THE PRICE OF LABOUR AND WORK IN AUSTRIA.

THE price of labour and the cost of living. on which it is more or less based, are no doubt very important factors in influencing the expenses of manufacture, in determining the value of goods, and in promoting or restricting both home and foreign competition ; but it must not be supposed that low wages and cheap food are the only or even the main causes, or, in fact, we may almost say, are in any way the direct causes *per se* of the ability of foreign manufacturers to compete in the actual seats of industries in articles which have hitherto been considered as home specialities. There are a variety of causes besides these, some apparently insignificant of themselves, and others, which at first sight hardly appear to have any connection with individual production, yet have nevertheless a practical influence on the ultimate result too important to be ignored in a general investigation of this subject.

A very significant factor in the cost of manufactures for export is the "unit of value" expressed by the coin in which the wages of workmen are reckoned. In England this is the shilling ; in France, Belgium, and the Latin races, the franc ; in Germany, the mark ; and in Holland and Austria, the gulden, or florin. These form the "standard" on which all subsequent calculations are based, and its relative value is but slightly influenced by temporary or local variations in the actual price of food. To say that the actual value of all these coins is the same would be absurd ; but the value of articles in general is so far subservient to the standard, that it is not too much to say that what costs a florin in Austria can be bought for a shilling in England, for a franc in France or Belgium, and for a mark in Germany. Therefore, adopting the shilling as "par," the French or Belgian manufacturer starts with an advantage, all other things being equal, of 16 per cent., the German with 4 per cent., and the Dutch and Austrian with a disadvantage of nearly 60 per cent., which is slightly increased in Holland by the "agio" on paper, and materially decreased in Austria by the agio on gold, as the manufacturer in the latter case pays his employés in paper, and receives gold in exchange for his goods. The enormous import of German goods into Austria, where the expenses of carriage are a minimum, at a price which, after allowing for the agio on gold, and a duty of 5s. per cwt., is still less than the prime cost of the same articles of home manufacture, can only be accounted for in this way :—The problem can neither be solved by the theory of over-production and forced sales, of superior technical education and the introduction of labour-saving machines, nor by that of an inferior value of property and of the necessaries of life. Germany has outlets enough for her over-production, without encroaching on Austria. The technical education of the South is quite equal to that of the North ; Austrian manufacturers are equally alive to the importance of new machinery. Hungary supplies Germany with grain and cattle under a heavy import duty, and still the German workpeople live better and are better housed than the same class in Austria. It is simply the difference in the "unit of value" of the current coin, which makes itself felt in every phase of life, the value decreasing as a unit in proportion to the amount it represents.

Before proceeding to details of wages, food, and living, which may be considered as internal questions, dependent more or less on individual ability, tastes, and means, it may not be uninteresting to glance briefly at the external relations of the Austrian mechanic—that is, to matters over which personally he has no control, but which, on the other hand, rule and direct the whole tenour of his career —in other words, to the legislative decrees and ordinances that provide for every emergency, and leave him no other choice than implicit obedience.

In the first place youths under fourteen years of age are excluded entirely from employment in factories, and are only admitted between the ages of fourteen and sixteen on condition that the work is not calculated to retard their physical development. The hours of labour are restricted to eleven in the twenty-four, and only in exceptional cases may they be divided into night shifts. The first step towards obtaining employment, either as a journeyman or as an apprentice, is the provision of a pass-book of the following form :—

Form of Workman's Pass-book.

Christian and surname	Additional for youths and apprentices :—
Birthplace	
Date of birth	
Parish to which he belongs	Certificate of proficiency and of schools attended .. ..
Condition (single or married)	
Religion	
Trade	Name of place where father or guardian lives .. ..
Height	
Form of face	Whether the permission to follow or learn the trade has been granted by :—
Colour of hair	
Colour of eyes	
Shape of mouth	The father .. ..
Shape of nose	The guardian .. ..
Especial marks (moles, &c.)	Or the authorities of the parish ..

which must be signed by the person therein described, and must be legalised by the authorities of the parish in which it is issued.

The next step in seeking employment outside the boundaries of his own parish is to report himself to the police of the district in which it is his intention to settle, and to obtain their permission, which, when granted, is recorded in his pass-book. To effect this he must show them his certificate of birth and "Heimaths Schein," or certificate of domicile—*i.e.*, to what parish he belongs—and, if he has served an apprenticeship, the certificate of efficiency signed by his master, confirmed—in case the latter belong to a guild—by the president of the same, and countersigned by the police authorities of the district in which he served. Having fulfilled all these trifling requirements he is entitled to apply for work in any factory. On being engaged he must give up his book to his new master, who is answerable both to him and to the police for its being duly taken care of as long as the engagement lasts. Every change of situation, with the accompanying testimonial, or only so much of it as is favourable to the workman—§80 of the Gewerbe Ord.—is entered in the pass book and countersigned by the police, so that in time an official record of his private life is accumulated, in which a blank may at any moment be fatal to his career. In the absence of a special agreement he is paid weekly, and must give and requires fourteen days' notice of discharge, except he has presented a forged book, is incapable of performing the work he has undertaken, is addicted to drunkenness, has forfeited his master's confidence through theft, has betrayed trade secrets, has left his work without permission, or incited fellow workmen to strike, has insulted, threatened, or attacked his employers, or their servants, or been careless with fire and lights, is afflicted with a loathsome disease, or incapacitated through his own carelessness, or, if not himself to blame, is absent for more than four weeks, and if he be incarcerated for longer than fourteen days. On the other hand, he is entitled to leave without notice when the work is injurious to his health, when his master grossly insults or strikes him or anyone belonging to him, when his master or servants endeavour to lead him or anyone belonging to him from the paths of virtue and honesty, when his pay is withheld, and when his master cannot find employment for him.

The hours of labour may not exceed 11 in every 24, so that since the complete cessation on Sundays has been introduced they have been reduced to a maximum of 66 hours per week. The employer is bound to allow 1½ hours rest during the day—not included in the 11 hours—and in the case of youths between sixteen and eighteen the necessary time for attending technical lectures.

As regards the actual wages paid, the same as in every other country, vary according to the locality ; the following are, however, extracted from the pay sheets of two of the largest railway locomotive and repairing shops in Vienna, from a large engineering firm in the same city, and from one of the most important ironworks in Bohemia.

The wages paid in Vienna per week of six days of eleven hours each are as follows :—

Description of workman.	Railway Works No. I.						Railway Works No. II.						Private Works.			
	Day-work.		Piece-work.		Day and piecework.		Day-work.		Piece-work.		Day and piece-work.		Day-work.		Piece-work.	
	Par.	Ordinary exchange.	Par.	Ordinary exchange.	Par.	With Ordinary exchange.	the Au Par.	strian Ordinary exchange.	florin Par.	at Ordinary exchange.	Par.	Ordinary exchange.	Par.	Ordinary exchange.	Par.	Ordinary exchange.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Boilermaker	21 0	17 6	31 6	26 3	29 6	24 7	20 6	17 1	—	—	20 6	17 1	—	—	—	—
Coppersmith	16 0	13 5	33 11	28 3	31 2	26 0	21 2	17 8	—	—	21 2	17 8	—	—	—	—
Locksmith	17 6	14 7	30 7	25 6	28 9	24 0	19 11	16 7	29 0	24 2	20 6	17 1	24 0	20 0	30 0	25 0
Brazier	17 7	14 8	29 3	24 5	29 0	24 2	18 5	15 5	27 0	22 6	19 4	16 1	24 0	20 0	33 0	27 6
Blacksmith	19 0	15 10	38 7	32 2	38 6	32 1	20 2	16 9	30 6	25 5	23 10	19 11	—	—	—	—
Striker	14 0	11 8	28 11	24 1	27 2	22 8	15 0	12 6	22 5	18 8	18 2	15 2	—	—	—	—
File-cutter	—	—	37 8	31 5	37 8	31 5	—	—	—	—	—	—	21 7	18 0	28 0	23 4
Carr. smith	16 4	13 7	26 7	22 2	26 2	21 9	19 0	15 10	26 6	22 1	19 9	16 6	—	—	—	—
Fitter	19 4	16 1	31 8	26 5	28 2	23 6	19 6	16 3	—	—	19 6	16 3	—	—	—	—
Turner	15 8	13 1	28 8	23 10	27 10	23 2	17 0	14 2	25 11	21 7	20 7	17 2	24 0	20 0	32 0	26 7
Mechanic	—	—	—	—	—	—	—	—	—	—	—	—	26 5	22 0	30 0	25 0
Carpenter	17 2	14 3	28 6	23 10	28 2	23 6	19 2	16 0	27 4	22 9	21 1	17 7	—	—	—	—
Sadler	20 0	16 8	29 5	24 6	28 8	23 10	19 5	16 2	28 2	23 6	27 10	23 2	22 9	19 0	28 0	23 4
Painter	15 6	12 11	25 4	21 1	24 10	20 8	19 2	16 0	28 8	23 10	25 11	21 7	—	—	—	—
Mason	21 0	17 6	32 2	26 9	21 1	17 7	18 8	15 7	—	—	18 8	15 7	—	—	—	—
Founder	—	—	31 0	25 10	31 0	25 10	—	—	24 10	20 8	24 10	20 8	21 7	18 0	30 0	25 0
Labourer	12 11	10 9	24 1	20 1	14 6	12 1	13 10	11 6	—	—	13 10	11 6	—	—	—	—

The wages earned at the ironworks in Bohemia by the leading workmen are considerably higher, owing less probably to the individual capacity of the men employed than to the energy infused into the system on which the works are conducted by the proprietor and manager, who, in a few years has doubled the output, to the mutual advantage of himself and his workmen.

	At par.		At ordinary rate of exchange.	
	s. d.	s. d.	s. d.	s. d.
The leading hands earn per week	42 0	to 48 0	35 0	to 40 0
The good workmen (skilled) ,,	24 0	to 30 0	20 0	to 25 0
The workmen (unskilled) ,,	18 0	to 24 0	15 0	to 20 0
Day labourers ,,	10 0	to 14 6	8 4	to 12 0

With the exception of the day labourers, who are employed in sweeping, unloading, &c., the whole of the work, including tending the Martins-Siemens furnaces, Thomas process, rolling mills, &c., is done by piece work. It will be noted from the above table of prices that although the workmen are but slightly affected by the difference in the rate of exchange, coffee being almost about the only article of foreign produce that they consume, the proprietors, who manufacture for export, derive a proportionate advantage to the depreciation of Austrian currency.

The workmen in provincial factories are comparatively better off than those in Vienna ; house rent is cheaper ; in almost all cases schools are provided for the children, and the necessaries of life are nothing like so dear. In Vienna, from one-fourth to one-third of the earnings are absorbed in rent for a small dwelling, in a cellar, or on a flat. A personal inspection of these dens is necessary to form an opinion of what constitute the home comforts of a workman's family life. Externally the building may be palatial ; but as the architects to whom the erection of these so-called "rent-barracks" is entrusted are either above such trifles as ventilation and proper sanitary arrangements, or too restricted in their outlay to do more than achieve an attractive façade, the internal arrangements are not calculated to promote either health, morality, or comfort.

