plant from Dronfield to Workington, but I question if they will do it so early. The Derwent Works, which the company purchased simultaneously with taking over the Dronfield concern, cost it £105,000. They consist of three large blast furnaces, with all the necessary appliances. For the production of steel rails the Dronfield plant, of course, will be placed close to the blast furnaces, and new works are at present in progress for the combination. The whole works, when completed, will cover over 80 acres of land. Workington will have yet another long chimney added, with a roomy shed in which will be placed six Bessemer converters in three pits. The average output at which the company aims is 3000 tons of steel rails per week, and to accomplish this the new mills will be of larger capacity than the present Dronfield Works. The additions at Workington are expected to cost over £40,000. The cost of removing the plant at Dronfield to the coast is estimated at £34,000. At the last annual meeting it was stated that by the removal of the Dronfield Works the company expected to save £50,000 a year in carriage of raw material to Dronfield, and £20,000 in the despatch of rails to the port. This is equal to 19 per cent. per annum on the capital required for the purchase and removal, and equal to a dividend of 7½ per cent. on the existing capital of the company. The population of Workington will be increased by some 3000, and 500 more houses will be needed to provide accommodation for them.

So far I hear of no other local firm following the bold lead of Messrs. Charles Cammell and Co. For export trade there is no denying the advantage of producing rails at the coast, but the home trade can be done quite as effectively in the centre of England. At Workington Messrs. Cammell and Co. will make rails for export only, and continue to manufacture rails for the home companies at Sheffield and at Penistone. At present the rail trade is brisk enough, but prices are very low, and even at these low quotations, competition is excessively keen.

At the Etna Works Messrs. Spear and Jackson are increasing their facilities for the production of saws. When the trade was dull certain parts of the works were given over for spade making. It has now been necessary to renew saw-making in the old shops, and as the spade and fork trade is also active, to find accommodation for it by transferring the steel manufacture to the other side of the street. The revival of the saw trade, it must be admitted, is mainly due to the adoption of American patterns, such as the "hollow-backed," which is a favourite in the Canadian market. A very good business is being done at present in hand saws for France. In forks, the wood shafts, come from Canada, are fitted here with steel tines, and return to the Canadian market the completed "forks."

The advance in the price of coal notified by the London firms appears to be owing more to apprehensions of increased prices than to actual rises in value at the collieries. The foolish talk at the Miners' Conference at Manchester about a general strike if colliers' wages were not generally raised, has evidently alarmed the dealers. On inquiry at the collieries in this district, I cannot find that any fresh advance was made in house coal for the district on the 1st of September, but for London the quotation was increased 6d. per ton. The value must increase again very soon, but as yet summer quotations are the rule in the locality, and for London there has been no further rise—except that noted—since August, when 6d. per ton was added.

The Albion Steel and Ironworks were exposed for sale on Tuesday, but found no purchaser, though offers were solicited at £25,000, and eventually at £20,000 and £15,000.

The new Master Cutler, Mr. Albert A. Jowitt, of the Scotia Steel Works, Attercliffe, was installed on the 7th inst., and gave the usual cutlery feast the same evening. Mr. Jowitt contemplates opening the question of making the Cutlers' Company a less exclusive corporation. At one time it could only be joined by those who made articles with a cutting edge; and one of the classes to whom he proposes to open its doors is the engineering profession.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

THE Cleveland Iron Market held at Middlesbrough on Tuesday last was well attended, and the tone thereof was steady with a tendency to firmness. The decision of the Scotch ironmasters announced just after the previous week's market, to the effect that they would not continue to act with their Cleveland competitors in restricting their output, had naturally a depressing effect for a time, and prices rapidly went down until, towards the end of last week, 43s. 6d. was again reached for No. 3 g.m.b.

On Monday, however, the Cleveland ironmasters' returns for August were issued, showing a net decrease in stocks of 21,842 tons. This return was regarded as extremely favourable by all interested, especially in view of the accumulation which must have occurred in the Stockton race week. A reaction therefore set in, and prices recovered on Tuesday about half what they had fallen to the previous week. No. 3 g.m.b. may now be taken to be worth 44s., f.o.b. Middlesbrough, and forge iron 1s. less.

The ironmasters' returns show that at the end of the month there were 120 furnaces in blast, whereof 81 are making Cleveland iron and 39 hematite and basic qualities. One furnace has been taken off the latter product and put on to the former. The output of Cleveland iron for the month was 147,818 tons, and of other kinds 76,949 tons, making a total of 224,767 tons, or 2526 less

than July. In makers' stores there was an increase of 5672 tons, the total quantity being 61,837 tons. The North-Eastern Railway Company's stores decreased 2450, and Connal's 2442 tons. The net result is a diminution in stocks to the extent of 21,842 tons. The total quantity held at the end of the month was 309,494 tons, as against 331,336 tons on the 31st July.

The agreement to restrict, entered on the 1st October, 1881, expires on the 30th inst., and has been attended so far by a reduction in stocks to the extent of 124,927 tons.

Some orders from the United States have been received, and two cargoes, amounting together to nearly 3000 tons, have recently been shipped at West Hartlepool by Messrs. Furness and Co. These vessels will bring back flour, bacon, and other farm produce. The shipments for last month were exceptionally heavy, reaching about 95,000 tons.

The manufactured iron trade is tending towards increased firmness. Shipbuilders and other consumers have been entering into the market largely during last week, and the quantity contracted for has been considerably in excess of what was rolled off. It was just this time last year that a period of heavy buying commenced, and the manufacturers believe that a similar period has now recurred. Ship-plates are, however, still offered at £6 15s. to £7, f.o.t. Middlesbrough, according to quantity and time of delivery. Bars and angles are quoted at £6 5s. to £6 7s. 6d., less 2½ per cent. discount.

The ironworkers connected with the manufactured iron trade have sent in a claim to the Board of Arbitration for 7½ per cent. advance, to come into operation at the termination of the "Pease" award. It will be remembered that the employers gave notice of a reduction, to commence at the same period, but have not yet fixed the amount of their claim. The men base their application on the generally improved prospects of trade, and because the returns for the second quarter of the year, published by Mr. Waterhouse, the accountant, showed, it is said, higher prices than those upon which Sir J. W. Pease based his award. It is believed, however, that this notice is really a piece of strategy on their part. They have already decided that the question shall be arbitrated, so far as they can influence the disposal of it, and they no doubt think that the more they claim the more they will get; or at all events, the more likely they will be to avoid a heavy reduction. It is, however, not at all certain that the employers will agree to arbitrate at all, inasmuch as the recent award was repudiated by the men, and was only enforced by a long and expensive contest.

A meeting of the standing committee of the Board of Arbitration was held at Darlington last week, to consider the claim from puddlers at three works for 6d. per ton extra for every half pig of hematite used for making better class puddled bar. Mr. David Dale was the arbitrator, and on taking his seat he took occasion to say that the "arbitration tree," if he might so call it, had been subject to rather severe blasts of late; that it had, nevertheless, deep roots, and he hoped would have a stronger hold in future than in the past. Evidence was taken on both sides, the men declaring that puddling hematite was much more difficult than puddling Cleveland iron, and should be paid for at a higher rate. The employers brought evidence that this was not the case, and pointed out the fact that in Cumberland six heats of pure hematite were easily worked, and at ordinary puddling price. Mr. Dale complimented both sides on the courtesy with which they had advanced their claims, and reserved his decision.

The ironworkers in the North of England are about to present a testimonial to Mr. Trow, their general secretary, for the valuable services he has rendered them for many years. They have appointed a committee to carry out this object. Mr. Trow richly deserves the compliment likely to be paid him. He is an able, intelligent man; while he is a most effective advocate for the interests of those who employ him, he is at the same time straightforward and honest to a degree which many others might imitate with great advantage.

It is to be regretted that Mr. Dunn, the able secretary of the Cleveland Miners' Union, has resigned his post. It has not been made known why this has occurred; but, inasmuch as Mr. Dunn has all the good qualities which also mark Mr. Trow, it is to be feared that he had been found not to suit the ideas of certain of his constituents who have not yet attained to the same moral level.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THE breakdown in the agreement between the Scotch and Cleveland ironmasters, for the restriction of the output of pig iron was, in the end, rather unexpected, and has tended to produce some derangement in the market. When the proposal for a renewal of the compact was first talked of, about four weeks ago, the feeling was that it might very likely not be renewed; but there subsequently grew up a strong belief in its continuance, so that the failure of the ironmasters to agree came upon the trade as a surprise. Messrs. William Baird and Co. are said to have been in the end the chief objectors to another term of restriction; and the proportion of furnaces owned by them is so great that without their concurrence it really would have been of little use for the other firms to persevere. That the restriction of the past twelve months has produced good effects no one will deny; but now that the makers' stocks have been greatly reduced, it is natural, when the demand for pig iron is so good at home and abroad, that the ironmasters should be desirous of enjoying full liberty in the matter of production. In the meantime the values of warrants have been considerably depressed, and large realising sales have taken place in the market within the past few days.

Business was done in the warrant market on Friday morning at 49s. 10d. to 49s. 6½d. cash, and 50s. to 49s. 10d. one month, the afternoon quotations being 49s. 6d. to 49s. 3d. cash, and 49s. 9d. to 49s. 6d. one month. On Monday forenoon business took place at 49s. 5d. to 49s. 10½d. cash, and 49s. 7½d. to 50s. 1d. one month, the transactions in the afternoon being at 49s. 10½d. to 50s. cash, and 50s. ¾d. to 50s. 2½d. one month. On Tuesday forenoon business was done up to 50s. 3d. cash, and in the afternoon the quotations were 50s. 3d. to 50s. 1d. cash, and 50s. 5½d. to 50s. 3d. one month. Yesterday business was done from 50s. to 50s. 3½d. cash, 50s. 6d. to 50s. 4d. one month. To-day business done at 50s. 2d. to 49s. 11d. cash, or 50s. 4d. to 50s. 2d. one month. Market firm.

The prices of makers' iron are a shade easier, in sympathy with warrants, as follow:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 61s. 6d.; No. 2, 54s.; Coltness, 65s. and 55s.; Langloan, 63s. and 55s. 6d.; Summerlee, 62s. and 53s. 6d.; Calder, 62s. and 53s.; Carnbroe, 55s. and 51s. 6d.; Clyde, 54s. 6d. and 51s. 6d.; Monkland, Quarter, and Govan, each 51s. 6d. and 50s.; Shotts, at Leith, 63s. and 55s. 6d.; Carron, at Grangemouth, 53s.—specially selected, 56s.—and 52s.; Kinneil, at Bo'ness, 51s. and 50s.; Glen-garnock, at Ardrossan, 55s. and 51s. 6d.; Eglinton, 52s. 6d. and 51s.; Dalmellington, 52s. 6d. and 51s.

The past week's arrivals of Middlesbrough pigs at Grangemouth were 4205 tons, as compared with 6505 in the corresponding week of last year.

There is a continuance of activity in nearly every branch of the manufactured iron trade.

In the course of the week the coal trade appears to have been fairly active, and a good trade is still anticipated. At Glasgow shipments are somewhat retarded by repairs that are being made at the quays of the mineral terminus. On the south side of the Frith of Forth the shipping trade in coals is brisk, and a slightly better tone has prevailed in Fifeshire. The coalmasters of that and the adjoining county of Clackmannan hold out no prospect to the miners of their wages being increased at present, as profits will not admit of it.

During the past month 26 vessels, with an aggregate tonnage of 36,980, were launched from the Clyde shipbuilding yards, as compared with 21 vessels, of 32,780 tons, in the corresponding month of 1881. In the eight months there were 166 vessels and 233,773 tons put into the water, against 153 vessels and 214,990 tons in the corresponding period of last year.

WALES & ADJOINING COUNTIES.

The week started badly, and a general strike at Landore Steel Works and another at the Coedcae Colliery, one of the most important sinkings in the Rhondda Valley, seemed to presage the advent of bad times again; fortunately prospects are better, and an amicable settlement has been brought about in both instances. As to Landore steel works, it would appear that the hammermen have been paid at the rate of £5 10s. per week, and the metalmen £3 10s., the class of steel by the Siemens process of these works being of first excellence, and requiring extreme care and ability. These wages the owners sought to reduce, in order to enable them to compete more successfully for trade; and though for a time this was refused and counter propositions submitted, eventually the hammermen at the new works returned at a compromise; and though at the new works there is a partial standstill, it is expected to be prolonged only a few days. Then at Coedcae again, where a thousand men are employed, the men came out, maintaining that they ought to be paid by the Cymmer rate, and this they plead would give them 4d. per week more than they now get, and hauliers 3d. per month! It is scarcely conceivable that a large number of middle aged and old men would resort to a stand-out on such paltry pretences, and possibly they would not have done so but for the hauliers, who were the leading spirits in the strife. On Wednesday the men arranged to resume work on the understanding with Mr. W. T. Lewis that they would work on until the end of the month, which would give time for the arrangement of the dispute. I have since heard that the origin of the dispute was through some mathematically-gifted collier discovering that the decimals of the Cymmer rate were not taken into consideration. What may not be expected when the next generation of school-board educated boys comes to the front? Small coal is advancing in price and getting scarcer. One firm has discontinued supplying it. Doubtless the activity in the patent fuel trade has something to do with this. The tin-plate trade in the Llanelly district is rather slack; elsewhere work is tolerably good, and market quotations are maintained.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

* * * It has come to our notice that some applicants of the Patent-office Sales Department, for Patent Specifications, have caused much unnecessary trouble and annoyance; both to themselves and to the Patent-office officials, by giving the number of the page of THE ENGINEER at which the Specification they require is referred to, instead of giving the proper number of the Specification. The mistake has been made by looking at THE ENGINEER Index and giving the numbers there found, which only refer to the pages, in place of turning to those pages and finding the numbers of the Specification.

Applications for Letters Patent.