With regard to articles of diet, it is almost impossible to give even an average bill of fare. The characters and tastes of the workmen vary according to their nationality. A native of the German provinces is hardly content unless he can have his basin of broth and fresh meat once a day, whereas natives of other provinces, reared with simpler and more frugal habits, are satisfied with far humbler fare. A rapidly ascending curve, intersecting a series of ordinates representing severally horseflesh, beef, soup, pork, bacon, cheese, sausages, and bread, in the order given, would present a very fair idea of the relative consumption of articles forming the staple commodities of life. Small beer, or, as it is popularly styled, "liquid bread," is the principal beverage. Coffee is almost, tea quite, beyond the reach of an ordinary workman. The prohibitory duties on these articles, although they help directly rather to lessen the revenue in detail, are indirectly the means of increasing the total, by fostering a greater demand for "schnaps," which, being a native product, is a quadruple source of income to the State, as it is subject to taxation on its fabrication and sale, and requires a special licence for both operations.

Socially, the position of the artisan in Austria, thanks rather to a feeling of equality produced by the self-consciousness and due appreciation of equal educational advantages, than to that of democratic assertion, is quite as good as, if not superior to, that of the same class in any country, and, under difficulties, his sobriety and lightheartedness—which latter in his case takes the place of stoical endurance—insure him respect wherever he goes. Politically, his position is equivocal. Although endowed with a vote, his opportunities of acquiring a knowledge of its value are few. Every meeting must be notified to the authorities, and an official sanction of the subjects to be discussed obtained before holding it, and the same is attended by a Government official, with unlimited power to enforce the *cloture*. The discussions, no less than the opportunities of attending and taking part in them, are further circumscribed by that last remnant of feudal barbarism enforced by Viennese landlords, the "Sperr-Stunde," or closing all private houses at ten o'clock—as his means will scarcely allow him to indulge frequently in the luxury of paying 2½d. to enter his own dwelling after this hour. Owing to this, and to other causes which do not belong here, his natural proclivities are restricted, and he is forced by controlling influences to seek in secret the knowledge which he cannot obtain openly.

No wonder that the tree of knowledge, and the taste of its forbidden fruit, should still exert a baleful influence over curious minds, and that the old serpent, moderating its attributes into the humbler guise of "social equality," should still occasionally find believers in his specious arguments. As a rule, however, the Austrian workman is less tainted than others—at least, as far as one can judge under the circumstances which surround him—and the feeling between employers and employed, if not cordial and demonstrative of reciprocal respect, indicate at least a rigid observance of the laws and supervision by which their mutual relations are regulated and controlled.

PANHELLENIC STEAM NAVIGATION.

THE following communication from an engineer in Greece will be read with interest. It is pleasant to find that in these days of universal depression, English marine engineers, at all events, maintain their high reputation abroad :—

In the midst of war; and rumours of war; of bankruptcy of banks, corporations, and merchants whose names have hither to been guarantees unimpeached; of an almost hopeless state of affairs in the whole of the Levant from a commercial point of view, when the currency is so forced that prices for provisions, &c., have almost reached a declared war standard, and gold can only be had by paying in paper nearly 30 per cent. above its standard price for it; when taxes are so high in Greece that even English engineers serving in Greek merchant steamers, British subjects, are compelled to hand over as much as 20 per cent. of their pay to support the inordinately strained condition of the country; and while poor little Greece is trying to keep up appearances under the frown of all the Powers of Europe, it is very satisfactory to be able to point to at least one thriving corporation, and in the rise and success of the Panhellenic Steam Navigation Company, to see to what a position enterprise and good management can raise a fleet of only a few ships in the short space of two or three years. If your readers will bear in mind the geographical position of Greece, the almost entire absence of railway communication, the only line of the smallest consequence being the one from Corinth to Athens, and the large number of islands in this part of the world, they will readily understand the necessity there exists for a good, regular, well appointed means of conveying passengers, mails, and merchandise, from one island to another, or to and from the many towns and centres of the mainland itself. This necessity has been met until within the last few years by vessels of the Austrian Lloyd's Company, the Florio Rubatino Company, the Greek Steam Shipping Company, and a few private boats, offering no comforts and little regularity. Of the Austrian and Italian companies nothing need be said, save this, that when the Greeks are in a position to do the whole of their own carrying business, there is little doubt that they will be in a position to put all other competitors out of the field, and that the Austrian Lloyds, Rubatino, Fraisinet, Messageries Maritimes, and other foreign companies must content themselves with only such share of Greek patronage as can be spared from their own navigation companies. The Greek Steam Shipping Company is, however, an important one, and in point of number of ships, and the possession of an arsenal and ships of its own at Syra, in a very strong position. It is furthermore heavily subsidised by the Hellenic Government, which has the right to take up any or all of its ships for troop carrying or other purposes, but for some years there is little doubt that this company has been on the decline. Originally, all its ships carried English engineers, but for some time, and for reasons of economy, the cold shoulder

has been turned on these men, with a result which has been severely felt in the pockets of the shareholders of the company, though they do not, cannot, or will not realise the cause. At the present time many of the ships of this company have been taken up for use by the Government, but as the national exchequer is in a very crippled state, it is open to question whether the Greek Steam Shipping Company reaps much advantage from the hard work at present required of it, beyond the inner knowledge of its own—enforced—patriotism. Starting from the Piræus—the Greek Steamship Company sails from the island of Syra—are a few small and unimportant vessels belonging generally to private individuals, beside the vessels of the Panhellenic Steam Navigation. This corporation was formed about four years ago, building its foundations on the ruins of the New Greek Steamship Company, which had fluttered a more or less fitful existence for the two years before, and taking over its entire fleet. At first the new company was anything but successful, the boats being found to be in a state of repair such as necessitated a large outlay to put them in order; but from the time when it secured the services of M. Theologus—a gentleman having a large and varied experience of English commercial life, gained during many years of residence in this country—as president of the council of administration, and those of M. Psacaropolus—who for the twenty-five years before had been general manager of the Russian Steam Navigation—as general manager, the Panhellenic began its flourishing course, paying dividends when other companies were on the verge of ruin, and being now about to order four new steamers of the highest class in point of speed, luxurious passenger accommodation, and high tonnage, with which a new Greek line will be opened between Odessa, Constantinople, Athens, Corfu, and Trieste, having a branch from Corfu to Naples and Marseilles. These new steamers will all be capable of steaming from 12½ to 13 knots; they will be fitted with engines on the triple-expansion system, will have accommodation for the carrying of about 100 passengers and about 1700 to 2000 tons of cargo, and will undoubtedly place the company in the very first rank of the Mediterranean lines.

Of the fleet as at present constituted, consisting of some half-dozen steamers, the most important vessel in point of speed and comfort, though not one of the largest, is the Thessalia—a vessel built many years ago for the mail-carrying and passenger service between Brindisi and Alexandria, on which line she sailed under the name of the Prince Currano. She was built by Messrs. Palmer Bros., of Jarrow-on-Tyne, and also engined by that firm, making her first trial trip twenty years ago. Her dimensions are: Length, 255ft.; beam, 26ft.; mean draught, 14ft. 6in.; and her speed on trial then attained 15 knots. She was evidently built regardless of cost, and her hull and decks are as good to-day as they were when she was launched. Her lines are peculiarly fine and graceful, and there can be no question that there is not a prettier model in all the Mediterranean. For some years she remained on the Brindisi line; but it being found that her coal consumption was too great when travelling at so high a speed as fourteen knots, she was taken over by a private Italian firm, for passenger carrying along the coast and between the islands of the Adriatic. In 1874 her engines were compounded by her original builders, and, being fitted with new boilers, she again sailed in the Mediterranean passenger and mail-carrying trade, being acquired by the New Greek Steamship Company in 1879, since which time she has been entirely employed in the Greek service, where she has become the most popular vessel amongst all classes of passengers in the Levant. She has always, however, been an extravagant vessel in point of fuel consumption; and the Panhellenic Company, after trying her for about three years, determined early last year to replace the whole of the machinery, entrusting the order to Messrs. Andrew Leslie and Co., of which firm they had been clients from the beginning. Experience having shown in the cases of the Macedonia and Epirus, how admirably the engines of the North-Eastern Marine Engineering Company were adapted to the necessities of the Levantine trade, the order for the Thessalia's new engines were placed with that company by Messrs. Leslie and Co. In July of last year the Panhellenic Company having determined, with much enterprise, to erect the whole of the machinery on board the Thessalia in the Piræus, Messrs. Leslie and Co. sent out an engineer to Greece for the purpose of removing the old engines and boilers, preparing the vessel for the new, and erecting them, afterwards taking charge of them during the period for which they were guaranteed. No work of such magnitude had ever before been undertaken in Greece; and as the appliances which were available for the purpose were of the most crude and primitive order, there was much doubt thrown on the possibility of satisfactorily accomplishing the work, and the would-be clever men of the Piræus smiled at the temerity of M. Psacaropolus for undertaking such a job. The result, however, has proved him to be right, and an example of what can be done with poor appliances has been shown to the Greek shipowners—an example by which, no doubt, they will benefit. On the face of it, however, there was plenty of ground for the adverse opinion, for it was known that the old boilers weighed nearly 30 tons each, and that the only means of lifting them was by an avowedly rotten wooden fixed shear legs, which would not plumb the boilers, and which was fitted only with old rusty chain blocks and two hand winches.

It may be mentioned in passing that these shear-legs had been erected only about three years ago, for the purpose of removing and replacing with new ones the old boilers of his Majesty's ship, George, but as soon as this work had been accomplished the legs were allowed to rot, for the Greeks do not yet understand the use of paint on wood or iron, and having used any machinery once for the purpose for which it is intended, they leave it to take care of itself as best it may. M. Psacarpolus had these legs examined, and finding them to be unsafe for the boilers, he had a couple of heavy spars 14in. diameter lashed along each of the legs, and when the repaired apparatus had been fitted with two great new six-fall blocks carrying 5in. Manilla ropes, in addition to the two old iron blocks, the gear was strong enough to have lifted the Thessalia altogether, engines, boilers, and all. Before leaving the subject of this crane, it may be said what it was called upon to do, and the amount of extra labour caused by the fact of its being a fixture. First, the Thessalia was placed under it, and the old and heavy steam domes were lifted one at a time, the lifts being very slow, owing to the great power of the gear, and the fact that the work was done by hand winches. As soon as the lift came above the line of the bulwarks the ship had to be drawn away from the pier-head so that a lighter should be run in to receive the weight hanging in the slings of the crane; it was nearly as long a job to lower the lift into the lighter as to raise it from the steamer. The weight being safely deposited on board the lighter, that craft was drawn away and the steamer once more placed alongside for the next lift. When it is known that there was no steam help of any kind, either on board the ship or ashore, and that all the moving of the steamer herself and of the lighters was done by hand, and that from thirty to forty lifts were necessary, an idea may be formed of the amount of labour involved.

The new machinery having been sent out by Messrs. Leslie and Co. to the Piræus by the s.s. Canute in September, was removed from the hold of that vessel in a similar manner; but as Captain Mitchell's ship was fitted with powerful steam winches for hauling the vessel off and on, and as his officers and himself did everything to simplify and ease the work, only the very heavy weights—the boilers, cylinders, condenser, bed-plate, and columns—were lifted by the crane on shore, the winches of the ship when not moving her being employed in discharging all the lighter gear over the other side. The greatest difficulty with the Canute was that, being a broad-beamed ship, the shore gear did not plumb the hatches by about 8ft., and that there was in consequence of this a great deal of wear-and-tear on the ship, for each lift had to be kept well hauled out at the time when it came near to the decks. The Minister of Marine had placed at the disposal of the Panhellenic Company, together with the shear-legs, an unlimited supply of sailors and labourers from the Arsenal; and as Captain Mitchell used his powers to expedite the discharge of the machinery, every part of the new engines and boilers of the Thessalia was safely deposited in mahunas—lighters—in three days, a work which would hardly be beaten with all the scientific appliances to be found in England.

The old engines and boilers of the Thessalia were found to be in a most deplorable condition, not owing to defective manufacture, but to the manifest absence of anything whatever in the way of management or care, betraying not only gross negligence, but a sublime ignorance of the rudimentary principles of marine engineering on the part of engineers recently in charge of them. The cylinders were found to be scored and scraped, and out of truth, owing to defective adjustment of the piston springs. The slide valves were patched in the most wonderful way, and the intention had evidently been to admit steam as slowly as possible, for which purpose an ingenious patch was found on the high-pressure valve, which gave an opening of ⅜in. on one end before the other end began to admit steam; liners were placed under the feet of the excentric rods to counteract even the intended effects of the patches on the valves; the crank, cross-head, and one of the main bearing brasses were in twice the number of pieces originally intended by Messrs. Palmer Bros.; the tunnel bearings had been allowed to drop and bring the main shaft out of line; the boilers had evidently been absolutely unused to cleanliness, and the whole of the machinery, from the propeller to the fore winch, betrayed a supreme absence of mechanical intelligence on board the ship. The so-called engineers had been merely engine drivers, and the engines had been allowed to take care of themselves, being driven until they could not move, and struck work from absolute disease, brought on by a chronic supply of Levantine engineers (?) No data as to the performance of the engines could be obtained, no diagrams had been taken, and the only facts to be elicited were that the engines were in a sad state, and that the coal consumption to drive the ship at anything like ten knots was enormous, and that crew and passengers went in risk of life and limb owing to the highly dangerous state of the boilers. The engineers who took charge of the engines and boilers of the Thessalia early last year ought to have been decorated for their bravery in going to sea with her, had they any knowledge as to her real condition; but "where ignorance is bliss 'tis folly to be wise."

Greek steamship owners have yet to learn the wide distinction which exists between an engineer and an engine driver; and though lessons on this subject are being thrust from day to day under their very noses they will not apply the knowledge. There are many old English engineers in the country, who left England before marine engineering came into the front rank as a science, who consider that their highest claim is to be "a mechanic," and whose constant shibboleth is, "I can do a day's work against any man!" But in these days we do not seek for the men who can handle hammer and file and soldering bit to take charge of our steamers. Well and good if we can get men with these accomplishments, they are nothing more nor less; but what we want are men of brains and intelligence, men who can direct work and control men, men who can instruct their subordinate "mechanics" in cases of emergency, as well as in the ordinary routine of sea life; in fact, men such as it is the intention of the Board of Trade should be given certificates to take charge of hundreds of lives in great steamers as chief engineers. The Board of Trade will not give a certificate to a chief engineer unless he has actually served for a certain period as a second engineer in a steamer having engines of over 100-horse power nominal; and as a man must have fully served his apprenticeship and acted as a junior engineer at sea for a minimum term of one year before he is allowed to sail as a second engineer, it is at least a certainty that all chief engineers are at least competent to use hammer and file as well as the best of the "mechanics" at an emergency. The steamship owners of Greece set up in their mind's eye only the "hammer and file" standard of engineers alluded to above, and as they do not realise how far below the modern scientific standard that falls, they appoint engineers of their own country a little below it, on their own terms, with a result which is neither to the well-being of their engines nor the advantage of their dividends. In Greece there are many so-called engineers having second-class certificates from the Board of Trade, but as the qualifications for a second-class certificate are three years in any workshop and one at sea in the engine-room of an English steamer, it is clear that a man may spend his three years constructing olive presses in Athens or Corinth, and one year as a greaser in the engine-room of one of the boats of Messrs. Papayanni and Co., at a shilling a month, before he blooms in the Piræus as a first-class man with a "diploma." The Greek engineers with chief's certificates are not many, and for obvious reasons. The object of this long digression from the immediate subject is to show the reason why the engines and boilers of the vessels in the Greek service do not last beyond the term of five or six years, and why, owing to a poor present economy of a few pounds a month, the owners are obliged to spend some four or five thousand pounds for new engines in one-third of the time in which this outlay would have been necessary had they secured the services of skilled, intelligent, experienced, and certificated English engineers to take charge of their steamers. If the owners could realise what this means we do not think that they would be blind to their own interests to the extent of £1000 a year for each ship; for assuming that a small pair of engines costing £5000 are placed in charge of an ordinary class of Greek engineer, we are justified by experience in stating that they would require to be replaced in five years, while their life under the most adverse circumstances, in the hands of an English "chief engineer" would be ten years, showing a saving in prime cost of £1000 a year for the English "chief," saying nothing of the repair bill. An English "chief" does almost all his own repairs, and regards it in the light of a disgrace if he is unable to make them, while a Greek takes the most trivial thing to whatever works may be most convenient, and as the system of commission rules strongly in the East, he actually in many cases has a premium on the amount of repairs he can give out. There is little in the way of supervision, and if the engineer in Greek waters assures his manager or director that it is quite the order of things, if main bearings or crank brasses appear in four instead of two pieces, if combustion chamber crowns are burned, cylinders badly cut, or journals oval, the engines get the blame, not the incapacity of the engineer. M. Psacaropolus recognises these facts, and is quite determined to retain permanently the services of the engineers who come out with the new steamers. He has learnt by experience that in nothing about ships can the "penny-wise-pound-foolish" practice be more fatal to dividends than the care of the engines.

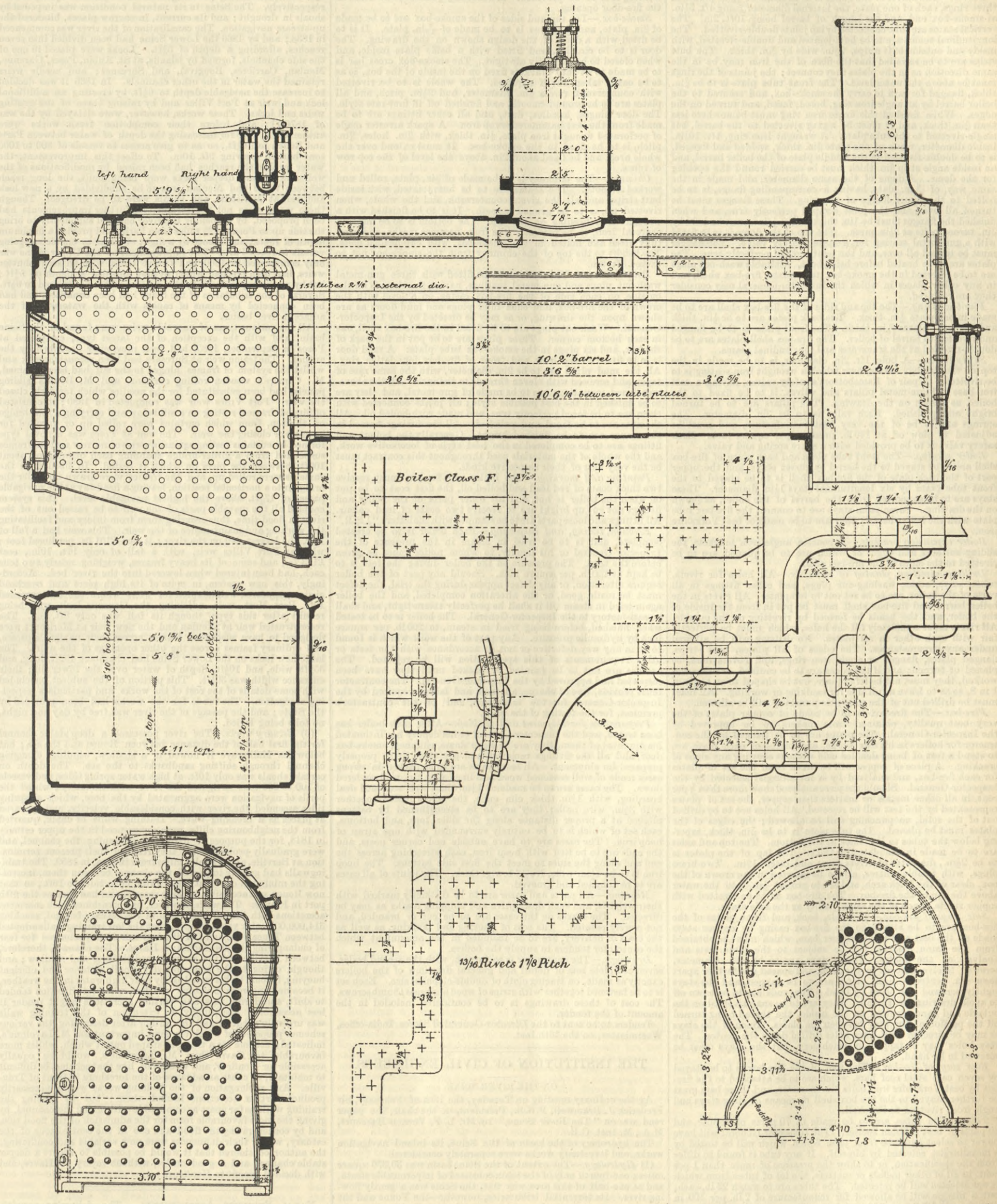
After the old engine seating of the Thessalia had been cut down to accommodate the new engines—some mistake having occurred to necessitate this work in the drawings sent to England—when a pair of new stern bushes had been fitted into the stern tube, for which work the ship's stem was loaded, and her stern lifted out of the water, and the old shafting correctly lined and fitted in its tunnel bearings, the ship was ready for her new engines, which were safely and securely fixed on board of her during the month of October, no difficulty of any kind being experienced in doing so.

But as soon as all the heavy work had been done the real difficulties of the case began, for the Greek mechanics are of the rough and slow order, able to do work, and good work, too, where sledge-hammers may be used, but being entirely at sea where fitting of more or less accuracy is required; and even in the arrangement of such apparently simple things as handrails and platforms they are very stupid, and everlastingly worry the engineers for instructions as to how a piece of plate is to be cut or a rod bent; they cannot manage work of any kind without the reflective cigarette always at hand, and it is not easy for an Englishman, without Mediterranean experience to realise how exasperating it is to see a man make two or three strokes with a hammer or a file, then rest while he rolls his tobacco in its paper; the cigarette being made must be lighted, and as there is in Greece a heavy tax on matches, the smoker wanders away to get a light from a friend, and as some gossip must intervene, the work at the end of a day has been as nearly *nil* as absence of intelligence, absence of skill, and presence of gossip and tobacco can render it. It is quite hopeless to lead a crusade against cigarettes during working hours, and the writer has seen half-a-dozen carpenters, standing up to their knees in shavings, working in the hold of the Thessalia, all smoking, the deck-officers saying, "If we prevent them they will leave." Owing to the military necessities of the country, which at the end of October called into existence an army nearly five times as large as that maintained during times of peace, all the workers of the country were placed in uniform and taken away, their places being supplied by veritable "fossils" on board the Thessalia, and even of these the number to be found was very limited, and the wages demanded proportionately high. Had the conscription been put in force before the Thessalia had her engines on board, she would now be a soulless hull, and would have to remain so unless young blood had been imported into Greece from other countries.