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

- 4112. BATHS, W. Morgan-Brown.—(W. W. Rosenfeld, New York, U.S.)
4113. SEWING KNIT GOODS, &c., J. H. Johnson.—(C. H. Wilcox, New York, U.S.)
4114. AUTOMATIC NIPPER FOR WIRE ROPE, J. C. Spence and B. G. Nichol, Newcastle-upon-Tyne.
4115. STEAM PUMPS, J. F. Spencer, London.
4116. MANUFACTURING PAPER, C. O. McAllum, Newcastle-upon-Tyne.
4117. MACHINE FOR WASHING LAWN-TENNIS BALLS, A. S. Openshaw, Birmingham.
4118. CONSTRUCTING CASKS, &c., S. T. Thomas, Wolverhampton.
4119. PROPELLING SHIPS, &c., G. F. Harrington, Isle of Wight.
4120. SELF-ACTING TEA OR COFFEE URN, &c., R. W. Raphael, Baltimore, Ireland.
4121. FASTENINGS FOR SCYTHES, A. J. Boulton.—(A. Hagedorn, Osnabrück, Germany.)
4122. SAFETY STIRRUPS, A. J. Boulton.—(F. Lehmann, Tanagerhütte, Germany.)
4123. FILTERS, M. Richards, Stafford.
4124. MAKING METALLIC BOXES, &c., S. Rossé, Brixton.
4125. APPARATUS FOR ROASTING COFFEE, W. T. Sugg, Westminster.
4126. SPEED-ACCELERATING DRIVING MECHANISM, W. R. Lake.—(L. S. Fithian, Mount Clair, U.S.)
4127. ELECTRIC CONTROLLER, &c., for CLOCKS, &c., T. Wright, Malta.
4128. MACHINERY FOR REDUCING TIN STUFF, J. Toy and S. H. Stephens, Cornwall.
4129. BAKERS' OVENS, H. J. Haddan.—(C. M. Valfort, Macon, France.)
4130. MANUFACTURING BOXES FROM PAPER, &c., H. J. Haddan.—(E. B. and H. S. Munson, New York, U.S.)
4131. MANUFACTURE OF SILICATE OF ZINC, &c., C. F. Claus, London.
4132. APPARATUS FOR LETTING-OFF MOTION FOR WEAVING LOOMS, E. G. Swann.—(M. Parser, Holland.)
4133. PENCIL CASES OR HOLDERS, W. R. Lake.—(A. T. Cross, Providence, Rhode Island, U.S.)

30th August, 1882.

- 4134. SPINNING FRAMES FOR SPINNING, JUTE, &c., S. J. V. Day.—(J. Robertson, Samnugur, Calcutta.)
4135. VALVE MOTIONS &c., of STEAM ENGINE, A. C. Kirk, Glasgow.
4136. INDICATOR FOR CABS, J. Finney, Manchester.
4137. MACHINERY FOR FLANGING HOLES IN METAL PLATES, A. C. Kirk, Glasgow.
4138. DEODORISING, &c., APPARATUS, G. Nobes, London.
4139. MACHINERY FOR PRESSING WOOLLEN, &c., FABRICS, J. Burras and W. Renton, Leeds.
4140. MACHINES FOR SPINNING FLAX AND HEMP, J. S. Coey and J. McArthur, Leeds.
4141. RECIPROCATING PISTONS FOR FLUID PRESSURE ENGINES, &c., H. J. Haddan.—(M. V. Schilts, Cologne, Germany.)
4142. DOOR-LOCKS, H. J. Haddan.—(O. Belger and F. Preller, Germany.)
4143. DIVING APPARATUS, E. Easthope, Wolverhampton.
4144. MANUFACTURE OF CAUSTIC POTASH AND SODA, W. L. Wise.—(La Société Anonyme Lorrain Industrielle, Paris.)
4145. MARINE AND FLUVIAL STRUCTURES, J. G. Tongue.—(C. J. Keenan, Paris.)
4146. EXTRACTING JUICE FROM SUGAR CANE, H. H. Grierson.—(C. Hughes, Matanzas, Cuba.)
4147. GALVANIC BATTERIES, S. H. Emmings, London.
4148. APPARATUS FOR GENERATING, &c., ELECTRICAL ENERGY, P. de Villiers, London.
4149. APPARATUS FOR HANGING ELECTRIC, &c., LAMPS, A. M. Clark.—(H. G. Fiske, Springfield, U.S.)

31st August, 1882.

- 4150. STEERING GEAR, J. Granroth, Greenock, N.B.
4151. COUPLINGS FOR RAILWAY WAGONS, &c., S. Keeton, Lenton.
4152. APPARATUS FOR SUPPLY OF INK, &c., to PENS, G. R. Hughes and T. Carwardine, Hampstead.

- 4153. CARPET FASTENER, E. Edwards.—(J. A. Wilmot, Riverside, New Brunswick.)
4154. CHIME CLOCKS, H. Robert and H. F. Gouvenon, London.
4155. APPARATUS FOR THE EVAPORATION OF LIQUIDS, &c., Baron Podewils, Munich.
4156. APPARATUS FOR INTRODUCING MANURE INTO THE EARTH, L. A. Groth.—(K. Zaruba and A. Kounovsky, Pilsen, Bohemia.)
4157. TRICYCLES, &c., W. J. Lloyd, Staffordshire.
4158. APPARATUS FOR MEASURING, &c., ELECTRIC CURRENTS, A. L. Lineff, London.
4159. TELEPHONIC APPARATUS, J. H. Johnson.—(A. D'Arsonval, Paris.)
4160. TELEPHONIC INSTRUMENTS, J. Husbands, London.
4161. FILE FOR HOLDING PAPERS, &c., P. Lawrence.—(W. R. Clough, Newark, New Jersey, U.S.)
4162. ELECTRIC LIGHTING, T. T. Smith, London.
4163. FILTERS, A. M. Clark.—(W. Maynard, New York.)
4164. WORKING HYDRAULIC LIFTS, J. M. Day, W. R. Green, H. C. Walker, and R. Carey, London.
4165. STEAM AND HOT-WATER APPARATUS, W. R. Lake.—(E. F. Osborne, Saint Paul, Minnesota, U.S.)

1st September, 1882.

- 4166. FACILITATING THE IMPREGNATION OF AIR, &c., WITH ANTISEPTIC MATTERS, J. Mayer, London.
4167. INSTANTANEOUS BOAT DISENGAGING APPARATUS, C. Mace and J. Brewster, Sunderland.
4168. CARBON FOR USE IN ARC, &c., ELECTRIC LAMPS, H. J. Marshall, Linslade.
4169. PADDLE-WHEELS, P. M. Crause, Eastbourne.
4170. ROCKING CHAIRS, J. Hopewell, Salford.
4171. SAFETY COUPLINGS FOR WAGONS, &c., G. R. Snowden, Bradford.
4172. FRAMES OF BAGS, &c., V. Huppe, Germany.
4173. CONSTRUCTING SHIPS OR VESSELS, &c., C. D. Abel.—(E. Lavarenne, Paris.)
4174. METERS FOR WATER AND OTHER FLUIDS, J. Rettle, London.
4175. SECURING HEADS OF BROOMS TO HANDLES, W. J. Sage, London.
4176. PRINTING MACHINES, W. S. Hope, London.
4177. FISH BOLTS FOR RAILWAY FASTENINGS, A. M. Tippet, Barrow-in-Furness.
4178. SECONDARY, &c., BATTERIES, D. G. FitzGerald and T. J. Jones, London.
4179. VENTILATORS FOR RAILWAY CARRIAGES, &c., R. H. Brandon.—(Princes J. P. d'Aragnon, Paris.)
4180. CARBONS FOR INCANDESCENT ELECTRIC LAMPS, J. Jameson, Newcastle-upon-Tyne.
4181. APPARATUS FOR PRODUCING HIGH VACUUM, J. Jameson, Newcastle-upon-Tyne.
4182. APPARATUS FOR SHIPPING COAL, &c., P. J. Mesent, Tynemouth.

2nd September, 1882.

- 4183. RAILWAY VEHICLES, W. L. Wise.—(E. Röber, Dresden.)
4184. METAL FENCING, W. Bailey, Wolverhampton.
4185. STOPPERS FOR BOTTLES, &c., N. Thompson, London.
4186. CONSTRUCTING VOLTAIC BATTERIES, L. Hartmann, London.
4187. BREECHE-LOADING SMALL-ARMS, E. James, Birmingham.
4188. APPARATUS FOR PREPARING WOOL, &c., I. Bailey, Keighley.
4189. STEAM ENGINES, A. W. Pattie and G. W. Robertson, Glasgow.
4190. APPARATUS TO UTILISE THE ILLUMINATING POWER OF COMBUSTION FROM GAS, &c., H. Defty, London.
4191. HAIR RESTORER, E. Edmonds.—(J. Braithwaite, Paris.)
4192. ELECTRO-HYDRAULIC METER, &c., R. Hammond and L. Goldenberg, London.
4193. MACHINE FOR CUTTING, &c., the LININGS OF HATS, W. H. Beck.—(L. Chosson, Paris.)
4194. COVERING CONTENTS OF RAILWAY TRUCKS, &c., H. S. King.—(H. Davies, Lahore, India.)
4195. MAKING PAPER BAGS, T. Coates, Carlisle, and N. Chandler, Hedgesford.
4196. APPARATUS FOR RECORDING VOTES, J. Lazenby, Darnall.
4197. SEWING MACHINES, J. Warwick, Manchester.
4198. GALVANIC BATTERIES, E. B. Butt, Walthamstow, and W. T. Scott, Stratford.

4th September, 1882.

- 4199. CONSTRUCTING HOPPER, &c., DREDGERS, W. R. Kinipple, London.
4200. HANDLES FOR BICYCLES, &c., G. S. Kelsey, Birmingham.
4201. APPARATUS FOR CARBONISING AIR, &c., H. Defty, London.
4202. AXLE-BLOCKS FOR CARRIAGES, R. Palmer, Manchester.
4203. DRYING WASTE ANIMAL MATTER, &c., J. F. Johnston, London.
4204. METAL WAGONS, &c., A. H. Wallis, Basinstoke.
4205. COPYING PRESSES, &c., H. J. Haddan.—(A. Schapiro, Germany.)
4206. WARMING AIR BEFORE INHALING, &c., S. A. Darier-Gide, Geneva.
4207. MAGIC-LANTERN LAMPS, F. Newton, London.
4208. ACTUATING RAILWAY SIGNALS, &c., R. Evans and H. J. Bennett, London.
4209. STARCH AND FOOD FOR ANIMALS, H. H. Lake.—(W. T. Jebb, Buffalo, New York, U.S.)
4210. DISCHARGING BILGE WATER FROM THE HOLDS OF VESSELS, A. M. Clark.—(H. Cordes, Hoboken, U.S.)

Inventions Protected for Six Months on Deposit of Complete Specifications.

- 4004. MANUFACTURE OF STARCH FROM MAIZE, &c., W. R. Lake, Southampton-buildings, London.—A communication from W. T. Jebb, Buffalo, U.S.—26th August, 1882.
4095. UMBRELLA, PARASOL, and SUNSHADES MOUNTINGS, A. C. Henderson, Southampton-buildings, London.—A communication from C. Grataloup and J. B. Leymarie, Paris.—26th August, 1882.
4133. PENCIL CASES OR HOLDERS, W. R. Lake, Southampton-buildings, London.—A communication from A. T. Cross, Providence, Rhode Island.—29th August, 1882.
4141. RECIPROCATING PISTONS FOR FLUID-PRESSURE ENGINES, H. J. Haddan, Kensington.—A communication from M. V. Schilts, Cologne, Germany.—30th August, 1882.
4155. EVAPORATION OF LIQUIDS, &c., Baron Podewils, Munich.—31st August, 1882.

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

- 3540. PERMANENT WAY, &c., of RAILWAYS, F. W. Webb, Crewe.—4th September, 1879.
3682. MAKING HATS, &c., J. Turner, Denton.—15th September, 1879.
3810. LOOMS FOR WEAVING, S. O'Neill, Eccles.—22nd September, 1879.
3476. MICROPHONIC APPARATUS, W. P. Thompson, London.—29th August, 1879.
3480. BREECHE-LOADING FIRE-ARMS, &c., W. Soper, Reading.—29th August, 1879.
3509. REGULATING MECHANISM FOR ELECTRIC LAMPS, R. E. B. Crompton, London.—2nd September, 1879.
3535. HORSE GEAR FOR OBTAINING MOTIVE POWER, H. Crowley, Manchester.—3rd September, 1879.
3516. PRINTING WOVEN FABRICS, H. Oliver, Dumbarton, N.B.—2nd September, 1879.
3506. ELEVATING AND TRANSPORTING GRAIN, &c., W. Poulson, Liverpool.—2nd September, 1879.
3507. SUPPLYING GAS TO THE ROASTING OF COFFEE, H. Faulder, Stockport.—2nd September, 1879.
3519. HORSE-COLLARS, W. R. Lake, London.—2nd September, 1879.
3556. PERMANENT WAY OF RAILWAYS, &c., J. W. Grover, London.—4th September, 1879.
3517. MAKING CLAY TOBACCO-PIPES, W. Abbott and A. Dymock, Glasgow.—2nd September, 1879.
3520. CUTTING SCREWS UPON WROUGHT IRON PIPES, &c., J. Mackenzie, London.—2nd September, 1879.

- 3587. ELECTRIC LAMPS, &c., F. J. Chessbrough, Liverpool.—6th September, 1879.
3889. COMBING FIBROUS MATERIALS, A. M. Clark, London.—27th September, 1879.
3548. STEAM, &c., POWER HAMMERS, S. Massey, Openshaw.—4th September, 1879.
3565. DYNAMO-ELECTRIC MACHINES, W. Elmore, London.—4th September, 1879.

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

- 3000. MALLEABLE CAST IRON, J. Tenwick, Grantham.—3rd September, 1875.
3109. TWINE OF CORD, A. Waithman, Prestwich.—4th September, 1875.
3105. CUTTING AND FOLDING PAPER, &c., W. Conquest, London.—4th September, 1875.
3125. RAILWAY BRAKE APPARATUS, J. Y. Smith, London.—6th September, 1875.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 22nd September, 1882.