The work of placing the engines and boilers was slow, but only for the reason that when any heavy piece of machinery had been deposited in the ship, it became necessary to fix it in its position before the next item could be lowered, and as a crew of about 100 men were required for the crane and winches, it was not always convenient to secure them at the time they were required, for they generally were taken from the arsenal and were under the command of a naval officer who worked to the direction of the engineer sent from England. In January the Thessalia was placed in the new floating dry dock, which has recently been moored off the arsenal at Arrappi, a distance of some seven miles from the Piræus, which distance she was able to steam, though very slowly, for the main injection pipe had not been fitted, nor the jet injection, and owing to the ballast sea cock being in a very defective condition, a very small supply of water could be given to the condenser. At 35 revolutions, however, a vacuum could be maintained, and the journey was performed in about an hour and a-half. The new floating dock was much needed at the arsenal, as hitherto all the king's ships were obliged to go to Trieste, at great expense, for cleaning or repairs. The dock was constructed in France, and is still in the charge of French engineers, who choose to be very mysterious about its intricacies, though it is simplicity itself. The return run of the ship, which had during her four days' stay in the dock been supplied with the much-desired injection pipe, was satisfactory, the engines running very smoothly and easily; and though the trim was none of the best, eleven knots was the speed obtained at this the first full-speed run. Since that time the cabin arrangements for the crew and passengers have been entirely overhauled, new deck houses have been constructed, and where the decks required renewing it has been done, the saloons for first and second-class passengers, which occupy the greater part of the vessel, have been entirely repainted and decorated, and no money has been spared, under the experienced and indefatigable supervision of M. Psacaropolus, to render the Thessalia the smartest looking and the most luxurious passenger steamer in the Levant.

Before speaking of the official trial trip, a few particulars concerning the proportions of the new and the old engines may be given; and it will be remembered that the desire of the Panhellenic Company was rather to secure an economy in fuel than an unnecessarily high steaming speed. The old engines, which were compounded by Messrs. Palmer Brothers in 1874, were of very heavy design, and had cylinders of 33in. and 66in. diameter, with a stroke of 33in., steam being supplied by two double-ended boilers 10ft. in diameter by 13ft. 6in. long, each boiler having four furnaces, and carrying steam of 70 lb. pressure. In the absence of any data as to revolutions, indicated horse-power, diagrams, &c., we are not in a position to say what these engines have recently been doing. It is, however, known that the coal consumption was something like 13 tons a day, and that the speed of the ship has not exceeded nine knots. It is manifest from the state of the boilers that a pressure more than 50 lb. would have been dangerous, and it is more than doubtful if, under any class of fuel or firing, more than this could have been maintained. The engines themselves, judging from their condition, must have veritably rattled round, the large number of pieces of the various brasses—rendered so evidently by heat and cold water—ought to have enabled the engineers (?) to have adjusted them to a nicety. The new engines, by the North-Eastern Marine Engineering Company, Wallsend-on-Tyne, are smaller in size, but are still a thoroughly strong, sound pair of engines; the dimensions of the cylinders are 32in. and 58in. diameter respectively, having a stroke of 36in. Steam is supplied by a pair of fine steel boilers 11ft. in diameter, by 11ft. 7in. long, having two furnaces each, and supplying steam at a pressure of 80 lb. on the square inch; they are fitted with high steam domes joined to them by narrow necks, and as steam is taken from the tops of these, dry steam, and an absence of priming, may be safely counted on. The vessel will, under ordinary circum-

CONTRACTS OPEN—LOCOMOTIVE ENGINE BOILERS.



stances, be required to steam about 10½ knots, at which her fuel consumption will not exceed 8 tons per day of twenty-four hours; but should it be necessary to reach a port before nightfall, or for any other cause, the engines can be driven at a higher speed. The comforts of the engineers have been well looked after. They are berthed in a deck-house immediately abaft the engine-room, into which a window opens from the chief engineer's berth; and as he is furthermore provided with a pressure gauge, a speaking-tube on to the lower platform, and a gong for calling or being called at any moment, he can take the utmost care of his owners' interests with the minimum of trouble to himself. The engine-room itself is peculiarly spacious, being fitted with large and convenient store-rooms, lavatory, &c., and as it has been fitted with three large ports at either side, plenty of light can be obtained, and, in fine weather, an abundance of fresh air. With the new machinery of the Thessalia not only has a high economy been effected in the coal consumption, but, as the boilers are single-ended and shorter than the old ones, one of the old stokeholes has been thrown into the cargo-space of the ship, with a result which will no doubt tell in its profits at the end of the year.

A preliminary trial was run on February 26th, the vessel—though, unfortunately, in a still unfinished state—taking a small number of passengers and some cargo from the Piræus to Syra, a distance of 72 knots. A speed of slightly over 12 knots was maintained, the engines indicating, with only 70 lb. steam, about 610-horse power, and running smoothly and well. No attempt was made to force the ship, as the intention of the engineer in charge was rather to get the various bearings to run smoothly and well, reserving the high speed trial for the official trip, which took place on the following day, from Syra to the Piræus, and which was in every way satisfactory, the engines making sixty-eight revolutions, and driving the ship at a speed of 13¼ knots, with 685 horse-power, of which the low-pressure engines contributed 343, showing only one horse-power difference from the high-pressure. In spite of the fact that the engines were in full gear, and the ship driven at its highest speed, the coal consumption, which had been carefully noted, was slightly under 1·80 lb. per horse-power per hour, thus giving one more example as to the economy which invariably accompanies the engines built by Mr. Allan, and affording a very satisfactory contrast for the Panhellenic Company between the new and the old engines. The Thessalia began her regular service on March 3rd, as a mail steamer running between the Piræus, Zante, Corinthe, and Corfu, and there is little doubt that her success and popularity will fully justify the large outlay which the Panhellenic Company has expended in making her the smartest vessel in the Levant.

CONTRACTS OPEN.

LOCOMOTIVE BOILERS FOR SIND, PUNJAB, AND DELHI RAILWAY.

THE work required under this specification consists of ten locomotive boilers, which are to be constructed in general accordance with the drawing. They are for renewal of boilers of engines made by Messrs. Kitson and Co. and by Messrs. Stephenson years ago.

The whole of the boiler plates which are flanged or otherwise worked in the fire, the rivets used in the boilers, and also all other parts specially mentioned in this specification, must be of Lowmoor iron supplied by the Lowmoor Iron Company. The remainder of the boiler plates, butt strips and rings, angle irons, and stays used in these boilers must be of Lowmoor, Bowling, Farnley, or Taylor Brothers' best quality of iron. The smoke-boxes and chimneys are to be made of best best Staffordshire iron. All plates and angle irons are to be legibly marked with the maker's name and brand, which are to be so placed that they can be seen when the parts of the boilers in which they are used are finished. The names of the makers from whom it is proposed to obtain the iron and copper plates and the brass tubes are to be submitted to the Inspector

General, and must be approved by him before the orders for materials are arranged.

Barrel.—The barrel of the boiler is to be made of $\frac{7}{16}$in. plates, in three rings, each of one plate, the internal diameter being 4ft. 3$\frac{1}{2}$in. at smoke-box end, and the length of barrel being 10ft. 2in. The vertical seams are to be connected by lap joints double-rivetted. The longitudinal seams are to be butt-jointed and double-rivetted, with inside and outside butt strips, 7$\frac{1}{2}$in. wide by $\frac{5}{8}$in. thick. The butt strips are to be so rolled that the fibre of the iron may be in the same direction as in the plates they connect; the joints of the rings must be above the water level. The front tube plate is to be $\frac{5}{8}$in. thick, flanged forward to carry the smoke-box, and secured to the boiler barrel by an angle iron ring, bored, faced, and turned on the edges. When finished this angle iron ring must be nowhere less than $\frac{5}{8}$in. thick, and it must be zigzag rivetted to the barrel, but single-rivetted to the tube plate. A wrought iron ring, 1ft. 10$\frac{3}{4}$in. inside diameter, made of one plate $\frac{5}{8}$in. thick, welded and flanged, is to be double-rivetted to the middle plate of the boiler barrel, and an inside angle strip $\frac{5}{8}$in. thick must be carried round the opening for the dome. A dome of the same diameter, and made in the same way, of $\frac{9}{16}$in. plate, having a corresponding flange, is to be bolted to the upper flange of the ring. These flanges must be turned all over, and the joint scraped perfectly true, and when finished the flanges must be 1in. thick. The joint must be held by $\frac{5}{8}$in. turned bolts at 2$\frac{1}{2}$in. pitch. The top of the dome is to be fitted with a gun-metal seating for a spring safety valve. The flanges must be turned all over, and the joint scraped perfectly true. The plates are to be heated before being bent. Suitable wash-out plugs are to be inserted in the smoke-box tube plate, fire-box shell, and in any other places in which the Inspector-General may consider they are required.

Fire-box casing.—The top and sides of the fire-box shell are to be made in one plate $\frac{1}{2}$in. thick. The back plates are to be $\frac{1}{2}$in. thick and the front plates $\frac{9}{16}$in. thick. The front plate is to be flanged and rivetted to barrel of boiler. The fire-box shell plates are to be double-rivetted at the transverse and longitudinal seams.

Safety valves.—A hole, 1ft. 2in. diameter, is to be made in the top of the fire-box casing, over which a wrought iron seating is to be rivetted. A pair of Ramsbottom's safety valves, having a cast iron base and gun-metal pillars and valves, is to be fixed to the boiler, as shown on the drawing. The pillars are to be turned bright and polished. Each valve is to be 3in. diameter. The springs are to be of the very best manufacture, and must be adjusted to blow off at 140 lb. pressure per square inch. Each safety valve is to be provided with a spare spring and valve.

Boiler staying.—The front tube plate and back plate of fire-box shell are to be stayed to the barrel by gusset stays, and the upper part of the back plate of the fire-box shell is to be stayed to the front tube plate by six longitudinal stays 1$\frac{1}{2}$in. diameter. These stays are to be supported from the barrel of the boiler, as shown on the drawing. Seven palm stays are to connect the fire-box tube plate with the boiler barrel; they are to be made of best Yorkshire iron.

Boiler expansion brackets.—Expansion angle iron brackets, the sliding surfaces and edges of which are to be planed, are to be rivetted to the sides of the fire-box shell.

Drilling, rivetting, planing of edges, &c.—All holes for rivets, tubes, stays, cocks, washing-out plugs, and other fittings in all parts of the boiler, are to be set out to template. All rivets in the boiler barrel and fire-box shell must be put in from the inside of the boiler, and the heads be formed by rivetting on the outside. All rivets must completely fill the holes, which must be perfectly fair with each other in all plates. No drifting will be allowed under any circumstances. The edges of all plates, butt strips, flanged plates, flanged or angle iron rings, and covers must be planed or turned; and if the edges are to be caulked, or otherwise worked, they must not be left square, but be shaped to an angle of 1 in 8, so as to leave a full side for caulking or working. All holes must be drilled out of the solid; no punching will be allowed.