- 1655. FILTERING AIR ESCAPING FROM MILLSTONES, &c., E. Fiechter, Liverpool.—A communication from G. Baier.—6th April, 1882.
1968. COMBINED STEAM ENGINE AND BOILER, E. Edwards, London.—A communication from H. C. Hoffmeister.—26th April, 1882.
1976. OPENING TINS, CANS, &c., T. H. George, Attleborough.—26th April, 1882.
2019. GAS BURNERS, T. Fletcher, Warrington.—28th April, 1882.
2029. INGREDIENTS FOR PREPARING WOVEN FABRICS, &c., D. T. Gardner, London.—A communication from N. Hardinn.—28th April, 1882.
2033. SECURING BLADES OF KNIVES, &c., in their HANDLES, M. Merichenski, Poplar.—29th April, 1882.
2040. APPARATUS FOR COMBING WOOL, &c., J. W. Harding, Leeds.—Com. from S. Pegler.—29th April, 1882.
2126. GAS MOTOR ENGINES, S. Worssam, Chelsea.—5th May, 1882.
2192. BRIDGES OF LOOPS FOR INCANDESCENT ELECTRIC LAMPS, C. J. Allport, London.—10th May, 1882.
2237. MICROPHONES, J. H. Johnson, London.—A communication from A. D'Arsonval.—11th May, 1882.
2246. DIFFERENTIAL PULLEY APPARATUS, W. R. Lake, London.—A com. from F. Roy.—12th May, 1882.
2811. LUBRICATORS, B. J. B. Mills, London.—A communication from O. H. Jewell.—14th June, 1882.
3871. ROLLER FOR WINDOW-BLIND ROLLERS, &c., H. A. Williams, Lincoln.—15th July, 1882.
3581. FRICTIONAL BRAKES OR CLUTCHES FOR MACHINERY, H. Fisher, Nottingham, and J. S. Walker, Wigan.—28th July, 1882.
3594. GLASS, W. S. Sutherland, Birmingham.—29th July, 1882.
3619. FACILITATING ELECTRIC LIGHTING, J. Verity, London.—31st July, 1882.
3727. TYPE-WRITERS, A. H. Boulton and C. Dickie, London.—Com. from A. Hansen.—5th August, 1882.
4095. UMBRELLA, &c., MOUNTINGS, A. C. Henderson, London.—A communication from C. Grataloup and J. B. Leymarie.—26th August, 1882.

Last day for filing opposition, 26th September, 1882.

- 2049. AUTOMATIC FIRE-EXTINGUISHERS, J. R. Brown, Providence, U.S.—1st May, 1882.
2051. MACHINERY FOR WASHING WOOL, &c., T. J. Mullings, London, and W. Whiteley, Lockwood.—1st May, 1882.
2056. CONTROLLING THE DISTRIBUTION OF SEWAGE, &c., J. H. Shipway, Birmingham.—1st May, 1882.
2059. PAPER-CUTTING MACHINE, H. J. Haddan, London.—A com. from G. Broussier.—1st May, 1882.
2060. OPERATING FOG-HORNS, A. L. Wharton, Great Grimby.—1st May, 1882.
2061. BREECHE-LOADING FIRE-ARMS, J. Williams, Birmingham.—2nd May, 1882.
2069. CONNECTING AND SUPPORTING HEALDS IN LOOMS FOR WEAVING, J. Aspinall, Ravensthorpe.—2nd May, 1882.
2070. MECHANICAL SEPARATION OF ORES, H. J. Haddan, London.—Com. from L. de Soulages.—2nd May, 1882.
2071. SMELTING FURNACES, &c., H. J. Haddan, London.—A com. from L. de Soulages.—2nd May, 1882.
2077. REFINING PETROLEUM OIL, &c., E. W. Bell, Liverpool.—Com. from E. C. Kattel.—2nd May, 1882.
2079. DRAWING AND COMBING WOOL, &c., H. H. Lake, London.—A com. from C. Fletcher.—2nd May, 1882.
2090. LOOMS FOR WEAVING, J. Brownlee, Glasgow.—3rd May, 1882.
2097. PRODUCING ARTIFICIAL MARBLES, &c., R. Guilton, Brighton.—4th May, 1882.
2107. ELECTRIC SAFETY APPARATUS FOR THEATRES, &c., P. Jensen, London.—A communication from R. J. L. Haviland.—4th May, 1882.
2120. URINALS, W. McGill, Lambeth.—5th May, 1882.
2135. FORMING OR PREPARING LEAD, &c., T. Cuttriss, Leeds.—A com. from C. Cuttriss.—6th May, 1882.
2154. LUBRICANTS, &c., H. Montgomerie, Cleadon.—8th May, 1882.
2230. WINDING ENGINES, T. Perkins, Hitchin.—11th May, 1882.
2234. LIFE-PRESERVING BED, A. M. Clark, London.—A communication from M. H. Holmes and J. R. Steiner.—11th May, 1882.
2252. STEEL-PINNED COVERING FOR RAG TEARING, &c., MACHINES, T. R. and T. W. Harding, Leeds.—12th May, 1882.
2268. PROPELLING, &c., VELOCIPEDS, H. T. Davey and P. A. Holst, London.—13th May, 1882.
2287. INCREASING THE FINENESS AND LUSTRE OF LINEN, &c., F. C. Glaser, Berlin.—A communication from H. Knab.—16th May, 1882.
2290. STANDS FOR SEWING MACHINES, &c., W. R. Lake, London.—Com. from A. FitzGerald.—16th May, 1882.
2332. ADJUSTABLE RECLINING CHAIRS, J. Cowan, Liverpool.—18th May, 1882.
2521. HYDRAULIC LIFTS, J. M. Day, W. R. Green, and H. C. Walker, London.—27th May, 1882.
2764. SINGLE-RAIL RAILWAYS AND ROLLING STOCK, A. M. Clark, London.—A communication from C. F. M. T. Lartigue.—12th June, 1882.
2786. INSTRUMENT FOR MEASURING, &c., VARIATIONS OF PRESSURE, A. M. Clark, London.—A communication from E. Bourdon.—13th June, 1882.
2981. PURIFYING GAS, &c., J. Duke, Glastonbury.—23rd June, 1882.
3230. VELOCIPEDS, W. T. Shaw, Surbiton, and W. Sydenham, London.—7th July, 1882.
3424. MALLET FOR CORKING BOTTLES, &c., A. S. Kershaw, Rochdale.—19th July, 1882.
3425. BALL VALVES, H. A. Cutler, Upton.—19th July, 1882.
3509. DRAWING ROLLERS FOR SPINNING MACHINES, A. J. Boulton, London.—A communication from C. Jenatzy-Leleux.—24th July, 1882.
3543. WHEELS FOR GRINDING, &c., J. Robinson, Manchester.—26th July, 1882.
3592. SECONDARY BATTERIES, F. J. Bolton, London.—28th July, 1882.
3609. OBTAINING CARBONATE OF STRONTIA FROM THE RESIDUES IN THE MANUFACTURE OF SUGAR, D. Sidersky and H. Probst, Rositz, Germany.—29th July, 1882.
4094. OBTAINING STARCH, &c., from GRAIN, W. R. Lake, London.—A communication from W. T. Jebb.—26th August, 1882.

Patents Sealed.

List of Letters Patent which passed the Great Seal on the 1st September, 1882.)

- 982. APPLIANCES FOR PROTECTING SEATS FROM DAMP, DUST, &c., C. P. Sharpley, London.—1st March, 1882.
1000. RAPIDLY ETCHING PATTERNS ON GLASS, &c., E. C. Hancock, Worcester.—2nd March, 1882.
1008. LOOMS FOR WEAVING, T. Singleton, Darwen.—2nd March, 1882.
1017. INSULATING APPARATUS FOR TELEGRAPH WIRES, &c., J. S. Lewis, Birkenhead.—3rd March, 1882.

- 1053. SUPPORTING AND DISENGAGING SHIPS' BOATS, M. E. T. Bülow, Hamburg.—4th March, 1882.
1059. KEYS OR PEGS OF VIOLINS, HARPS, &c., J. Stuttaford, New Batnet.—4th March, 1882.
1067. SELF-ACTING BLOCK SIGNALING APPARATUS, E. Callot, St. Denis.—6th March, 1882.
1095. FILTER PRESSES, W. G. Strype, Wicklow.—7th March, 1882.
1107. PREPARING THE FIBRE OF THE STALK OF THE COTTON PLANT FOR THE MANUFACTURE OF PAPER, F. Wheaton, Brooklyn, U.S.—7th March, 1882.
1141. CARDING MACHINERY, J. Dobson, Galashiels, N.B.—9th March, 1882.
1149. VALVES, &c., A. W. Harrison, Abergavenny.—9th March, 1882.
1155. PERCOLATING COFFEE JUGS, E. Jones, Birmingham.—10th March, 1882.
1162. DISTRIBUTING AND REGULATING ELECTRIC CURRENTS, W. R. Lake, London.—10th March, 1882.
1163. ELECTRIC LIGHTING APPARATUS, W. R. Lake, London.—10th March, 1882.
1164. PROTECTING THE INTERIOR OF GRAVES, J. Walters, Kingston, Devon.—10th March, 1882.
1167. PURIFYING GAS, G. C. Trewby, Beckton.—10th March, 1882.
1172. INCANDESCENT ELECTRIC LAMPS, J. Wauthier, Clerkenwell.—10th March, 1882.
1188. APPARATUS FOR DRYING, CLEANING, and DRESSING GRAIN, &c., J. Walworth, Bradford.—11th March, 1882.
1192. APPARATUS FOR FOLDING, TUCKING, &c., W. R. Lake, London.—11th March, 1882.
1194. APPARATUS FOR RUFFLING, FLATTING, &c., W. R. Lake, London.—11th March, 1882.
1195. ELECTRIC CIRCUITS, &c., W. P. Thompson, London.—11th March, 1882.
1198. FOUNTAIN PENS, W. E. Kay, Farnworth.—11th March, 1882.
1200. MINING MACHINES, F. D. Vosux, London.—13th March, 1882.
1202. STEAM BOILERS, H. J. Haddan, Kensington.—13th March, 1882.
1212. MANUFACTURING GAS, &c., A. W. L. Reddie, London.—13th March, 1882.
1214. APPARATUS CONNECTED WITH FURNACES FOR CONSUMING SMOKE, &c., H. H. Lake, London.—13th March, 1882.
1220. MANUFACTURING CHLORINE, C. Wigg, Liverpool.—14th March, 1882.
1222. TRANSMITTING AND RECEIVING TELEGRAPHIC MESSAGES OR SIGNALS, H. H. Lake, London.—14th March, 1882.
1268. FIRE-BARS, M. H. Watts and E. Swindells, Macclesfield.—16th March, 1882.
1282. BREECHE-LOADING FIRE-ARMS, L. Gye, London.—16th March, 1882.
1310. CIRCULAR BOBBIN-NET MACHINES, W. H. Beck, London.—17th March, 1882.
1342. MANUFACTURING GLASS, C. A. W. Schön, Hamburg.—20th March, 1882.
1402. TUBULAR BOILERS, J. Imray, London.—23rd March, 1882.
1420. ICE FOR DOMESTIC USE, R. P. Pictet, Geneva.—24th March, 1882.
1579. LOCKS AND LATCHES, D. Summerfield, Aston, near Birmingham.—31st March, 1882.
1664. DISTRIBUTING AND CHECKING TICKETS, &c., J. Lawson and J. Sirech, Bordeaux.—6th April, 1882.
1696. FISHING BAIT, &c., M. Carswell, Glasgow.—8th April, 1882.
1981. HOES, ADZES, and MATTOCKS, R. P. Yates, Birmingham.—22nd April, 1882.
2280. BOTTLE-FILLING MACHINES, C. M. Sombart, Magdeburg.—15th May, 1882.
2304. PIANOFORTES, S. Pepper, London, and J. Carter, Southampton.—22nd May, 1882.
2490. DRILLING OR BORING METALS, A. Higginson, Liverpool.—26th May, 1882.
2533. CONSTRUCTION AND ARRANGEMENT OF PONTOON DOCKS, &c., R. Turnbull, South Shields.—27th May, 1882.
2641. TELEPHONIC COMMUNICATORS, A. W. Rose, London.—5th June, 1882.
2748. BURNING PYRITES, E. Bramwell, St. Helens.—12th June, 1882.
2966. LAWN TENNIS APPARATUS, W. Brookes, Manchester.—22nd June, 1882.
2972. HAT FORMING UMBRELLA OR PARASOL, A. Gros and C. Salbreux, France.—22nd June, 1882.
3064. PRODUCING SOUND INGOTS AND CASTINGS OF STEEL, &c., A. Longsdon, London.—29th June, 1882.
3066. WORKING RAILWAY POINTS AND SIGNALS, W. Stroudley, Brighton.—29th June, 1882.
3108. SECONDARY BATTERIES, &c., H. J. Haddan, London.—1st July, 1882.
3128. ELECTRIC LOGS FOR ASCERTAINING THE SPEED OF SHIPS, &c., R. M. Lowne, London.—3rd July, 1882.

(List of Letters Patent which passed the Great Seal on the 29th August, 1882.)

- 1093. MARKING OUT LAWN TENNIS COURTS, &c., R. W. Ralph and W. Underhill, Newport.—7th March, 1882.
1096. ACTUATING CAPSTANS, W. L. Williams, London.—7th March, 1882.
1098. WORKING VELOCIPEDS, J. M. Taylor, Seer Green, and G. Wethered, Maidenhead.—7th March, 1882.
1104. LASTING BOOTS AND SHOES, W. R. Lake, London.—7th March, 1882.
1109. FIXING SHEETS OF ZINC ON ROOFS, &c., T. W. Helliwell, Brighouse.—7th March, 1882.
1113. COMBINATION STENCH TRAPS, R. Pearson, Kingston-on-Hull.—8th March, 1882.
1114. LAMPS FOR BICYCLES, &c., W. Skaife, London.—8th March, 1882.
1120. PREVENTING ACCIDENTS TO HOISTS, T. L. Hall, Manchester.—8th March, 1882.
1123. MANUFACTURING PAPER, &c., J. H. Annandale, Midlothian.—8th March, 1882.
1125. SUSPENDING BEDS AND SEATS, F. Lebaocq, Brussels.—8th March, 1882.
1133. BOTTLE STOPPERS, A. Clark, London.—8th March, 1882.
1158. SUBSTITUTE FOR GUITA-PERCHA FOR INSULATING, M. Ziegler, London.—9th March, 1882.
1165. CLEANSING THE INSIDE SURFACE OF FLEXIBLE TUBES, &c., T. Marshall, East Greenwich.—10th March, 1882.
1171. REGULATING THE BURNING OF CARBON, &c., A. Graham, London.—10th March, 1882.
1174. GENERATING, &c., ELECTRICITY, J. S. Williams, London.—10th March, 1882.
1181. HEDGE-CLIPPING, &c., J. Ridall, Crosspool.—11th March, 1882.
1182. BOTTLING AERATED WATERS, J. T. Hayes, Walthamstow.—11th March, 1882.
1184. TREATING RICE, G. P. Witt, London.—11th March, 1882.
1223. MALTING, &c., A. Perry, Roscrea.—14th March, 1882.
1281. COMPRESSING FUEL, E. W. Harding, Bishop Wearmouth, and W. Watkins, Hendon, Sunderland.—16th March, 1882.
1291. FRUIT-FLAVOURED ALCOHOLIC BEVERAGES, H. A. Bonneville, London.—17th March, 1882.
1301. METALLIC BOXES, G. F. Griffin, London.—17th March, 1882.
1303. TELEGRAPHIC AND TELEPHONIC SYSTEMS, P. M. Justice, London.—17th March, 1882.
1369. METAL DRUMS FOR OIL, &c., H. D. Wall.—21st March, 1882.
1417. DREDGING, &c., W. Smith, Aberdeen.—24th March, 1882.
1427. VARIABLE EXPANSION GEAR, T. English, Hawley.—24th March, 1882.
1566. BLEACHING JUTE, &c., T. G. Young, Kelly, N.B.—1st April, 1882.
1592. PROJECTILES, J. Vavasseur, London.—1st April, 1882.
1838. PACKING FOR PISTON VALVES, &c., J. Bell, Liverpool, and R. H. Harper, London.—18th April, 1882.
2063. FIRE-ARMS, H. Lake, London.—2nd May, 1882.
2227. PNEUMATIC BRAKE APPARATUS, F. W. Eames, Leeds.—11th May, 1882.

- 2250. CASKS OR BARRELS, S. Wright, Liverpool.—12th May, 1882.
- 2366. PREVENTING EXPLOSIONS, T. Sheehan, London.—19th May, 1882.
- 2375. AIR PUMPS, C. H. Gingham, Newcastle-upon-Tyne.—19th May, 1882.
- 2423. MOTORS, &c., W. P. Thompson, London.—23rd May, 1882.
- 2618. DYNAMO-ELECTRIC MACHINES, R. E. B. Crompton, London.—3rd June, 1882.
- 2700. MALLEABLE IRON, P. J. Ogle, Swansea Valley.—8th June, 1882.
- 2984. MARINE ENGINES, G. Rodger, Barrow-in-Furness.—23rd June, 1882.
- 3062. DETACHABLE GAS LAMPS, W. R. Wynne, London.—29th June, 1882.
- 3183. PREPARING COTTON FOR SPINNING, A. M. Clark, London.—5th July, 1882.
- 3187. REGULATING THE SUPPLY OF AIR TO FURNACES, &c., R. H. Brandon, Paris.—6th July, 1882.
- 3283. CLEANING, &c., WHEAT, S. Pitt, Sutton.—11th July, 1882.
- 3315. COATING WIRE WITH METAL, W. R. Lake, London.—12th July, 1882.
- 3319. TREATING HIDES OR SKINS, W. R. Lake, London.—12th July, 1882.
- 3443. MEDICAL BATTERIES, W. R. Watson, London.—20th July, 1882.

List of Specifications published during the week ending September 2nd, 1882.

- 1800*, 4d.; 1385*, 4d.; 5222, 4d.; 5400, 2d.; 5450, 2d.; 5578, 2d.; 5632, 2d.; 5722, 2d.; 17, 8d.; 198, 6d.; 264, 6d.; 271, 6d.; 300, 8d.; 339, 6d.; 352, 6d.; 361, 6d.; 363, 4d.; 382, 6d.; 393, 4d.; 397, 10d.; 418, 1s.; 424, 2d.; 425, 6d.; 428, 2d.; 429, 6d.; 431, 8d.; 432, 8d.; 433, 6d.; 436, 1s.; 437, 4d.; 442, 8d.; 443, 6d.; 446, 6d.; 454, 4d.; 456, 6d.; 457, 2d.; 458, 8d.; 459, 6d.; 461, 2d.; 462, 6d.; 464, 2d.; 467, 2d.; 468, 2d.; 469, 6d.; 472, 6d.; 474, 2d.; 475, 2d.; 477, 6d.; 480, 2d.; 481, 2d.; 482, 6d.; 483, 6d.; 484, 6d.; 486, 4d.; 488, 6d.; 490, 6d.; 491, 10d.; 494, 2d.; 495, 6d.; 496, 6d.; 498, 6d.; 499, 6d.; 502, 6d.; 503, 6d.; 508, 6d.; 509, 6d.; 510, 6d.; 511, 4d.; 512, 6d.; 515, 4d.; 516, 6d.; 521, 6d.; 544, 8d.; 551, 2d.; 552, 6d.; 553, 6d.; 584, 4d.; 633, 4d.; 672, 4d.; 1083, 6d.; 1183, 4d.; 1958, 6d.; 2278, 4d.; 2302, 2d.; 2526, 6d.; 2561, 10d.; 2563, 6d.; 2596, 4d.; 2623, 6d.; 2632, 6d.; 2646, 6d.

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

ABSTRACTS OF SPECIFICATIONS.

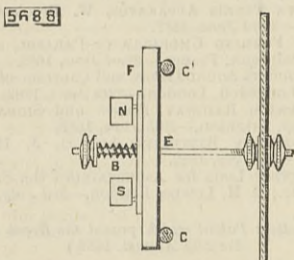
Prepared by ourselves expressly for THE ENGINEER at the office of Her Majesty's Commissioners of Patents.

5578. TRANSMISSION OF MOTIVE POWER, W. G. S. Mockford, London.—20th December, 1881.—(Provisional protection not allowed.) 2d.

This consists in the use of an endless cord, rope, wire, or chain twisted with one or more twists or turns round pulleys placed on the driving shaft and the shaft to be driven.

5688. IMPROVEMENTS IN CYMAPHERS OR APPARATUS FOR TRANSMITTING SOUND BY ELECTRICITY, C. F. Varley, Bealey Heath, and F. H. Varley, Mildmay-grove, Middlesex.—27th December, 1881. 10d.

The figure shows one method of carrying out this invention. The style E projects through a carbon rod. On the end of E there is an adjusting nut for regulating the pressure spring B, which is made to press the carbon rod against the contact pieces C, C'. To the carbon rod an iron armature F is attached. Near F the poles N and S of an adjustable magnet are placed. These attract F and counteract spring B. Now, if the magnet is powerful enough, it will overcome B and open the circuit between C and C'. If the space between F and the poles



N and S be increased the magnetic force is weakened, and spring B forces the carbon rod into contact with C and C'. Thus, by regulating the resistance of N S and the force of B, any degree of contact pressure can be produced, and the most sensitive condition for transmitting sound by means of electric waves obtained. Many other methods of carrying out this invention are also described and illustrated.

5722. PREVENTING OR LESSENING THE EFFECTS OF EXPLOSIONS IN COAL MINES, J. S. McDougall, Manchester and London.—30th December, 1881.—(Provisional protection not allowed.) 2d.

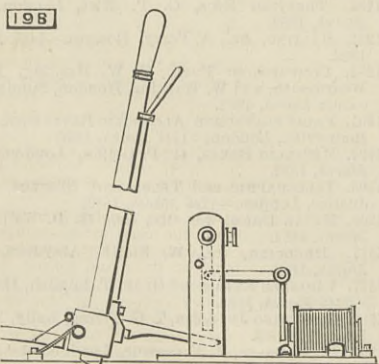
This consists in the use of chloride of calcium or chloride of magnesia or other suitable deliquescent salts, which possess the property of absorbing moisture from the atmosphere and of extinguishing flame or other combustion. The salts are used either dry or dissolved in water, and are scattered over the dust or upon the exposed surfaces of the coal mines.

17. INCREASING THE HEATING EFFECT OF FUEL AND DIMINISHING THE PRODUCTION OF SMOKE IN FURNACES, G. D. Peters, London.—2nd January, 1882. 8d.

This consists in the use of an injector to admit into the furnace above the fuel jets of steam with or without atmospheric air, so as to insure the more perfect combustion of the fuel.

198. IMPROVEMENTS IN ELECTRIC BLOCK SIGNALS AND ELECTRIC LOCKING APPARATUS FOR LEVERS WORKING SEMAPHORES AND POINTS ON RAILWAYS, &c., J. Radcliffe, Retford, Notts.—13th January, 1882. 6d.

The object of the invention is to prevent the signal-



man from lowering his signal until he has received "line clear." The signal lever is locked by means of a vertical bar suspended from its upper end over a

projecting tongue, attached to and forming part of the clip lock of the lever. A link attached to the armature of an electro-magnet is connected with the bar as shown in the figure. The electro-magnet is connected with the block signalling instrument at the station in advance, and in such a manner that a current is only passed to the magnet when the instrument is at "line clear." When the current passes, the electro-magnet attracts its armature, draws the bar free from the projecting tongue of the lever clip lock, and the signalman is able to move the lever. In addition to the above the inventor claims a block-signalling apparatus.

264. SOUNDING THE DEPTH OF LIQUIDS, T. Bassett, Liverpool.—19th January, 1882. 6d.

The object is, first, to provide an instrument in which equal increments of pressure shall be represented by equal divisions on a scale used for ascertaining the depth of immersion, and in which a long range of measurement shall be obtained in a comparatively short instrument; and secondly, to provide durable, cheap, and efficient sounding apparatus. According to the first part the instrument consists of a brass tube divided longitudinally and obliquely into the receiving and measuring compartments, one end of the tube being closed and small openings left between the compartments. At the other end of the tube the large end of the measuring chamber is closed, and openings left into the receiving compartment. A gauge glass communicates at each end with the measuring compartment. According to the second part of this invention the sounding apparatus consists of two tubes connected by a flexible joint, one end of the tube being left open and the other end closed.

271. PURIFYING GRAIN, &c., H. J. Haddan, London.—19th January, 1882.—(A communication from P. Lefebvre and J. Nagel, Brussels.) 6d.

This relates to apparatus for purifying grain and other cereals from stones, sand, dust, straw, and other impurities, by means of air currents drawn in by a revolving ventilator.

297. IMPROVEMENTS IN GALVANIC BATTERIES, &c., J. and A. J. Higgin, Manchester.—20th January, 1882. 6d.

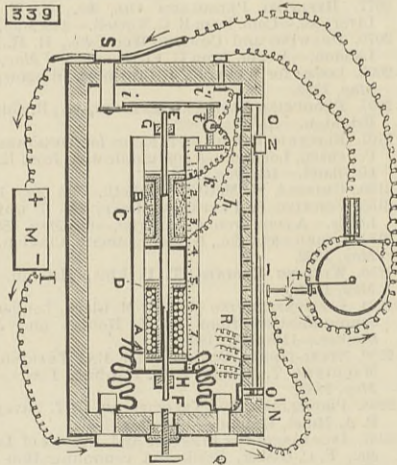
This invention includes the substitution of tin for the zinc elements in batteries, and a simple means whereby the tin is recovered in a form suitable for certain chemical manufactures. Inside a stoneware jar a hollow cylinder of tin is placed. Inside this cylinder is placed a porous cell. In the outer cell dilute sulphuric acid is placed, and in the porous cell a carbon rod surrounded by pyrolusite or native peroxide of manganese broken small. When in action the sulphuric acid produces proto-sulphates of tin and manganese, which remain in solution. The tin is subsequently separated by adding to the saturated solution sufficient peroxide of manganese in fine powder to cause the protosulphate of tin to become persulphate. The liquid is then diluted largely with water, when a precipitation of stannic acid or oxide takes place. This is subsequently washed, thrown on a filter, drained to a paste, and is then ready for further treatment for chemical purposes.

305. IMPROVEMENTS IN ELECTRIC LAMPS, J. N. Aronson, London.—21st January, 1882. 6d.

This relates to the construction of the globes of incandescent lamps with reflectors formed of the same material as the globe itself, the reflective surface being produced by silvering, enamelling, or other means.

339. IMPROVEMENTS IN REGULATING ELECTRIC LAMPS, &c., E. de Pass, London.—23rd January, 1882.—(A communication from B. Abdank, commonly called Abakanowicz, Paris.) 6d.

The principle of the invention is the introduction of a resistance balance, as the inventor calls it, into the circuit of the lamp, which measures the resistance of the arc. The figure illustrates, in section, one form of this balance. A and B are two movable solenoids, one in the main circuit, the other in a shunt. Through these passes a core CD, having non-magnetic extensions C E and D F, which slide freely in bearings G H. The main current passes from terminal I of the machine M by Q, coil A, and Q1 to the lower carbon of lamp. The derived current is taken from Q1 through terminal N; it then traverses resistances R—only a portion of which are shown—in the box, enters a

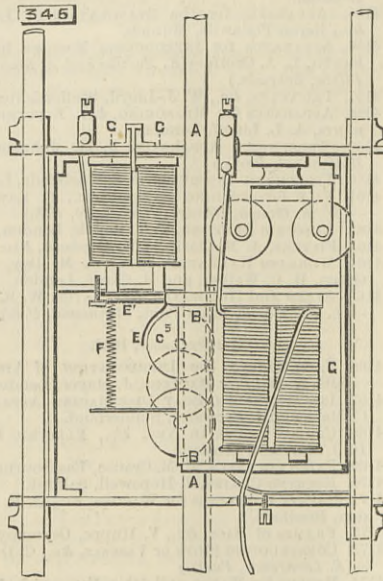


movable indicator Z—travelling over a graduated scale—and passes through rod O1, traverses h h, enters shunt solenoid B, and out through wire k into t, rod i held by a weak spring, and terminal S. By this means a resistance interposed in the circuit can be measured. Suppose that on the introduction of such resistances CD approaches solenoid B; if then, by means of Z, additional resistances P R be inserted in the circuit of B, the attraction of A will become greater than B, and CD be attracted that way, so that by adjusting Z an equilibrium will be produced, and the resistance required to produce it be ascertained. Moreover, A and B are movable on a slide, and their position with regard to CD changes their attractive force upon this core. This reciprocal motion, indicated on the graduated scale of the slide, in combination with a short travel of CD, also allows the resistance introduced into the main circuit to be measured.