Fire-box.—The fire-box is to be made of copper plates of the very best quality, obtained from makers to be approved by the Inspector-General. The plates are to be flanged by the contractor for boilers in his own works, and pieces of each plate are to stand a test of being doubled cold without showing any signs of cracking. A piece of copper will be taken from the set of plates for each fire-box, and analysed by a metallurgist selected by the Inspector-General. Should the piece analysed show more than $\frac{1}{2}$ per cent. in all other metals or matters than copper, the set of plates represented by the test will be rejected. All holes are to be drilled out of the solid, no punching will be allowed; the edges of the plates must be planed. The tube plate is to be $\frac{5}{8}$in. thick, tapering below the tubes to $\frac{1}{2}$in. thick at the bottom. The top and sides are to be made in one plate $\frac{1}{2}$in. thick. The lap of the plates is to be 2$\frac{1}{2}$in., diameter of rivets $\frac{15}{16}$in., and pitch, 1$\frac{3}{4}$in. Two brass plugs, with fusible centres, are to be inserted in the crown of the box, clear of the brick arch, and are to project $\frac{1}{2}$in. into the water above the top of the fire-box. The fire-box is to be rivetted with copper rivets, made of the same quality as the side stays.

Side stays of fire-box.—The side, back, and front plates of the fire-box are to be stayed to the fire-box casing by copper stays made of the best soft rolled copper bars, which must be obtained from the same makers, and be subject to the same tests and analysis as the plates. These stays are to be $\frac{7}{8}$in. diameter, screwed twelve threads to the inch, and spaced not farther apart than 4in. centres. Both plates are to be tapped, and the stays tightly screwed into them by hand. The ends are to be sawn off to avoid drawing the thread. They are to be snap rivetted on the outside and hand rivetted on the inside, the thread being turned off the portion of the stay between the plates. Such of the stays as may be directed shall have holes drilled down the centre. The stay holes may be tapped by machinery, but the stays must be screwed in by hand.

Roof stays of fire-box.—The roof of the fire-box is to be stayed by seven cast steel roof bars, which are to be attached to the fire-box by best Yorkshire iron bolts 1in. diameter, and these bars must be further stayed to the fire-box shell by means of sling stays and angle irons rivetted to the shell.

Tubes.—The tubes are to be made of 70 parts of copper and 30 parts of best Silesian spelter. The Inspector-General will have power to select one tube from each boiler, which will be tested by a metallurgist selected by himself. If any tube is found to differ from the specification, or to show the presence of more than 1 per cent. in all of other metals or matters, the lot of tubes from which it was selected will be rejected. The tubes are to weigh 23 lb. each, but a margin will be allowed for manufacture of 7 lb. per 100 in excess, and of 7 lb. per 100 in defect. They are to be solid drawn, and obtained from makers to be approved by the Inspector-General. They are to be 151 in number, 10ft. 8$\frac{1}{4}$in. long and 2$\frac{1}{4}$in. diameter outside, No. 12 B.W.G. thick for one foot next the fire-box, then tapering to No. 14 B.W.G. at the other end. The tubes must be parallel on the outside, the difference of thickness being given on the inside. The ends are to be carefully annealed. At the smoke-box end the tubes must project through the plate at least $\frac{1}{4}$in.; there will be no ferrules at this end, but the tubes must be fixed with one of Dudgeon's tube expanders. At the fire-box end the tubes must be expanded and carefully laid over, $\frac{1}{4}$in. projection being allowed for the same. The ferrules are to be 1$\frac{3}{4}$in. long, and are to have a taper of 1 in 24; they are to be made from solid drawn cast steel tubes, cut and turned to go into the tubes a tight driving fit, care being taken that the ends of the tubes are not cracked. The end of the ferrule inside the tube must be rounded to prevent its cutting the tube, and the ferrule must project $\frac{1}{4}$in. outside the tube.

Fire-hole and door and foundation ring.—An opening is to be made in the back plates of the fire-box and fire-box casing for firing. The bar round this opening must be formed of a forged ring, 3in. wide by 3in. thick, planed on both sides and made so that a projection of $\frac{5}{8}$in. is inside the copper plate. The rivets in the shell plate must be countersunk. The foundation ring is to be 2$\frac{1}{4}$in. by 2$\frac{1}{2}$in., and must be machined all round both inside and outside, and be so made as to allow of double rivetting at the corners. A sliding fire-hole door with the gear necessary for working it is to be provided. A deflecting plate is to be fitted in the fire-door opening.

Smoke-box.—The top and sides of the smoke-box are to be made of $\frac{5}{8}$in. plate, and the front is to be made of $\frac{7}{16}$in. plate. It is to be fitted with a door, of the design shown on the drawing. The door is to be circular, and fitted with a baffle plate inside, and when closed to be perfectly air-tight. The smoke-box cross bar is to be made to fit into brackets fixed on the inside of the box, so as to be easily taken out if required. The whole is to be rivetted with countersunk rivets $\frac{5}{8}$in. diameter, and 2$\frac{1}{2}$in. pitch, and all plates are to be ground smooth, and finished off in first-rate style. The door hinges, handles, dart, and all other fittings are to be made from the best hammered scrap iron. A spark arrester made of perforated wrought iron plate, $\frac{1}{4}$in. thick, with $\frac{5}{8}$in. holes, $\frac{3}{4}$in. pitch, is to be fixed in the smoke-box. It must extend over the whole area, and be fixed about 2in. above the level of the top row of tubes.

Chimney.—The chimney is to be made of $\frac{1}{4}$in. plate, rolled and worked smooth. The seams are to be butt jointed, with inside butt strips, and all the rivets countersunk, and the whole, when rivetted up, is to be ground smooth. It is to be finished with a wrought iron beading on the top. The bottom is to be made of charcoal iron, to be perfectly free from hammer marks, and carefully fitted and bolted to the smoke-box, with cup-headed bolts. The height to the top of the chimney from the smoke-box not to exceed 3ft. 8in.

Boiler fittings.—The boiler is to be fitted with three gun-metal wash-out plugs and gun-metal seatings, having the threads on the outside, on each side of the fire-box casing, on a level with the crown of the fire-box, and such mud plugs and mud doors as are shown upon the drawing, or as may be directed by the Inspector-General. Wash-out plugs are to be fitted in the fire-box shell, one in each bottom corner. Three plugs are to be put in the back of the box, and six plugs in the smoke-box tube plate. A mud door is to be fitted at the back and front of fire-box foundation ring. All the mud plugs are to be 2in. diameter, with the same rate of taper, and screwed with eleven threads to the inch. All the above-mentioned mountings are to be made of gun-metal, and they are to be finished in the best possible style; all joints connected with them are to be faced perfectly true, and made with boiled oil. All the nuts are to be faced and polished. All the fittings named in the clause are to be finished bright. Generally the boilers and fittings are to be completed in the best style of locomotive work, and the whole of the materials used throughout this contract must be the very best of their respective kinds.

Painting and marking.—The boiler and fire-box must receive two thick coats of red lead and boiled oil, the first coat to be put on when the boiler is hot, and all other parts of the boiler and fittings not got up bright are to receive two coats of lead colour. All fittings and loose parts are to be stamped with the letters "I.S.R."

Erection, testing, and inspecting.—Each boiler is to be erected complete, and is to be tried in steam in the presence of the Inspector-General or his deputy, to whom notice must be given before the trial. The pressure on the boiler during the test is to be kept at 150 lb. per square inch. Should any part of the boiler require alteration, or any defect appear during the trial, the defect must be made good, or the alteration completed, and the boiler again tried in steam till it shall be perfectly steam-tight, and shall be satisfactory to the Inspector-General. The boiler is to be tested when finished, before being tried in steam, to 200 lb. per square inch by hydraulic pressure. Any part of the work which is found to be in any way defective or not in accordance with the tests or other requirements of this specification will be rejected. The articles are not to be painted or packed until they have been inspected and approved by the Inspector-General. The contractor must provide, free of charge, all tools and labour required by the Inspector-General for the inspection, and on the contractor's premises, for the testing of the work.

Preparation for shipment and packing.—After each boiler has been tested, and the Inspector-General or his deputy has intimated his approval of them, they are to have dome, chimney, smoke-box door, and all the fittings removed, and are then to be properly prepared for shipment. All loose parts are to be packed in strong cases made of well seasoned wood and lined with tin, well soldered down. The cases are to be made of 1$\frac{1}{4}$in. thick well seasoned deal boarding, with 1$\frac{1}{4}$in. thick elm ends, the whole nailed together with 3$\frac{1}{2}$in. wire nails; they are to be strengthened by battens pitched at a proper distance along the sides, tops, and bottoms, each set of which is to be entirely surrounded with one strap of hoop iron. The cases are to have outside end corner posts, and the ends are to be tied with hoop iron, each stretching across the end and along the sides to meet the first side battens. The hoop iron is to be 1$\frac{1}{2}$in. wide, No 18 b.w.g. thick. The joints of all cases are to be tongued and grooved.

Marking.—All parts and cases are to be distinctly marked with their weights, and such descriptive and shipping marks as may be directed. The marks on the cases are to be cut or branded, and not merely painted. The cost of packing and marking, as well as the costs of delivery, are to be included in the amount at which the contractor tenders to supply the boilers.

Drawings.—The contractor is to furnish, with the second boiler, seven complete sets of detail and general drawings of the boilers exactly as made, on tracing cloth of double-elephant size. Each set is to be fastened together with strips of wood and orass thumb screws. The cost of these drawings is to be considered included in the amount of the tender.

Tenders to be sent to the Director-General of Stores, India-office, Westminster, on the 16th inst.

THE INSTITUTION OF CIVIL ENGINEERS.

ON THE RIVER SEINE.

At the ordinary meeting on Tuesday, the 16th of February, Sir Frederick J. Bramwell, F.R.S., President, in the chair, the paper read was on "The River Seine," by Mr. L. F. Vernon-Harcourt, M.A., M. Inst. C.E.

The hydrology of the basin of the Seine, its inland navigation works, and its estuary works were separately considered.

(1) *Hydrology.*—The extent of the Seine basin was 30,370 square miles; one-fourth only of the basin consisted of impermeable strata, and as one-half of this area was flat, the Seine was a gently flowing river. Its torrential tributaries, however—the Yonne and the Marne—gave a mixed character to its flow at Paris, where the highest floods were produced by a conjunction of later rapid floods of the torrential tributaries with the earlier long continued floods of the gentle affluents. Dividing the year into the hot season from May to October, and the cold season from November to April, it was found that, though the rainfall was greatest in the hot season, high floods never occurred except in the cold season, when evaporation was inactive and the soil became saturated. The principal floods observed at Paris during the last 150 years were referred to in the paper, and their peculiarities discussed. The first attempt at predicting floods was made on the Seine in 1854. Careful observations had enabled rules to be framed for deducing the probable rise of the lower portions of the main river and its tributaries, from the rise at certain points on the upper rivers; and as about four days elapsed before a flood from the upper basin reached the lower river, it was generally possible to announce a flood on the Lower Seine three days before its arrival. The predictions were made with remarkable accuracy, and had proved most valuable in warning riparian inhabitants of an approaching danger. Moreover, every facility was afforded for the passage of a flood by the warnings sent to the weir-keepers, and by the system of movable weirs adopted throughout the Seine basin.