346. IMPROVEMENTS IN ELECTRIC LAMPS, &c., R. E. B. Crompton, London.—24th January, 1882. 8d.

This relates to improvements in arc lamps. The action of the lamp will be understood by reference to the figure, and the following explanation. When no current is passing the gearing frame B B rests within the main frame in its lowest position, the rack rod A A being free to descend through it until stopped by its carbon resting on the lower carbon. When the current enters the lamp it passes through the helix of the main magnet G, lifts the frame B B, and with it the rod A A through its proper stroke, thus parting the carbons and establishing the arc. When thus lifted the frame B B brings the soft iron end E1 of the brake E within the attractive influence of the fine wire feed magnets C C. So long as the difference of potential at the two sides of the arc remains normal, the current through C C is only sufficient to give it attractive power to balance the opposing regulating spring F which presses the brake E on brake wheel G3. When the difference of potential exceeds that for which the regulating spring is regulated, the feed magnets overcome the spring, lift the brake off the brake-wheel, and allow the rack rod A A to descend until the difference of potential is again normal. An improvement consists in the provision of a long fine

wire of high resistance, in connection with, say, the positive terminal of the lamp and earth, the object being to provide a leakage wire for the static charge



which is acquired by the lamp. Another improvement consists in an arrangement for cutting the lamps out of circuit.

352. CUTTING CHEESE, W. Chisholm, Hawick, N.B.—24th January, 1882. 6d.

This consists essentially in fitting a wire in connection with revolving wheels fixed on a frame, and cutting the cheese by winding up the wire on the wheels.

358. IMPROVEMENTS IN SOUNDING APPARATUS, C. A. McEvoy, Adelphi, London.—24th January, 1882.—(Not proceeded with.) 2d.

This relates to a means for completing the circuit through a sounding apparatus on board a ship or boat, when a lead or sinker attached to a sounding line, through which runs an insulated wire, shall have made contact with the bottom.

359. IMPROVEMENTS IN AND CONNECTED WITH ELECTRIC LAMPS, J. N. Aronson, London.—24th January, 1882. 8d.

This relates to incandescent lamps, and has for its object the combining of several carbons, either in one globe or several clusters of carbons in glass tubes in one large globe, so that on the failure of one, another can be substituted for it, and put in circuit either automatically or by hand. One arrangement, when several carbons are used, is to enclose each terminal or connecting wire in a glass tube fused around it, and then to arrange the tubes in a group and fuse them into a mass, which may be fixed in the globe by fusion, or like a stopper. The ends of the wires are formed into contact pieces. The socket is provided with contact pieces in connection with the leading wires; these may be either sliding or stationary, and the inventor brings these into contact with the terminals of one of the carbons at a time, either by hand or by an automatic arrangement in connection with an electro-magnet and armature, so that on the failure of a carbon a fresh one may take its place.

363. CONVERTING RECIPROCATING INTO ROTARY MOTION, A. M. Clark, London.—24th January, 1882.—(A communication from F. Elbing, Bohemia.) 4d.

The object is to overcome the dead centres of the usual crank mechanism without loss of motion and power, and consists in the use of a shifting crank pin guided to move in a path eccentric to the crank axis.

382. WITHERING AND DRYING TEA, J. H. Johnson, London.—25th January, 1882.—(A communication from J. C. Allen, Bengal.) 6d.

The object is to effect the drying of tea, and at the same time and by same fires to raise steam for working the machinery for the other processes, such as rolling, and it further relates to improvements on patent No. 4254, A.D. 1877. The furnace of a steam boiler is utilised to heat air to be supplied to the drying cylinder, in which a drum of trays containing the tea is caused to revolve.

386. IMPROVEMENTS IN THE CONSTRUCTION OF CORES FOR CABLES, &c., W. T. Henley, Plaistow.—26th January, 1882. 6d.

This relates to the construction of a core with multiple conductors, which may be used for a number of circuits or a few, a switch connecting all the conductors in one or in separate circuits, from two upwards, according to the direction in which it is turned. The conductors of the core are first insulated separately and then all inclosed in another coat of insulation, being next served with yarn and protected with wires in the usual way. The improvement consists in surrounding the core with strong manilla or Russian hemp laid up into closely spun yarns, which are laid round the core in long spirals and then served with galvanised steel wires of small size; the cable is then covered with tape or yarn and compound as usual.

389. MAGAZINE FOR FIRE-ARMS, W. R. Lake, London.—26th January, 1882.—(A communication from W. Traube, Louisville, U.S.) 6d.

This consists, first, in an inclined guide formed on the trigger guard for elevating the rear end of the cartridge as it leaves the magazine, in connection with a stop notch on the inside of the receiver or frame of the gun at the top, against which notch the cartridge strikes, and also in a connection with a finger on the bottom and front of the bolt, which finger passes under and elevates the bullet end of the cartridge into alignment with the bore of the gun when the bolt is forced forward; secondly, in a hammer provided with an extension blade to prevent the turning of the same and the premature discharge of the cartridge, on the bottom of which blade, near its forward end, a notch is formed, which in connection with a similar notch formed on the rear prevents the accidental withdrawal of the breech from the receiver or frame; thirdly, in a swinging extractor hook pivoted to the bolt head diametrically opposite to its bite on the rim of the cartridge, and provided with a projection that strikes against the receiver when the bolt is withdrawn, in connection with a cam cut on the bolt head; and fourthly, in a thumb screw acting against the bolt for locking the breech.

391. STYLOGRAPHIC FOUNTAIN PENS, W. P. Thompson, Liverpool.—26th January, 1882.—(A communication from G. W. Carleton, E. Coffin, jun., and A. S. French, New York.) 8d.

This relates to the general construction of such pens, the specification having twenty-five claims.

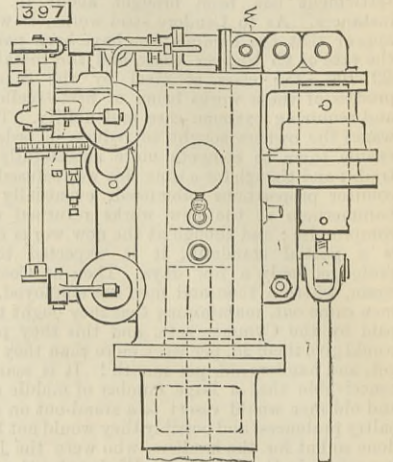
393. CUTLERY, &c., H. M. Marsden, Sheffield.—26th January, 1882.—(Not proceeded with.) 4d.

This consists, first, in constructing the blade of the knife of two qualities or tempers of steel; secondly, in forming a knife with a hollow handle in one piece of metal. Several other improvements are described.

397. GAS ENGINES, C. Emmet, Leeds.—26th January, 1882. 10d.

The improvements may be applied either to horizontal or vertical gas engines; the drawing is a plan showing the application to horizontal engines. The

pump Q is attached to cylinder and serves as a gas pump, worked by eccentric on the crank shaft, and capable of being disconnected and worked by hand to start the engine. The quantity of gas pumped can be varied by causing the pump plunger to approach nearer to or further from the end of the pump. A receiver W for the gas has an overflow valve which allows excess of gas to pass back into the pump, and this receiver communicates with a chamber formed in the rear of the cylinder, and from which the gas



passes into the cylinder through a perforated plate so as to divide it into jets which mingle with the air in cylinder. A rotary hollow plug-shaped lighting valve B is applied to the air valve-box, and is driven by suitable gearing from crank shaft, and as it revolves receives a supply of gas which is ignited by a fixed atmospheric burner.

398. SUGAR, C. Scheibler, Berlin.—26th January, 1882. 4d.

This relates to improvements on the fifth claim of patent No. 331, A.D. 1881, consisting in the application of saccharate of strontium for the separation of beet juice or other saccharine juices. The separation of the "non-sugary" portions contained in the beet or other saccharine juices is effected by the application of caustic strontium instead of lime.

399. ORNAMENTING VITREOUS OR SEMI-VITREOUS SURFACES, W. Slater, Stoke and E. C. Hancock, Worcester.—26th January, 1882. 4d.

The object is to produce an appearance of etching or "matting" on such surfaces without the use of acid, and it consists in the use of fine siliceous, calcareous, or other like non-vitrifiable matters to such surfaces, so that when subsequently fired the pattern or material will act upon the glaze and produce an incised, "matted," or decaled effect.

405. DREDGING, C. J. Ball, London.—26th January, 1882. 8d.

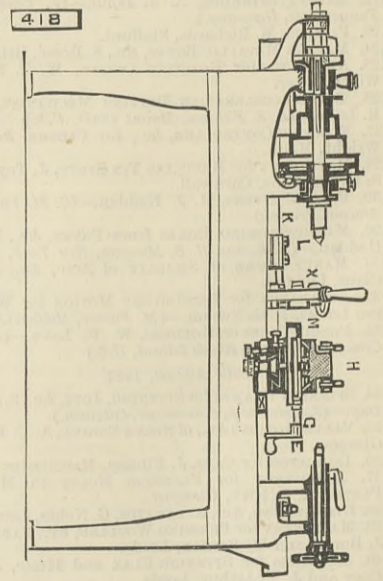
This relates to improvements on patent No. 987, A.D. 1878, consisting in the use of a peculiarly-formed pump. The pumps, which are of the centrifugal kind, are placed above the level of the water, and the necessity of a foot valve, or even of filling the pumps before starting, is avoided by lowering the suction pipe into the water, and placing an obturator on the end of the delivery pipe. The pump is then placed in communication with an ejector, whereby a vacuum is produced, and the water rises by the suction pipe into the pump, so that on starting the machine the pump also starts. But to avoid having to repeat this operation each time the pump is stopped, previous to restarting, the pump is caused to deliver downward, and the piping then brought through a half circle to the required direction for delivery, care being taken that the fall and rise of the pipe is somewhat more than the height of the suction above water level. Other improvements are described.

410. SEPARATING OIL OR TAR FROM BLAST FURNACE GASES, G. Chapman, Glasgow.—27th January, 1882.—(Not proceeded with.) 2d.

The gases are caused to pass through a chamber containing a number of diaphragms, discs, or screens kept constantly wetted with water. These discs are perforated and placed across the chamber, so that the gases must pass through such perforations.

418. LATHES, J. Dewrance, Surrey.—27th January, 1882. 1s.

In lathes which are required to repeat time after time the same work, and in which several tools of different form are used, a square block H is used with the tools clamped to its sides, and having a circular foot to fit a hole in the slide G, while a hole is formed

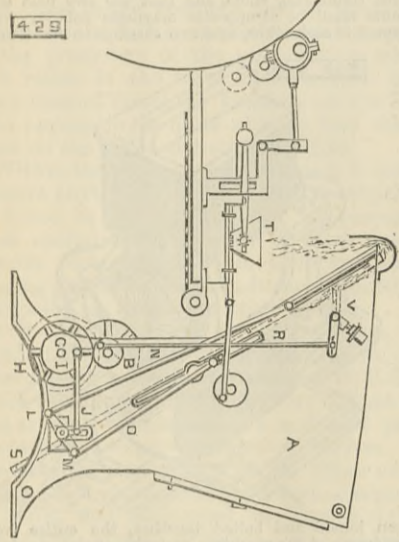


in such foot to receive the stem of the traversing nut upon the hand screw E of the upper guide. The block can be turned round upon the upper slide so as to bring any tool into working position, when it is locked by a pin or bolt. For screw cutting a sliding bar K is employed, and can slide longitudinally and also turn in bearings. A sleeve L can be clipped to this bar, and carries a hand lever M free to turn thereon. The tool is secured in the socket X. At the end of bar K is a finger which bears against the pattern screw, revolved by gearing from the lathe spindle.

424. PREVENTING WASTE OF WATER FROM LAVATORIES AND BATHS, M. Ingram, Manchester.—27th January, 1882.—(Not proceeded with.) 2d.

The object is to dispense with overflow pipes and avoid waste and injury caused by taps being left on, and it consists in the use of a three-way tap connected to the water supply pipe, and also to a pipe leading to a receiver containing as much water as is needed to fill the bowl or bath. When the tap is turned off the water passes from the supply pipe and fills the receiver.

- 425. DAMPING PAPER FOR PRINTING, &c., A. Stierlin, Manchester.**—27th January, 1882. 6d.
A drum with perforated metal scoops is caused to revolve in a water chamber, and the water lifted by the scoops is thrown by centrifugal force through the perforations in a divided state, and falls on to a sieve, and passing through which, falls in the form of spray on the web of paper caused to travel under such sieve.
- 428. ARTIFICIAL HANDS FOR CLEANING AND EXHIBITING GLOVES, A. W. Child, Friern Barnet.**—27th January, 1882.—(Not proceeded with.) 2d.
This consists in connecting the thumbs of artificial hands to the rest of the hands by means of a flexible joint, so as to facilitate the putting on and removal of gloves.
- 429. FEEDING WOOL TO CARDING MACHINERY, W. Cliffe and E. Ainley, Golcar, and J. Shaw, Huddersfield.**—27th January, 1882. 6d.
This relates to feeding machinery, in which the material is transferred from a hopper to a scale pan previous to being deposited on the feeding apron. A is the hopper and B the driving shaft, a spur wheel on which drives shaft G extending through the hopper, and by means of a spur wheel H and a face plate I



and rod J imparts a rocking motion to shaft L, on which is mounted a double lever M connected by rods N and O to cross bars carrying a series of spiked reciprocating bars R and S, which lift the material gradually out of the hopper and allow it to fall into the scale pan T. If too much material is lifted the vibrating comb V beats back the superfluous material.

- 431. AUTOMATIC LATHES FOR CUTTING SCREW THREADS, &c., F. Wirth, Frankfurt-on-the-Main.**—27th January, 1882.—(A communication from Heyne Bros, Offenbach-on-the-Main.) 8d.
Two shafts supported on a bed-plate each carry a worm wheel at one end, and on the other shaft four cams are mounted and on the other five. Between the two shafts, and somewhat higher, is a third hollow shaft, on which three cone pulleys are mounted in different positions, two being near one end and between them is a square sleeve. On the other end of this shaft is the chuck. The rod to be cut is placed within the hollow shaft and supported at the ends.