(2) *Inland navigation works.*—The Lower Seine was so winding that the direct distance of 115 miles between Paris and the sea was increased to 230 miles by the river. The total fall of the Upper Seine, between Montereau and Paris was 74ft., and of the Lower Seine, between Paris and St. Aubin—the last lock on the river—was 76ft., amounting to average falls of 14$\frac{1}{2}$in. and 6$\frac{3}{4}$in. per mile respectively. The Seine in its natural condition was impeded by shoals in drought; and its current, in narrow places, hindered the up-stream navigation. The canalisation of the river was commenced in 1838; and by 1866 the Lower Seine had been divided into seven reaches, affording a depth of 5$\frac{1}{2}$ft. Locks were placed in one of the side channels, formed by islands, at St. Aubin, Poses, Garenne, Meulan, Carrières, Bougival, and Suresnes; and needle weirs retained the water in the other channels. In 1866 it was decided to increase the navigable depth to 6$\frac{1}{2}$ft. by erecting an additional lock and weir at Port Villez and by raising three of the existing weirs and locks. These works, however, were delayed by the war of 1870-71; and before their completion fresh works were authorised in 1878 for increasing the depth of water between Paris and Rouen to 10$\frac{1}{2}$ft., so as to give access to vessels of 800 to 1000 tons burden drawing 9ft. 10in. To effect this improvement, the water level in the reaches had been raised by modifications of the weirs, larger and deeper locks were being built, the long reach between Villez and Meulan was to be subdivided by a new lock and weir at Méricourt, and shoals were to be dredged. Though these works were not yet terminated, further improvements had been proposed, by deepening the river channel sufficiently to bring the tide up to Poissy, 12$\frac{1}{2}$ miles from Paris, and provide a minimum depth of 19$\frac{3}{4}$ft., and thence by a flight of locks to enable sea-going vessels to reach Paris. The improvement of the Upper Seine was only commenced in 1860, and twelve locks, with adjacent shutter weirs, had been erected, which at first afforded a depth of 5$\frac{1}{2}$ft.; but by works begun in 1878, this depth had been increased to 6$\frac{1}{2}$ft. Several of the tributaries of the Seine had been canalised, and had been connected by means of canals with the waterways of the adjacent river basins.

All the various types of movable weirs were found in the Seine basin, and with the exception of the latest type, completed at Poses in September, 1885, had been previously described by the author. The frame weir at Suresnes had been reconstructed; and whilst the system of frames hinged to the sill had been retained, M. Caméré's wooden rolling curtains, and M. Boulé's sliding panels, had been substituted for the needles which formerly closed the weir. Port Villez weir was completed in 1880; it consisted of hinged frames, resting on a sill below and carrying a foot-bridge on the top, from which curtains were rolled up or unrolled for opening or closing the weir. The weir at Poses was a novel type formed by curtains resting against a series of narrow vertical frames suspended from a girder-bridge spanning each opening of about 100ft. between the piers on which it rested. In flood time the curtains were rolled up, and the frames were drawn up under the bridge into a horizontal position, leaving a headway at the navigable passes of 17$\frac{1}{4}$ft. above the highest navigable level. This system enabled all the movable parts of the weir to be raised out of the river in flood time, thus securing them from injury and facilitating the working and maintenance of the weir. This weir had a fall of 13ft. the largest fall on the river; it cost £151 5s. per lineal foot; whereas Port Villez weir, with a fall of only 9ft. 10in., cost £163 7s., and some of its heavy frames, weighing nearly two tons each, had been injured when lowered into the river bed. Accordingly, this new system, in spite of its high piers and overhead girders, appeared well adapted for weirs where the fall exceeded 10ft. Port Mort weir, adjoining the Garenne lock, was being rebuilt after this type, though its fall was only 8ft. 8in. The reconstrusted weir at Meulan and the new weir at Méricourt were designed to have suspended frames across their navigable passes, and ordinary frames across the other openings of the weirs. The large new locks on the Lower Seine had chambers 462ft. long, and 55$\frac{1}{2}$ft. wide, and 10$\frac{1}{2}$ft. depth of water over the lower sill; their entrance width was 39$\frac{1}{2}$ft. This portion of the subject concluded with some details of the cost of the works and particulars respecting navigation. The funds for the works had been provided by the State; and the passage of the river was free by day and night, no tolls being levied.

(3) *Estuary works.*—The river possessed a deep stable channel for the first half of the distance between Rouen and the sea; but below La Mailleraye it flowed in a shallow, winding, changing channel through shifting sandbanks to the sea. The depth on certain shoals was only 10ft. at high water spring tides, and vessels of 100 to 200 tons navigated the river with difficulty; whilst the perils of navigation were aggravated by the bore, which at spring tides ascended the river with considerable velocity, and appeared at places as a breaking wave. Training walls of chalk, quarried from the neighbouring cliffs, were commenced in the upper estuary in 1848, for the purpose of fixing and deepening the channel, and were gradually prolonged till they reached their present termination at Berville, about twelve miles from the sea, in 1859. The trainingwalls had greatly improved the channel between them, increasing the minimum depth at high water neap tides to 18ft., so that now Rouen was accessible to large vessels, and had become the fifth port in France. The walls, however, had occasioned such enormous accretions both behind them and in the estuary beyond, reaching 314,000,000 cubic yards by 1880, that the low training walls adopted between Tancarville and Berville had not been prolonged for fear of endangering the approaches to Havre. The channel, therefore, between Berville and the sea remained shifting and shallow; and though, owing to the comparatively small distance and efficient buoying, it could be traversed safely near high water in fine weather, it became dangerous in stormy weather, when its direction tended to shift, and during fogs, and further accretions might render it less accessible. Accordingly, an extension of the training walls was urgently needed; and the author after describing the various schemes proposed, of which the most important was M. Lavoinne's, indicated a scheme for a trumpet-shaped outlet which, whilst more favourable to Havre than M. Lavoinne's, would be equally accessible for Honfleur, and would not, like that scheme, be difficult to maintain, or cause an advance of the foreshore in front of Trouville. Any prolongation of the training works would necessarily produce further accretions behind them; but by placing the training walls as far apart as compatible with fixing the channel, by giving the most favourable form for the admission of the flood tide, and by concentrating the flood and ebb in the central zone of the estuary, where their influences were now variable and conflicting, the author considered that it would be possible to secure a deeper stable channel, and a good outlet, without injury to Havre, and with decided benefit to Honfleur.

Naval Engineer Appointments.—The following appointments have been made at the Admiralty:—Thomas Rule, engineer, to the Anson; Charles F. H. Tilbrook, engineer, to the Warspite; Francis J. Moore, engineer, to the Osprey, additional; and Richard S. Hamm, engineer, to the Glatton.

The Tower Bridge.—The announcement made a few days ago that the Queen had consented to drive the first pile of the Tower Bridge in June next, turns out to be false, for her Majesty has not even been approached upon the subject. It is stated that the engineer of the bridge has recommended that British steel and iron shall be exclusively used in the construction of the bridge, and it is believed that the Bridge House Committee of the Corporation have decided in favour of that course. That, however, not being certain, a petition signed by 4000 citizens and ratepayers was presented to the Court of Common Council at their last meeting, urging the adoption of the engineer's suggestion, partly for the benefit of English trade, partly on the ground that British steel and iron were far superior for work of this kind to Belgian or other foreign manufactured iron. The former would cost considerably more than the latter, but the Council were pressed to make some sacrifice for the benefit of the working men and the trade of this country. Owing to a motion for adjournment being carried (by a majority of only three), no decision was arrived at by the Court, so that it is still not known what will be done. Feeling in the City is, however, very strong in favour of exclusively British material.

RAILWAY MATTERS.

A ST. PETERSBURG correspondent of the *Times* says:—"It is now certain that the Transcaspian Railway will be extended from Merve to Bokhara *viâ* Tchardshui on the Amu Daria, thence to Samarkand, and eventually to Tashkend."

THE London and North-Western Railway Company has put all its men on full time at the Wolverton carriage works. The men were put on short time in November last. The new orders will affect over 2000 men. It is hoped at Crewe, where the men are on short time, that the activity will extend to other departments.

IN a report on the collision which occurred on the 14th December last at Middleton Junction Station, on the Lancashire and Yorkshire Railway, Major-General C. S. Hutchinson, R.E., says:—"Had the whole of the empty train, and not the engine only, been fitted with the automatic vacuum brake, it is probable that the collision would have been prevented or nearly so."

THE roofing in connection with the Exchange station of the Lancashire and Yorkshire Railway Company, at Liverpool, is nearing completion. The ironwork is being supplied by a James Bridge firm, as sub-contractors for Robert Neale and Sons, of Manchester. When finished, there will be something like 2000 tons of iron in it. The work includes cast iron columns and a good deal of spouting.

RAILWAYS are very highly and actively appreciated in Queensland. The *Colonies and India* says the tender of Messrs. Robinson and Haig, of South Australia, will probably be accepted for the construction of the ninth section of the Western Railway, from Dulbydille to Charleville, distance 70 miles. The amount of the tender is £146,210, which is far below the other tenders and the official estimate.

THE Wolverhampton Chamber of Commerce has resolved to suggest to the President of the Board of Trade that legislative sanction for the amalgamation of two or more railway companies should in future be granted only on the condition that any canal possessed by either of the companies should be held subject to the right of any company owning an adjoining independent canal to acquire the canal held by the amalgamation.

THE *Railroad Gazette* record of train accidents in the States in December contains notes of 37 collisions, 32 derailments, and 5 other accidents—a total of 74 accidents, in which 31 persons were killed and 153 injured. Eleven collisions, 7 derailments, and 1 other accident caused the death of one or more persons each; 10 collisions and 10 derailments resulted in injury to persons, but not death. In all, 19 accidents caused death or fatal injury, while in 20 others there were lesser injuries; a total of 39 accidents, leaving 35, or 47 per cent. of the whole number, in which there was no injury to persons severe enough to be recorded.

THE coal carried to London by rail during February last shows an increase of 48,135 tons, as compared with the tonnage for the corresponding period of 1885, the respective weights being 626,322 and 578,186 tons. Taking the two months of the year, the quantity was 1,249,755 tons, against 1,216,432, the increase in the present year being 333,322 tons. Messrs. Newton, Chambers, and Co., Limited, of the Thorncliffe Collieries, head the list with 33,364 tons, Clay Cross being next with 25,238 tons, Grassmore Colliery 17,276 tons, Blackwell 16,863 tons, Langley Mill 15,861 tons, and Eckington (J. and G. Wells, Limited) 15,515 tons.

THE last section of the Bolan Railway along the *kotal* south of Darwaza is nearing completion. The earthwork from Darwaza to Quetta and thence round to Gurkhai, where the Harnai line debouches from the hills upon the Peshin Valley, has been completed, and labour is now concentrated upon the line from the Bostan Junction to Sayid Hamid, where the new entrenched position is to be made. As soon as the track to Darwaza is open, traffic material will be taken up by train to the plateau, and the rails will be laid along the earthwork, first to Quetta and afterwards to Gurkhai. The Bolan Railway will thus serve the immediate purpose of enabling the further sections of the Sind-Peshin Railway to be laid even before the Hurnai line is completed. As to its future, whether it is to be a permanent line or even to be newly aligned in parts, depends a good deal on the commander-in-chief's inspection of it next month.

ACCORDING to the report of the directors of the Great North of Scotland Railway Company, which will be read at the general meeting of the proprietors at Aberdeen on the 18th inst., the mileage worked by the company's engines number 302·25, the train mileage was 756,364, the miles maintained being, single 266·5, double 23·75, a total of 290·25, the cost of which was £19,188 19s. The locomotive power cost £19,944 11s.; carriages and wagons, £6670 14s.; coal, coke, and wood fuel, £7379 13s. The total revenue is £158,642 4s. 4d.; expenditure, £82,500 18s. 7d. The locomotive department, salaries, office expenses, and superintendence only cost altogether £468 11s. 7d., presumably including locomotive superintendent and assistants. The working expenses per train mile are 23·14d.; and on traffic receipts 46·30 per cent. In train mileage the increase is 26,003 miles over the corresponding half-year. The total expenditure for the half-year on revenue account shows a decrease of £1642 18s. 1d. During the half-year 6 miles 440 yards have been relaid with heavy steel rails.