- 432. TRIMMING OR DRESSING THE EDGES OF WOODEN PACKING CASES, &c., F. Myers, New York.**—28th January, 1882. 8d.
This consists, first, in improvements on patent No. 3548, A.D. 1880, and has for its object to trim the top edges of the sides of packing cases even with the top edges of the ends of same simultaneously with the trimming of the bottom of the edges of the cases. The second part relates to a machine for trimming the ends of pieces of wood prior to nailing them together to form packing cases.

- 433. MANUFACTURE OF CYANOGEN COMPOUNDS AND AMMONIA, L. Mond, Northwich.**—28th January, 1882. 6d.
This relates to improvements on patent No. 1027, A.D. 1860, and consists, first, in the manufacture of cyanogen compounds of barium or of ammonia therefrom by a preliminary heating of a mixture of barium carbonate or oxide and carbon in a reducing flame, until they form a pasty mass, and breaking the mass up into lumps when cool for the formation of cyanogen compounds by contact with nitrogen at an elevated temperature; secondly, in the manufacture of cyanogen compounds by means of barium salts or oxide and carbon, treating the barium salt and carbon at the temperature required to form the cyanogen compounds with the nitrogenous gases already heated by their passage through hot cyanogen compounds from a previous operation, so as to cool them.

- 437. EFFECTING FIREPROOF SEPARATION OF THE STAGE AND PROSCENIUM IN THEATRES, J. Imray, London.**—28th January, 1882.—(A communication from K. Pfeiffer, Vienna.)—(Not proceeded with.) 4d.
This relates to a fireproof curtain made up of strips of curved or trough-shaped iron or steel, and actuated by hydraulic apparatus to raise and lower it in a suitable fireproof framing.

- 441. IMPROVEMENTS IN ELECTRIC RAILWAYS, C. F. Varley, Beley Heath, Kent, and W. Judd, Penang, Straits Settlements.**—28th January, 1882. 4d.
This invention consists of a metal conductor laid in a groove cut in a sleeper, which is rendered non-conducting by being desiccated by superheated steam or hot air, and subsequently impregnated with insulating material, such as paraffin, &c. The sleepers are covered with guard plates fastened on them, which do not entirely close the upper surface of the sleeper, but are so arranged as to leave a space sufficient to allow a roller or rollers connected with the car to make contact with the conductor, so as to convey the electricity from the conductor to the electric motor in the car. The electricity is supplied to the conductor by dynamos at suitable places. Methods for insuring good insulation of the conductor are also described.

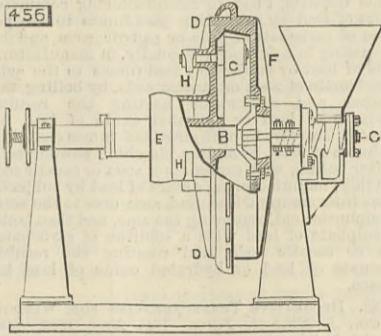
- 442. NAILING MACHINES FOR MANUFACTURE OF WOODEN PACKING CASES OR BOXES, F. Myers, New York.**—28th January, 1882. 8d.
This relates to improvements on patents No. 3555, A.D. 1880, and No. 795, A.D. 1881, and it consists in attaching to the front of the table a bracket on which slides an adjustable T-shaped arm with a vertical slot to fix it, so that its upper edge is level with the upper edge of the end of box, when the side pieces can be readily placed in position. Another improvement consists in devices to facilitate the nailing of strips or cleats of wood on the pieces to form the box, so as to connect them together, the object being to drive two rows of nails therein, one row being out of line with the other. Several other improvements are described.

- 443. OPENING AND CLOSING CARRIAGE DOORS, G. V. Fosbery, near Bristol.**—28th January, 1882. 6d.
This relates to means to enable drivers of Hansom cabs to open and close the doors from their seats, and it consists in cords or rods attached to the opposite ends of a lever mounted on a shaft, which carries a second lever, the ends of which are connected to racks gearing with pinions mounted on the hinge pin of each door of the carriage.

- 446. SECTIONAL DOCKS FOR INSPECTING AND REPAIRING SUBMARINE PORTIONS OF SHIPS, &c., C. J. Fox, Birkenhead.**—28th January, 1882.—(Partly a communication from R. P. C. Sanderson, New York.) 6d.
This consists of a vessel open at one or both ends and provided with hinged arms extending from the vessel to the side of the ships, so as to form a joint between them, canvas being then spread outside the arms to complete the joint.

- 454. METALLIC BRUSHES, G. and E. Ashworth, Manchester.**—30th January, 1882. 4d.
This consists in backing the wires of metallic hair brushes with sheet metal or other suitable electrical conductor, and providing attachment for a wire, cord, or conductor, so that the wires of the brush may form part of an electric or galvanic circuit.

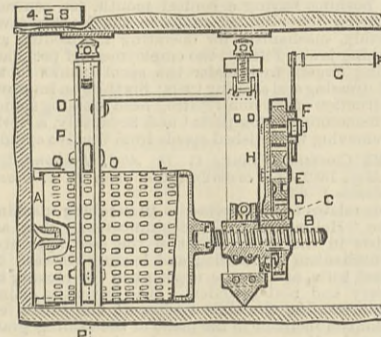
- 456. CRUSHING, GRINDING, PULVERISING, AND REDUCING MINERALS, &c., R. E. Skill, East Dulwich.**—30th January, 1882. 6d.
The main driving shaft B is connected with the endless screw conveyor G, and carries the main revolving disc D driven by pulley E, while the second disc F is driven independently at a slower speed, so that the material delivered to the space between the two discs is kept constantly in motion. C are the



crushing rollers mounted on one end of levers H fulcrumed in the disc D, and connected to a spring at the other end, the tension of which is adjustable, and which forces the rollers G against the inner surface of disc F.

- 457. IRON KITCHEN UTENSILS, H. Harting, Berlin.**—30th January, 1882.—(Not proceeded with.) 2d.
This consists in casting the vessels from good iron free from manganese or phosphor in moulds, decarbonising them afterwards so as to convert them into wrought iron, and producing a non-poisonous enamel or coating by pickling the surface in a mixture of sulphuric and nitric acid, which produces a solid coating of oxide of iron.

- 458. COAL-GETTING MACHINERY, M. and C. Burnett, Spennymoor, Durham.**—30th January, 1882. 8d.
The drawing shows the machine as driven by hand power, but it may also be driven by a suitable motor. A is the cutter head operated by screw B working through nut C, one half of which is attached to wheel D gearing with intermediate wheel E driven by pinion F which is actuated by handle G. The wheels E and F are



- mounted on radial arm H free to move on a circular projection cast with the lower or fixed half of nut C, so that it can be placed at any angle. The cutter head A is attached to cylinder L, perforated as shown and supported at the end by standard O, being guided in its rotation by rollers P. Means for conveying the coal to the surface are described.

- 459. PERAMBULATORS, BATH-CHAIRS, &c., E. Andrews, Sudbury, Suffolk.**—30th January, 1882. 6d.
This relates to means for preventing accidents to perambulators, &c., by causing a brake to be applied to the wheels as soon as the handle is released, so that they will be prevented from running down inclines.

- 461. RAILWAY SIGNALLING APPARATUS, C. Barker, Thetford, Norfolk.**—30th January, 1882.—(Not proceeded with.) 2d.
A lever on the train is actuated by projections on the line worked from the signal box, and causes a gong or whistle to be sounded.

- 462. STOPPING THE TUBES OF TUBULAR STEAM GENERATORS, J. Turner, Plaistow.**—30th January, 1882. 6d.

This relates, first, to a tool to clear the tubes of boilers of any deposits, and consists of a rod carrying at one end a straight cutter or scraper secured eccentrically on the rod, the other end of which is screw-threaded and passes through an external crosshead, so as to be tightened up by means of nuts when the cutter is in position. A cone is mounted eccentrically on one end of the rod which it supports. The tube stopper consists of a pair of semicircular flaps connected by a double joint to a rod and arranged so as to fall against the latter when being inserted into the tube, and fall outwards when through, so as to present a disc which, when the rod is drawn back, closes the end of the tube.

- 464. TRICYCLES AND BICYCLES FOR TRAVELLING BY WATER, W. S. Rock, Jersey.**—31st January, 1882.—(Not proceeded with.) 2d.

This consists of drums provided with paddles at the sides and floating on the water, being propelled in any suitable manner, and fitted with india-rubber tires to enable the machines to travel also on land.

- 467. BICYCLES, TRICYCLES, AND VELOCIPEDES, J. W. Golding, Kensington.**—31st January, 1882.—(Not proceeded with.) 2d.

This relates to means for throwing the driving wheels in or out of gear.

- 468. APPARATUS FOR SUSTAINING SLIDING WINDOW SASHES, &c., E. Wilkins, Wandsworth-road.**—31st January, 1882.—(Not proceeded with.) 2d.

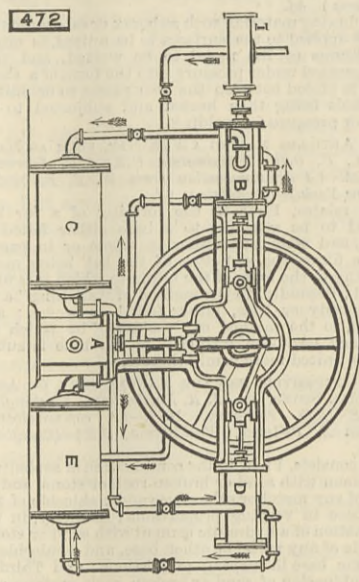
This relates to the use of a roller clothed with rubber, which, while the window is being raised, is moved within its box and allows the upward movement, but which when the window is released binds on the sash and prevents the descent of the window, which, however, may be effected by exerting a slight additional pressure on the window sash.

- 469. BOILERS AND FURNACES FOR HEATING GREENHOUSES, &c., J. Parkinson, Eaton.**—31st January, 1882. 6d.
The boiler is made with a shallow water space all round, and the furnace extends from the front of the water space at the back. The crown of the furnace is an arched water shelf connected to the front and side water space, but stopping short of the back, so as to leave communication from the furnace to the fire space

above. Between the crown of furnace and top of boiler are three other arched water shelves, the centre one connected to the front water space and stopping short of the back, whilst the other two are connected to the back water space and stop short of the front. The gases are thus caused to pass in a serpentine form between the water shelves.

- 472. DYNAMIC COOLING APPARATUS, H. E. Newton, London.**—31st January, 1882.—(A communication from L. Allen, New York.) 6d.

This relates to machines in which gas is compressed, and its temperature being reduced, is then expanded and used for cooling or refrigerating purposes. The compressor B, driven by steam engine A, takes its air from the surface cooler E; the cooler C takes its



air from compressor B, the air engine D takes its air from cooler C, and the surface cooler E receives the air from air engine D; I is an auxiliary air pump delivering into surface cooler E to compensate for leakage. The whole forms a closed cycle in which the air is compressed above and expanded again to a minimum limit of pressure materially higher than the normal atmospheric pressure.

- 474. APPLIANCE FOR BINDING OR HOLDING DOCUMENTS, &c., H. R. Stutchbury, Camberwell.**—31st January, 1882.—(Not proceeded with.) 2d.

On a pin fixed to the inner portion of the back pieces of metal move, and each carries a metal rod terminating in a button. At the bottom of the case spring clips are arranged, so that as the rods are pressed into position they engage on one side in a groove and on the other are pressed against a vertical kind of spring.

- 475. REFRIGERATORS, A. Samuel, London.**—31st January, 1882.—(A communication from M. J. Lissons, Montreal.)—(Not proceeded with.) 2d.
The safe is made with double walls of glass, so as to leave intermediate air spaces, and within it is a tray to hold ice to cool the air it contains.

- 477. SPRINGS, H. J. Haddan, Kensington.**—31st January, 1882.—(A communication from W. Barnes, Washington, U.S.) 6d.

The object is to produce a coiled spring, the band of which gradually increases in thickness from its inner to its outer end, and consists in the combination with rolls, one of which is arranged to recede from the other by the gradual withdrawal of screws, of a train of gearing adapted to actuate the screws.

- 480. BRACES, &c., L. A. Groth, London.**—31st January, 1882.—(A communication from C. Vorberg, Cologne.)—(Not proceeded with.) 2d.

This relates to an apparatus which may be used either as a bandage for wounds or to prevent the loss of blood, or as braces or suspenders or waist belts.

- 481. CRINOLETTES, E. Baker, Oxford-street.**—31st January, 1882.—(Not proceeded with.) 2d.

This relates to the use of a "crinolette" or "dress improver," consisting of a skirt formed with pockets, which can be inflated with air through suitable mouth-pieces.

- 482. LATCHES AND LOCKS, E. R. Wethered, Woolwich.**—31st January, 1882. 6d.

This relates to latches or locks fitted with a bolt operated by levers with handles upon them, which, by their weight, tend to throw the bolt forward.

- 483. FRAMES OR STANDS FOR CRUETS, W. Edge, Birmingham.**—31st January, 1882. 6d.

This relates to the use of a sliding frame containing the bottles, and which when raised brings the stoppers of such bottles under a curved part of the upper bar of the stand, so as to prevent the removal of the bottles, a suitable lock being provided to secure the sliding frame in its raised position.

- 484. FINGER RINGS, &c., W. R. Lake, London.**—31st January, 1882.—(A communication from R. J. La Grange, Philadelphia.) 6d.

This consists in forming the bow of the ring in segments, one of which is hinged to either side of the head of the ring, while within them a third segment is caused to slide, and is secured by suitable means.

- 486. HOT BLAST STOVES, E. A. Cowper, Westminster.**—31st January, 1882. 4d.

This relates to pipe stoves in which the cold blast is passed through pipes and comes out heated, and consists in forming the pipes of such stoves of steel, the stove itself being of cast iron. The blast is caused to first pass through the stove, whereby it becomes heated to a certain degree, and is then passed through the steel pipes and further heated.