ON Tuesday an electric railway was opened on Ryde Pier with a successful series of experimental trips, in the presence of the South-West of England Association of Gas Managers, who held their annual meeting at Ryde. The tramway, which runs down the pier, has hitherto been worked by horse traction, but some time since the directors determined to substitute an electric railway, and intrusted the work to Messrs. Siemens and Company. The prime motor is a gas engine, which is connected by a belt to one of Siemen's shunt-wound dynamos. The current is carried by cable to the positive conductor, which is a channel of iron running by the side of the tramway, and supported by brackets fitted on the sleepers and insulated. The ordinary rails, which are of steel, are used for the return current. The current is taken to a motor under one of the cars by means of a sliding contact. Each train is worked by one of the ordinary passenger carriages fitted with a motor, and each is capable of carrying about 13 tons. The carriages were driven up and down the railway at the rate of about twelve miles an hour.

THE Lehigh Valley Railroad Company is supplying its freight and passenger locomotives with a new form of grate, for which a number of important claims is made. This new device was invented by Isaac W. Swallow, a locomotive engineer on the Delaware, Lackawanna, and Western Railroad. The grates are manufactured under the patents of the American Water Bar Grate Company, 1123, Arch-street, Philadelphia, Pa. The grate is made up of two sections, each operated by a lever in the cab. The stationary bars extend the entire length of the grate and are hollow, permitting the circulation of water, so as to prevent overheating. Alternate bars may be shifted for raking and cleaning the fire, with the results, it is claimed, of effecting a large saving of labour over the old method of manipulation. The fire can, moreover, be cleaned of ashes and cinders by this new device without disturbing the burning coal. The *Iron Age* understands that the officials of the Lehigh Valley Company claim that they can save with the new grate from 1 to 1½ tons of coal in a run of 90 miles of an express train. The grate has also been used with a stationary boiler with different kinds of fuel, and from all accounts appears to have given very satisfactory results." If the Lehigh can save 30 per cent. of coal in 90 miles by any alteration in grate, the query arises what could have been used before as a grate. The American ton is 2000 lb. and $\frac{2000}{90} = 22$—that is to say, this grate saves 22 lb. per mile, or about three-fourths of the quantity required by an English locomotive for doing the whole work. It would seem from this that there are margins for improvement still available in American locomotive practice.

NOTES AND MEMORANDA.

IT has been recently pointed out that the number of births in France per 10,000 inhabitants has diminished more than one-third in a century. It was 380 in 1771-80, 289 in 1831-40, and only 241 in 1871-80.

THE total rainfall at the Ben Nevis Observatory during 1885 was 146·50in., the largest monthly fall being 24·33in. in December, and the least 4·97in. On December 12th there fell 5·34in., and on the following day 3·52in., or 8·86in. on these two days.

IN London 2640 births and 2143 deaths were registered last week. Allowing for increase of population, the births were 215 below, whereas the deaths exceeded by 390 the average numbers in the corresponding weeks of the last ten years, and the annual death-rate rose to 26·9, and exceeded the rate in any week since March, 1883.

A STRONG and useful cement for connecting ironwork, such as the bars in railings, gratings in their settings, and similar purposes, is said to be made with six parts of sulphur, six of whitelead, and one of borax thoroughly mixed. In applying it, it is wetted with strong sulphuric acid. It is spoken of as useful for fastening pieces of iron together by a very thin layer pressed between the two surfaces, and left a few days to dry.

AT the last meeting of the Paris Academy of Sciences, a paper was read "On the Measurement of the Velocity with which Vibrations are Propagated in the Ground," by MM. F. Fouqué and Michel Lévy. They describe an instrument which they have invented for the purpose of automatically recording the velocity of propagation, as well as the intensity and duration of vibrations such as those produced by the blow of a Nasmyth hammer.

IT is stated that the "Mitis" wrought iron castings are made by melting with the iron, or adding to it when melted, a very minute quantity of aluminium in the form of an alloy with cast iron. It is known that certain alloys have a fusing temperature lower than that of their constituent metals, and this is, it is said, brought into use by making the melted wrought iron fluid at a temperature much below that at which it would otherwise be viscous.

A NEW gum solution—*Chem. Centr.*—consists of two grams of crystallised aluminium sulphate dissolved in 20 grams water added to 250 grams strong gum arabic solution—2 grams in 5 grams of water. Ordinary solutions of gum arabic, however concentrated, fail in their adhesive power in many cases, such as the joining together of wood, glass, or porcelain; prepared, however, according to the above receipt, the solution meets all requirements.

A PAPER on "The Preparation of Hydrogen," by F. Hembert and Henry, is given in abstract from the *Compt. rend.*, 101, 797, in the *Journal of the Chemical Society*. Superheated steam is projected in fine jets on incandescent coke, and the mixture of equal volumes of hydrogen and carbonic oxide which is thus obtained is led into a second retort containing some refractory material so arranged that the gases pass over a very large heated surface. Steam heated to the point of dissociation is driven into this second retort, and the steam and carbonic oxide react on one another with production of carbonic anhydride and hydrogen, decomposition being facilitated by contact with the large extent of heated surface. About 3200 cubic metres of hydrogen are obtained per ton of coke, and the cost is about 0·015f. per cubic metre.

AN interesting fact connected with the Lake of Geneva has recently been brought to light by M. Hörnlimann, who is now preparing a hydrographical chart of the Leman basin. From the point where the Rhone enters the lake, to a distance of more than six kilometres, the river water, which is denser than the lake water, follows a trench in the alluvial deposits which is from 500 to 800 metres wide, and which, even beyond St. Gingolph, where the depth exceeds 200 metres, is 10 metres deep. A precisely similar groove has been observed at the mouth of the Rhine, in the Lake of Constance, with a depth of 70 metres and a width of 600 metres; and similar, though less, deep grooves are found opposite to the old mouths of the Rhone and the Rhine in the two lakes. The greater density of the river water is owing to its lower temperature and to the vast quantity of sediment suspended in it. The deltas of glacial rivers flowing into lakes differ, then, in a remarkable manner from the deltas of most rivers flowing into the sea; the water of these rivers, being less dense than that of the sea, spreads over the surface, and thus helps to form bars.

FROM M. Konovaloff's researches into contact actions, published in the *Journal of the Russian Chemical Society*, 1885, the following conclusions are noticed by *Nature*:—"The capacity of solid bodies for condensing gases on their surfaces is generally recognised, but their capacity of dissociating them under certain conditions must also be recognised now as a property of all solid bodies, although shared in by them in different degrees. Platinum enjoys this property to a high degree, but also many other solid bodies, glass among them, the intensity of its contact action obviously depending upon several circumstances—its chemical composition, the structure of its surface, and its temperature, as also upon the density of the gas it is brought in contact with. It being so, it appears possible, in the author's opinion, that in the dissociation phenomena studied by Sainte-Claire Deville—and having so great an importance for the theoretical discussions upon the dynamics of chemical reactions—the dissociation observed was a consequence of the contact action of the solid body. Contact action seems also to have played its part in the researches of M. Lemoine on the dissociation of hydrogen iodide."

SUMMING up the researches of Sainte-Claire Deville, Würtz, Faraday, Ramsay, Berthelot, and many others who have devoted attention to the part played by contact action in dissociation, M. Konovaloff shows that capillary structure and porosity are not necessary conditions in a solid body for producing dissociation; smooth surfaces may also condense vapours and gases, and sometimes retain them with such a force as to make the disengagement of the absorbed gas quite correspond to the dissociation of a chemical compound. The character of the surface, having of course a great importance, M. Konovaloff has carried on his experiments so as to study the influence of the character of the surface. The first part of his inquiry contains the experiments made as to the dissociation of the tertiary amylacetate, the method of inquiry being successive determinations of the density of its vapours on W. Meyer's method. The result arrived at is obviously that the structure of the surface of the glass which is brought into contact with amylacetate vapours is of great importance; but it is worthy of notice that the rough surface of the glass-powder condenses the vapour without producing a notable dissociation, while the smooth surface of the glass-cotton dissociates it.

IN a paper by A. Naumann and C. Pistor on "The Reaction between Carbonic Oxide and Steam"—*Journal of the Chemical Society*—experiments are described made with a view of ascertaining the temperature at which carbonic oxide and steam react to form carbonic anhydride aad hydrogen. The method consisted in passing carbonic oxide, freed from carbonic anhydride and oxygen, over water heated at 80 deg., so as to obtain an approximately equimolecular proportion of carbonic oxide and vapour of water. The mixed gases were passed through a porcelain tube the temperature of which was roughly determined by introducing into it certain salts or spirals of various metals; the resultant gas was then analysed by the usual methods. The following results were obtained:—At 560 deg. no reaction took place, at 600 deg. 2 per cent., at 900 deg. 8 per cent., and at 904 deg. 10·5 per cent. of the carbonic oxide was converted into carbonic anhydride. All the conditions which militate against a reaction between carbonic anhydride and hydrogen are favourable to that between steam and carbonic oxide, inasmuch as such a change would be exothermic—+ 10720 cal.—and the resultant carbonic anhydride is very stable at high temperatures, whilst the steam is readily decomposed into hydrogen and oxygen, the latter of which can burn the carbonic oxide.

MISCELLANEA.

WE are informed that about 1000 of the lamps at the forthcoming Indian and Colonial Exhibition are to be supplied from storage batteries of the Electrical Power Storage Company.

FOR many years past the Cockerill Company has been trying to convince the Belgian Government that it can make cannons as well as Krupp; and now at length the Belgian Minister for War has ordered a battery of six campaign guns from the large establishment at Seraing.

A BIG contract is being offered to the brickmakers by the Mersey Railway Company. It is for 100,000 tons of brindle and blue bricks, for the extension of the line from the Birkenhead Tunnel to New Brighton. There is sure to be a good deal of competition for the work between South and North Staffordshire brickmakers, and those of the Midland district. Prices have of late years come down considerably. Blue bricks, which used to be 30s. or 35s. per thousand, are now 20s. or 22s. per thousand. Brindle bricks have fallen to 16s. per thousand.

BURDETT'S "Official Intelligence," of which we have received some proof sheets from the issue of 1886, is a very full account of every security dealt with on the Stock Exchange, and therefore of all the principal engineering works now in operation. It is edited by the secretary of the Share and Loan Department of the Stock Exchange, and has every guarantee of statistic accuracy. The very full statistical and financial particulars given concerning canals and waterways in Great Britain, the London water companies and railway, makes this work useful to engineers.

CONTRARY to expectations, only one set of the engines required for the British war vessels now building has been given to the marine engineers of the Clyde. Messrs. J. and G. Thompson, of Clydebank, are to construct the engines, of 8500-horse power, for the belted cruiser Aurora, now being built in Pembroke Dockyard. The machinery for the armourclads Nile and Trafalgar have been given to London engineering firms, while Messrs. Harland and Wolff, of Belfast, have been ordered to supply the machinery for the vessels of the Scout class, now under construction at Devonport Dockyard.