- 488. PACKING FOR PISTON AND VALVE RODS, &c., W. R. Lake, London.**—31st January, 1882.—(A communication from the Matthews Steam Spring Packing Company, Boston, U.S.) 6d.

This relates to the packing of valve stems or rods by carrying the packing with the rod in a packing cylinder for steam, hot air, gas, and other engines.

- 490. SPRING MOTOR APPARATUS FOR TRAM-CARS, &c., W. R. Lake, London.**—31st January, 1882.—(A communication from W. T. Larimore, St. Louis, U.S.) 6d.

This relates to mechanism for assisting horses to restart tramcars, and for facilitating the running of the cars: as, for instance, in ascending inclines, and it consists essentially in a spring band or bands arranged to be coiled by the running of the wheels, and to work upon the wheels when uncoiling, and thus assist in the movement of the car.

- 491. MACHINE GUNS, O. Jones, Philadelphia.**—31st January, 1882. 10d.

This relates to guns in which a series of fixed barrels having their ends to receive the cartridges in a straight line are employed in combination with loading and extracting devices moving longitudinally to and fro at the rear of the barrels, and it consists chiefly in the means for supplying the cartridges and extracting and ejecting the empty shells. A rectangular frame contains a series of rows of tubes to receive the cartridges, and is actuated by mechanism to bring the rows in line with the barrels, when the cartridges are forced forward by plungers, each of which is hollow and carries a firing pin and a spring to drive the latter forward, and also an extractor.

- 494. LUBRICANTS, G. L. Scott, Manchester, and H. Kenyon, Altrincham, Chester.**—1st February, 1882.—(Not proceeded with.) 2d.

This consists in mixing and thoroughly incorporating rock oil, shale oil, petroleum, or any mineral oil with oily shales or oil-yielding shales.

- 495. MACHINERY FOR SAWING WOOD, J. Smith, Rochdale.**—1st February, 1882. 6d.

This relates to means for feeding wood to circular saw benches, and consists in mounting rollers in bearings on each end of the fence, and passing round them endless chains. One of the rollers is driven from the saw spindle, thereby causing the chain to travel, and the wood being forced into contact with the chain by a presser roller, is fed forward to the saw.

- 496. CENTRAL FIRE CARTRIDGES, C. S. Bailey, Waltham Abbey.**—1st February, 1882. 6d.

This relates to means to prevent escape of gases and produce cartridges specially adapted for hammerless guns, and consists in dispensing with the usual iron tube lining the base cup, and making the latter shorter than hitherto, and using in combination therewith an outer longer cup constructed so as to enclose the crown of the percussion cap, and also the whole of the inner cup, which is backed up by the paper packing and supports the flange of the cap chamber.

- 498. CUTTING OVAL AND CIRCULAR HOLES AND RINGS, A. Muir, Manchester.**—1st February, 1882. 6d.

A worm is fitted with feather keys on a driving shaft and gears with a wheel, to the underside of which an adjustable tool-holder is secured, and having in the upper part an annular groove to fit on to a circular bearing surface formed on the bottom of a sliding plate. From the latter project two lugs, between which the worm turns. In the top of the worm wheel is also a transverse groove to fit one part of a cross driver, the upper part of which fits into a groove in a flange at the bottom of a vertical spindle, and on this flange rests an adjustable disc, through a slot in which the spindle passes. The disc is set as much out of centre with the spindle as may be needed to give the difference required between the major and minor diameters of the oval to be formed, such disc working between flanges on the upper part of sliding plate, to which it communicates motion when the machine is used to cut ovals. By fixing the disc concentric with the spindle a circle will be cut.

- 499. SIZING AND WRINGING HANKS, J. Conlong, Blackburn, and J. Robertshaw, Manchester.**—1st February, 1882. 6d.

The strap is shifted on to the fast pulley by means of a pedal, so that a hook secured to its shaft is caused to rotate and so twist or wring the hank, which is passed over two hooks. The other hook can slide but does not revolve, and the twisting of the hank causes it to slide against the action of a weight suspended by a chain, and by suitable levers to shift the driving band on to the loose pulley.

- 502. MARINE BOILERS, A. Gibb, Greenwich.**—1st February, 1882. 6d.

The object is to utilise the waste heat of the products of combustion for heating the bottom or sides of the boiler, so as to promote a better circulation of water, cause equal expansion, prevent corrosion, and enable steam to be got up more rapidly without injury to the boiler; and it consists in connecting the smoke-box into which the return tubes lead with one or more legs or vertical flues leading downward into a horizontal flue extending beneath the whole of the bottom of the boiler between the stools on which it rests, and communicating with the uptake.

- 503. SUSPENSION LAMPS FOR BICYCLES, &c., H. Salisbury, Long-acre.**—1st February, 1882. 6d.

The top of the lamp is fitted with a hooked strap to grasp the wheel axle, while the top of the front door is curved to lap over it, and is held by spring catches on the hook. A lip on the door can be fixed so as to nip the under part of the wheel axle and prevent the lamp jumping. Stump ends are screwed into a threaded socket at the outer end of the guide rods and bear against the hub. Flanges on the upper part of the oil well slide in grooves in the inner side walls of the lamp body, so as to suspend the well and burner from the upper part and leave a clearance at bottom provided with air holes. A spring catch at the side of the lamp body retains the well and burner in position. A bow spring inside the door acts on the oil well and prevents shaking, and also forces the door open when the top catches are released. A weighted stem is fixed on top of the lamp and prevents it oscillating while travelling.

- 508. WITHDRAWING AERATED LIQUORS FROM BOTTLES, F. E. Wood, Worlington.**—2nd February, 1882. 6d.

A slightly conical tube of wood is fitted with a rubber band, so that when inserted into the mouth of the bottle the glass or other stopper is forced down, and the band then causes the tube to fit tightly. The tube at the outer end is fitted with a cock, by which the liquid can be withdrawn as required.

- 509. MANUFACTURE OF SALT CAKE AND MURIATIC ACID, &c., G. S. Haslehurst, Rumcorn.**—2nd February, 1882. 6d.

This consists in manufacturing salt cake, evolving muriatic gas and producing muriatic acid by the use of hermetically sealed revolving retorts, by which means, by excluding the atmospheric air, a distillable gas is evolved.

- 510. SLIPPING OR PULLING BOOTS AND SHOES FROM LASTS, G. Jenkins, Kingswood.**—2nd February, 1882. 6d.

This consists of a lever moving on a fulcrum, and one end of which can be slipped into an eye on the end of a hook, which is slipped into the boot or shoe or the last.

- 511. TURNABLES FOR REVERSIBLE CARRIAGES, W. Morris, Birmingham.**—2nd February, 1882. 4d.

The under ring is provided with a ball projecting beyond its upper surface, and the top ring is formed with recesses to fit over such projecting part.

- 512. STEERING GEAR, T. Archer, jun., Dunston.**—2nd February, 1882. 6d.

This consists in the application to steering gear of differential gear combined with clutch arrangements, so that when such gear is engaged, firstly a powerful leverage is brought to bear on the rudder chains, and secondly the strain due to the water on the rudder, after it is placed in the desired position, is so taken up in the differential gear itself as to impart little or no strain to the steering wheel. The gear it is preferred to employ consists of a toothed wheel actuated by an eccentric wheel within it, the number of teeth of the two wheels being different.

- 515. SILVERING GLASS, J. E. Pratt, Camberwell.**—2nd February, 1882. 4d.

This relates to the use of an inclined fixed table which is heated, and on which the glass is placed; the prepared liquid, being then poured on at top and running down to the bottom, is caught in a trough, a deposit of silver being left on the glass as the liquid passes over it.

- 516. SPRING MATTRESSES, CHAIRS, &c., F. Wirth, Frankfurt-on-the-Main.**—2nd February, 1882.—(A communication from J. A. Widemann, Basel, Switzerland.) 6d.

This relates to the construction of springs to be used in place of the usual spiral springs, and consists in forming the same with two arms by bending wire into a rectangular form and coiling it spirally at a central point.

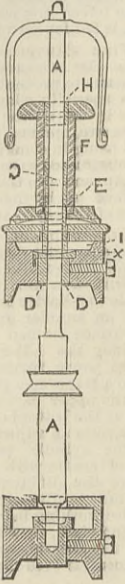
- 521. MAKING CIGARETTES, &c., R. Wallwork, Manchester.**—3rd February, 1882. 6d.

This relates to apparatus for forming cigarettes, and according to one modification it consists in a flat plate with a frame hinged to it lengthways, so as to be capable of being turned flat against the plate. This frame forms the receptacle in which the tobacco and paper are compressed. To the opposite side of the plate another frame is hinged so as to be capable of being turned flat upon the first frame, and it serves

to retain the paper in position and also as a hopper to receive the tobacco, which with the paper is pressed down into the first frame by a presser hinged parallel to that frame, and which also serves to press the paper when the edges are turned over tightly into the box.

543. THROSTLE SPINNING AND DOUBLING FRAMES, A. M. Fletcher, Oldham.—4th February, 1882. 4d. This relates to the collar bearing for the spindle and bobbin of the ordinary flyer throstle and doubling frames, so that increased speed may be obtained with greater steadiness, and the drag regulated in the ordinary manner, and for each change of counts; and it consists in forming the collar D with a long upward

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projection E to pass into without touching the interior of the barrel of bobbin F, in which the lower bush G is formed partly up the interior of the barrel. H is the upper bush of the barrel of the bobbin. Holes I allow oil to pass from the cup part of collar D to spindle A, and there is a slight cup formed at top of projection or tube E to receive oil put upon the blade part of the spindle when the bobbin is doffed. A pin fixes the position of the collar D in the coping rail X.

544. CUTTING OR DIVIDING BRICKS, TILES, OR SLABS FROM PLASTIC CLAY, &c., G. Otway, Brixton.—4th February, 1882. 8d.

On a suitable bed-plate a pair of parallel guides are formed opposite the cutting frame, and in these guides slides a rack with two sets of horizontal teeth at different levels, and on the same side as the lower set is another set of teeth projecting upwards. Attached to the rack is the moving table, and above the vertical teeth rack is a small pinion running on a spindle in the guide, and gearing with which is a double rack sliding in each side of the guide, and at the extremity of it is pivoted a rocking arm called a pusher riding over a vertical bar having a cam surface, by which it is raised on the completion of its stroke. By this arrangement the stream of clay is automatically divided to the exact length to form a number of bricks, which are then fed to the cutting table and acted upon by the usual cutting wires.

551. TREATING FIBROUS MATERIAL TO REMOVE INCrustATING SUBSTANCES, F. Wirth, Frankfurt-on-the-Main.—4th February, 1882.—(A communication from the Society for the Manufacture of Wood-pulp, Grellingen, Switzerland.) 2d.

This consists in treating fibrous material so as to remove the incrustating and other foreign substances contained therein, by boiling it with a watery solution of ammonia in a closed vessel with or without pressure.

552. KNIFE-CLEANING MACHINES, W. H. D. Jones, Brixton.—4th February, 1882. 6d.

This consists in so constructing the discs between which the knives are held while the discs revolve, that they have a certain amount of elasticity which enables the leather facings of such discs to accommodate themselves to the wedge form of the knife.

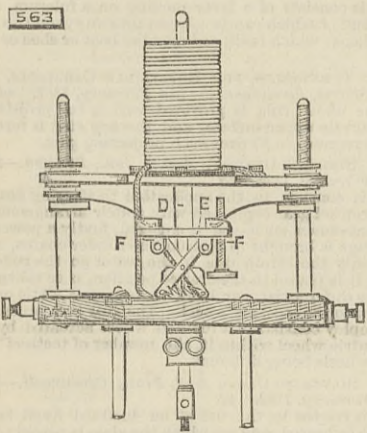
553. METALLIC CASES OF CARTRIDGES, T. R. Bayliss, Northfield.—4th February, 1882. 6d.

This consists in manufacturing the metallic cases of cartridges for machine guns from thick discs of metal or alloy, or from thick discs having the marginal portions reduced, and which are then drawn into tubes with the thick central portion outwards. The tube is then turned down in a lathe, the closed end being still left of the same diameter, whereby the rim or flange of the case is formed.

563. IMPROVEMENTS IN ELECTRIC LAMPS, A. J. Jarman, London.—6th February, 1882. 6d.

The construction of the lamp will be understood from the figure. The base of the core D is provided with lugs carrying pins F F, against which slide cross bars, pinned at their centres. When a current

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flows through the electro-magnet the core is drawn upwards, the cross arms are straightened and force the gripping pieces against the upper carbon rod, thus lifting it and establishing the arc. The slightest decrease in the magnetisation of the core causes the cross arms to touch the bed-plate, extending them, releasing the carbon rod, and so shortening the arc.

584. BRAKE BLOCKS OR SHOES FOR RAILWAY VEHICLES, J. Heald, Cardiff.—7th February, 1882. 4d.

This consists in substituting for the usual wood brake blocks, brake blocks made of wrought or cast metal connected at back by means of small ears to two iron brackets or adjusting rods screwed to the usual block hangers.

617. BRECH-LOADING SMALL-ARMS AND CARTRIDGES FOR SAME, W. M. Scott, Birmingham, and T. Baker, near Birmingham.—8th February, 1882. 6d.

This consists, First, in making in the faces of the break-offs of breech-loading small-arms having internal hammers, grooves or channels to provide means

for the escape of gases produced by the detonation of the percussion caps of the cartridges; and Secondly, in making similar grooves for the same purpose in the faces of the metallic heads of the cartridges to be used with such fire-arms.

633. ANTI-CORROSIve PAINT, A. Riegelmann, Hanau, Germany.—9th February, 1882. 4d.

This consists, First, in adding caustic anhydrous alkaline earths in combination with hydrocarbons, such as mineral oils, paraffine, to ordinary paints, so that the caustic earth remains in as free a state as possible; and Secondly, in manufacturing packing paper or fabric by coating one side thereof with the paint described, and the other side with chromo-glue—chromolein.

672. WELDING METALS, C. D. Abel, London.—11th February, 1882.—(A communication from J. Lafitte, Paris.) 4d.

The fluxing material, such as borax or sal-ammoniac, usually applied to the surfaces to be united, is mixed with filings of the metal to be welded, and then agglomerated under pressure into the form of a sheet, which is placed between the two pieces to be united, the whole being then heated and subjected to the blows or pressure for welding.

909. ARTICLES HAVING A FUR NAP, SUCH AS HATS, &c., H. Orth, Washington, U.S.—24th February, 1882.—(A communication from W. E. Doubleday, New York.)—(Complete.) 6d.

This relates, First, to the forming of a fur bat, adapted to be attached to a base either felted or woven, and composed either in whole or in part of feltable fibres, the structure of the bat being varied according to the form of the fabric to which it is to be applied; Secondly, to the method of "sticking" a fur to the body or base, either felted or woven; and Thirdly, to the method of "scalding," by which the fur which has been "stuck" to the base is subsequently united more firmly thereto.

975. COMPOSITION FOR THE MANUFACTURE OF ARTIFICIAL STONE, &c., J. R. Nottingham, Washington, U.S.—28th February, 1882.—(A communication from A. Pelletier, Washington, U.S.)—(Complete.) 4d.

This consists, First, in the combination of asphaltum or bitumen with sand or broken rock or stone, and an oxide of any metal or other base and a chloride of the same base in varying proportions; Secondly, in the combination of a hydraulic cement with sand or stone, an oxide of any metal or other base, and a chloride of the same base in varying proportions; and Thirdly, the combination of sand or broken rock or stone and an oxide of metal or other base and a chloride of the same base, with any suitable material to be used as a binder in varying proportions.

1033. FLOATING LIGHTS, J. Inrny, London.—6th March, 1882.—(A communication from J. Pintsch, Berlin.) 6d.

This relates to improvements on patent No. 4515, A.D. 1876, in which gas is supplied from a reservoir on the floating vessel or buoy through a regulator to reduce its pressure, and to the burner. In order to relight the burner, should it be extinguished by severe concussions, a small auxiliary jet is employed, and is supplied with gas direct from the reservoir without passing through the regulator, and which, therefore, being at a high pressure, is not so readily extinguished, and serves to rekindle the main burner.

1183. CORKSCREWS, G. W. von Naerocki, Berlin.—11th March, 1882.—(A communication from R. Hessel, Berlin.) 4d.

To obviate the necessity of removing the cork from the screw after it has been withdrawn, the screw is formed with a conical enlargement above it, and which, as the screw is driven into a fresh cork, driving the first cork upwards, the enlargement enters the latter, and divides it down the centre, so that the two halves fall off themselves.

1529. ATTACHING NON-CONDUCTORS TO HANDLES OF TEA-POTS, &c., T. and J. Brooke, Sheffield.—29th March, 1882. 6d.

A disc of ivory or other non-conducting material is formed with a screwed shank on each side of it, one thread being left-handed and the other right-handed. The shanks take into similar female threads formed in the socket of the tea-pot or other vessel, and the handle to be connected thereto.

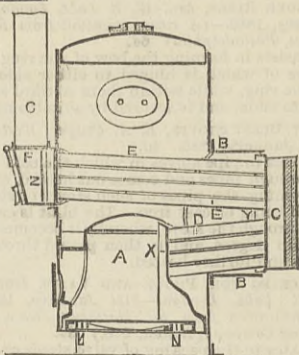
1891. MILLING MACHINERY, A. J. Boulton, London.—20th April, 1882.—(A communication from R. L. Downton, Saint Louis, U.S.)—(Complete.) 6d.

This consists in reducing grain to flour by passing it through a series of rolls revolving at differential speeds and in the same direction, and of successive degrees of fineness of dress, the first part of the series of rolls having a dress of round or oval flutes or inclined reversed sharp flutes, and the latter part of said series having a dress of sharp or serrated flutes arranged at an inclination to the axis, in combination with bolts arranged intermediate of each set and the succeeding set of rolls.

1958. STEAM BOILERS, G. W. Hawkesley and M. Wild, Sheffield.—25th April, 1882. 6d.

This relates to boilers of the vertical multitubular type, wherein the tubes are beneath the water line. The drawing shows one arrangement, the tubes being arranged on the return principle. A is the furnace inside the boiler at the lower end thereof, and has one side X flattened to constitute a tube plate. To the side of boiler is attached a cylindrical projection B carrying

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another tube plate Y, beyond which is the combustion chamber C. At the opposite side of the boiler is an oval or elongated tube plate Z, and covering it is the smoke box F carrying chimney G. Tubes D pass from tube plate X of the furnace to the lower part of tube plate Y of the projection B, thus giving communication between furnace A and combustion chamber C. Other tubes E connect the combustion chamber with smoke box F.

2026. REFRIGERATOR, W. R. Lake, London.—28th April, 1882.—(A communication from D. W. Davis and E. W. Voigt, Detroit, U.S.)—(Complete.) 6d.

This consists, First, in forming a chamber with an ice receptacle near the top and supported from below, and with a top adapted to cause a circulation of air in the chamber round the sides and over the top of the ice receptacle; Secondly, in arranging the legs of the ice receptacle so that they are supported on ledges and provided with drip-pipes; Thirdly, in causing the ends of the ice receptacle to form a tight connection with the roof of the chamber, while its side walls are upon a lower plane to allow air to circulate laterally over the top of the receptacle; and, Fourthly, in the general combination in a refrigerating chamber of a W-shaped ice receptacle with drip pans, ledges, supports, and openings and stops.

2042. TEMPLES FOR WEAVERS' LOOMS, W. R. Lake, London.—29th April, 1882.—(A communication from La Société de Tassinay Freres and Cie. Reims.) 1s.

This consists essentially in substituting for the teeth points or rollers usually fitted to loom temples and which frequently tear, fray, or cut the fabric on which they operate, by two cylindrical or conical rollers over which the fabric or web passes with an adherence which is regulated by the pressure brought to bear upon the rollers by a third cylindrical or conical roller, such pressure being sufficient to hold or retain the fabric, and cause it to be maintained in the loom at its regular or proper width.

2168. FILTERS, G. Macaulay-Cruikshank, Glasgow.—9th May, 1882.—(A communication from H. C. Rice, Louisiana, U.S.) 6d.

The filter consists of two cylinders or tubes of frusto-conical shape and of a sheet of filtering cloth or other filtering material. The inner tube, which is perforated, is of less diameter than the outer one, and forms the lower half of the receptacle for the liquid to be filtered, whilst the outer tube forms the upper half, from which the lower half is suspended by being inserted inside and forced down inside the other half.

2278. OXIDE OF LEAD, H. H. Lake, London.—15th May, 1882.—(A communication from G. T. Lewis, Philadelphia.)—(Complete.) 4d.

This consists, First, in manufacturing commercial oxides of lead by subjecting lead fumes to the joint action of carbonate of soda or caustic soda and heat by roasting in a furnace; Secondly, in manufacturing oxide of lead by subjecting lead fumes to the action of carbonate of soda or caustic soda, by boiling them together and afterwards heating the resulting carbonate of lead or hydrated oxide of lead in a furnace; Thirdly, in purifying lead fumes containing sulphuret of lead, by adding bleaching powder before or after boiling with carbonate of soda or caustic soda; Fourthly, manufacturing oxides of lead by subjecting fumes from complex lead and zinc ores to the action of sulphuric acid, removing the zinc, and then boiling the sulphate of lead with a solution of carbonate of soda or caustic soda, and roasting the resulting carbonate of lead or hydrated oxide of lead in a furnace.

2303. DECORATIVE TRANSPARENCIES FOR WINDOWS, &c., J. Mitchell, Paris.—16th May, 1882.—(Complete.) 2d.

This consists in forming windows having the appearance of stained glass windows with leaden glazing from pieces of coloured sheet gelatine or thin transparent variety of one of the nitro-cellulose products, such as celluloid, xylonite, &c., the different pieces being arranged to form any desired pattern, and secured together by strips of paper gummed or otherwise secured to the adjoining edges. The pattern is then supported between two sheets of glass.

2374. MANUFACTURE OF SPOOLS, &c., W. R. Lake, London.—19th May, 1882.—(A communication from J. M. Parker, Pawtucket, U.S.)—(Complete.) 6d.

This relates to a machine for making spools from square sticks; and comprises, First, the use of a rack to hold the sticks in a stack, and an automatic device to deliver them one at a time to feeding mechanism; Secondly, the employment of feeding rolls operating on the sticks by a yielding pressure to advance them to a "rougher," and gripping jaws which advance the rounded sticks from the rougher to stationary clamping jaws, the movements of the rolls and gripping jaws being intermittent simultaneously and equal in amount; Thirdly, providing the delivery end of the rougher spindle with a removable bushing having a conical mouth, for centrally delivering the rounded sticks to the feeding jaws; Fourthly, mechanism for operating the feeding and clamping jaws; Fifthly, the employment of peculiarly moving fingers to transfer the spool blanks to the head dressing and shaping tools; Sixthly, an improved construction of the non-rotating head dressing spindle and its accompanying parts; and Seventhly, a device for removing the finished spools from the live spindle.

2388. COMBING FIBRE, C. D. Abel, London.—20th May, 1882.—(A communication from F. C. Glaser, Berlin.) 6d.

This relates to improvements in combing machines of the "Heilmann" and "Schlumberger" class, and consists in the arrangement of the feed apparatus, the mechanism for forming and leading forward the combed tufts, as also the mechanism for moving the delivery and noil cylinders. The inventor claims, First, arranging the slide surface of the entire feed mechanism inclined to the plane of the feeding grate, so that the fibres may be properly seized by the teeth of the comb; Secondly, the use of two or more rollers connected with the feed mechanism, and caused to revolve on the backward motion of the feed mechanism; Thirdly, the mechanism for detaching the combed tufts and forming them into slivers, and consisting of a detaching cylinder separate from the sliver belt, and so arranged in relation thereto that the former detaches the full length of the fibre by rolling upon a segment, while the latter takes up the separate tufts from the former, and causes them to overlap each other; and Fourthly, the mechanism for imparting motion to the delivery and noil cylinders.

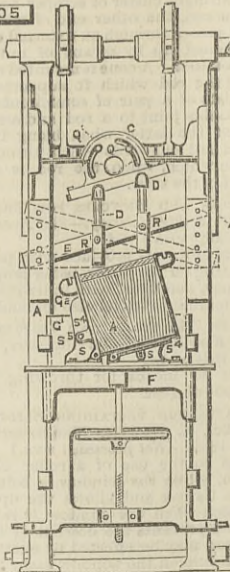
SELECTED AMERICAN PATENTS.

From the United States' Patent Office Official Gazette.

262,305. BOX-NAILING MACHINE, Frederick Myers, New York, N.Y.—Filed April 28th, 1882.

Claim.—(1) In a nailing machine, the combination, with the nail-driving mechanism, of devices, substantially as described for supporting the boxes at an angle, whereby the nails which are driven vertically

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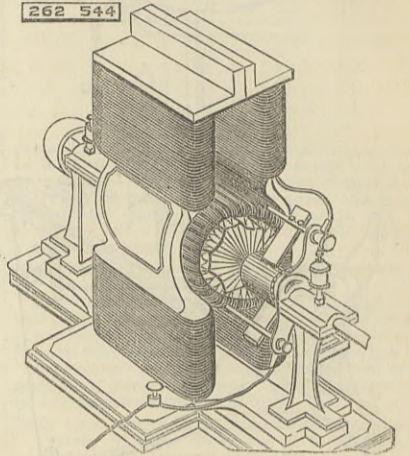
by the nail drivers will be driven obliquely into the wood, substantially as described. (2) The combination, with the table F of a nailing machine, of the adjustable supporting plates S S, substantially as above set forth and for the purpose specified. (3) The combination with the said supporting plates S S of the adjustable auxiliary crosshead Q, pivoted to the

main crosshead and adapted to support the nail drivers, and the adjustable bar E for supporting the nail boxes, substantially as above set forth and for the purposes specified. (4) The combination, with the auxiliary crosshead and the nail drivers or plungers, of the rod or bar T, having the recesses or grooves and provided with a flat face, substantially as above set forth and for the purposes specified. (5) The combination with the crosshead C of a nailing machine, of the adjustable auxiliary crosshead Q and the adjustable bar E, for the support of the nail boxes, substantially as described.

262,544. DYNAMO-ELECTRIC MACHINE, James A. Jenney, Fort Wayne, Ind., assignor to the Fort Wayne Electric Light Company, same place.—Filed April 15th, 1882.

Claim.—(1) The combination, in a dynamo-electric machine, of four electro field magnets, which, with their connecting plates and field segments, are made in two solid continuous masses of iron, so formed and joined in a plane passing either vertically or horizontally through the centre of the armature axis that the field magnets in such casting shall be in line with each other and in the two castings parallel with each other, and which are wound with their field coils in such directions that the two magnets in each casting shall have their similar poles joined in the field segment connecting them, and that the two field segments shall be of opposite magnetic polarity with respect to each other, said two castings to constitute

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when joined and bolted together, the entire iron framework of the machine, exclusive of the armature and its mounting, with a cylindrical soft iron armature, smooth and uniform in thickness in surface, mounted and revolving between the field segments aforesaid upon an open skeleton or framework of wood and brass or other non-magnetic material, adjustable in all directions from its central axis, the whole constructed, combined, and operating substantially as described, and set forth. (2) In a dynamo-electric machine, a skeleton or framework for the mounting and carrying of a cylindrical iron armature, consisting of two hubs, made of brass or other non-magnetic material, with radiating arms of like material, adjustable in length by being set as screws into their hubs, and supporting at their extremities wooden bars pressing against the inner surface of the armature, substantially as described and set forth.

CONTENTS.

THE ENGINEER, September 8th, 1882.

Table listing contents of the magazine, including sections like THE EFFICIENCY OF FANS, THE NORTH-EAST COAST EXHIBITION, and various technical articles and letters to the editor.

SOUTH KENSINGTON MUSEUM.—Visitors during the week ending Sept. 2nd, 1882.—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 12,800; mercantile marine, building materials, and other collections, 6477. On Wednesday, Thursday, and Friday, admission 6d., from 10 a.m. till 6 p.m., Museum, 2050; mercantile marine, building materials, and other collections, 707. Total, 22,034. Average of corresponding week in former years, 20,385. Total from the opening of the Museum, 21,296,343.