AT the annual meeting of the London Sanitary Protection Association, it was stated that the number of members is now over 1000, and the total number of inspections made during the year 1264—a large number having been made in the suburbs of London, and several in the country, including that of Eton College and other large public institutions. Unfortunately, the general character of the houses inspected was as insanitary as ever, only 5 per cent. being found in perfect order and 9·5 per cent. in fairly good order, whilst in 60 per cent. foul air was escaping directly into the house, and in 24 per cent. sewage was partly retained underground by leakage or choking of pipes. The report showed a balance in hand of £473.

THE first of the honours connected with the Mersey Tunnel fall to Mr. Charles Douglas Fox, C.E., the principal engineer of the work, her Majesty having conferred a knighthood upon him. His father, Sir Charles Fox, the constructor of the Crystal Palace, was the engineer—assisted by his sons—of the pneumatic railway, which was the first scheme projected for passing beneath the Mersey. That was authorised by an Act of Parliament in 1868; but it was soon after abandoned in favour of the steam railway. Sir Charles Fox withdrew from the undertaking in 1870, when Mr. Charles Douglas Fox took up the work, which was brought to a successful conclusion in January last. Mr. Brunlees was associated with Mr. Fox in the construction of the tunnel.

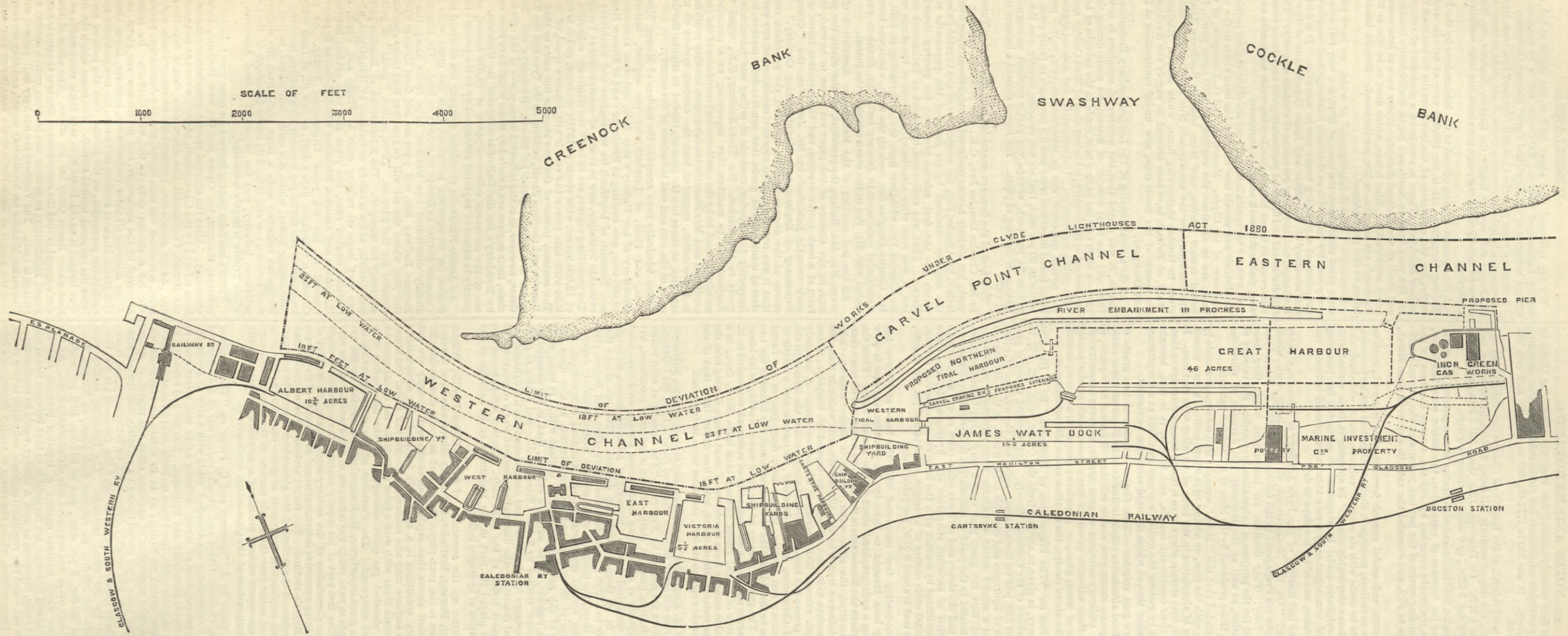
AT the last meeting of the Manchester Association of Engineers, Mr. Ald. Bailey, the president, in the chair, the proceedings, in the absence of the paper set down to be read, took the form of a book review evening, and the president introduced the work recently published by Mr. Jeans on the "Commercial Supremacy of England as a Manufacturing Country." In the course of the discussion which followed, the president remarked that it was not always the superior excellence of any particular class of manufactured goods that commanded a market, but very frequently the superior methods of selling and introducing such goods to the market. Mr. Thos. Ashbury, C.E., urged that if England was to maintain her supremacy as a manufacturing country it must be by the excellence and soundness of the goods she produced, and Mr. Nasmith touching upon another point involved in the question, suggested that the existing system of mineral royalties, at times like the present, tended to cripple the development of the iron and coal industries of the country.

THE Admiralty have accepted the tenders of Messrs. Maudslay, Sons, and Field, of Lambeth, for the engines, boilers, and machinery of her Majesty's ship Nile, first-class armour-clad, of 12,000 tons, now building at Pembroke; and of Messrs. Humphrys and Tennant, of Deptford, for the engines and machinery of the twin-ship Trafalgar, now in course of construction at Portsmouth. The propelling engines are to be of the minimum collective power of 12,000 horses, with steam at 135 lb. pressure, and it is expected that with this power the vessels will attain a speed of 16 knots. The contract power of the new ships is the same as that of the Renown and the Sans Pareil, building on the Tyne and the Thames, which are being engined by Messrs. Humphrys and Tennant. Great, however, as is the indicated horse-power of the new armour-clads, their engines are dwarfed by those which have been supplied by Maudslay's for the Italian armour-clad Re Umberto. These are of the enormous collective power of 19,500 horses, and are greatly in excess of anything attempted up to the present time.

AN Austro-Hungarian petroleum company has obtained the concession for transporting petroleum from the great wells in the Caucasus district to Europe by railway or boat. The company has already distributed two hundred large tanks along the Baku-Batoum Railway line, and pipes are laid from Batoum Station to the pier, where the oil will be run into boat tanks specially constructed for the purpose. Three million "poods" of petroleum are ready for transport. The introduction of Russian petroleum into Austria, which is chiefly undertaken by Hungarians, who work two very large oil refining mills at Fiume and Pesth, besides fourteen smaller ones, has given rise to a conflict between the Hungarian and Austrian Ministries which threatens to prevent the renewal of the ten years' Commercial Treaty. At present Caucasian petroleum pays a duty, as raw oil, of from sixty-eight kreutzers to two florins per hundred kilogrammes, according to its illuminating power, whilst it is really half-refined, so that all the Hungarian refineries make a large profit from the difference in duty between raw and refined oil to the detriment of the Galician petroleum industry, and the import of refined American oil, in which Trieste is largely interested.

VIENNA has been looking forward for some time to seeing its two principal theatres, the Opera and the new Hofburg, lighted by electricity. After the offers of several speculative companies had been refused by the Government, proposals were at last made that the British Continental Gas Association should take the matter up. As the Association possessed the necessary funds and enterprise, a contract was soon signed, and the Association purchased a site for a station close to the new Hofburg. Its plans were approved by the authorities, and permission was given to work. After allowing all these preliminaries, however, Baron Orczy, the Hungarian Minister resident in Vienna, has now suddenly appealed against the permission, on the ground that the back of his offices faces the proposed central station. The house which the Association bought is an old house with very thick stone walls, as is also that where Baron Orczy has his offices. The effect of the Minister's appeal is that the completion of the new theatre is now postponed indefinitely, as nothing can be done until a central electric station is built. The Viennese are not very well pleased with the Hungarian Minister for his dilatory appeal, and they are remarking that the people of Buda-Pesth would take it very ill if influences from Vienna interfered with any much-desired public work of theirs.

GREENOCK HARBOUR—GENERAL PLAN



GREENOCK NEW HARBOUR WORKS.

Among the visits paid by the members of the Iron and Steel Institute during the Glasgow meeting of last autumn, was one to Greenock, where, in spite of a heavy fall of rain, for which it seems that port is noted, they made an inspection, under difficulties it is true, of the new harbour works on the Garvel Park estate. The visitors were received by Mr. Thomas Wilson, secretary and general manager to the Greenock Harbour Trust; Mr. W. R. Kinipple, C.E., chief and consulting engineer to the Trust; Mr. C. W. Methven, M.I.C.E., assistant harbour engineer; Mr. Waddell, principal of the firm of contractors by whom the works have been carried out; Mr. Thomas Prentice, harbour trustee; and several other engineers and contractors.

The Garvel Park Works of the Greenock Harbour Trust were projected as early as 1870. Various schemes were proposed from time to time; but the works have ultimately been carried out in accordance with the accompanying general plan. They present a frontage to the Clyde Estuary of about a mile and a-quarter, and comprise the Western tidal harbour, now named the Garvel Basin; the James Watt Dock; the Garvel Graving Dock; and the Great or Atlantic Harbour, which is to be tidal, for some time to come at least. Of these works, the total water space is 90 acres; the total quay area, about 100 acres; and the length of quays, over three miles. A system of normal-gauge tramways, strong enough for heavy traffic, is laid round the docks, as well as into the shedding and warehouses erected on the south side of the James Watt Dock. These tramways are, as will be seen by the plan, put in communication with the Caledonian Railway, which is in connection with the London and North-Western and also with the Glasgow and South-Western, which has a running agreement with the Midland Railway.

The Western Tidal Harbour, or Garvel Basin, 35ft. deep at high, and 25ft. deep at low water, has 2480ft. of quays, while the entrance to the Estuary of the Clyde is 150ft. wide, so as to render it easily entered by the largest vessels. The walls of the pier head have been founded at 28ft. below low-water mark on hard boulder clay.

What is shown in the plan as the proposed extension of the Garvel Graving Dock is now being carried out, so that the dock will have an entrance at either end. The width is 80ft. and the length at present 635ft.; while the entrance, closed by one of Mr. Kinipple's patent travelling caissons, which will be more particularly referred to below, is 60ft. wide, with a depth on cill at high water of 20ft. The dock, 14¼ acres in extent—named after James Watt, who has left his mark at Greenock in the old graving dock still used—is shut off by Kinipple caissons from both the Western Tidal Harbour and the Great or Atlantic Harbour. It is 2000ft. long, and has a clear width throughout of 300ft. because, at the east end, where occurs the jetty, 800ft. long by 50ft. wide, the total width is 350ft. The depth of water on the cills of the James Watt Dock is 32ft. at high water, and consequently 22ft. at low water, while the width of entrance is 75ft., and the length of quays 6400ft. The annexed sketches show a section of the quay wall, and a sketch of the bollards or mooring pawls, which are of new and convenient form.

The Great or Atlantic Harbour, forty-six acres in extent, now being enclosed by the formation of the river embankment, is 3230ft. long by 600ft. wide. The depth in the centre is now only 22ft. at low water; but it is intended eventually to increase the depth to 28ft. at low, or 38ft. at high water. The materials for the embankment were afforded by the excavation, about 47ft. deep, of the James Watt Dock—a most fortunate circumstance, for otherwise the material excavated must have been conveyed to Loch Long, at a cost of £70,000. It may be said generally that, except the granite facing above low-water mark of the quay walls and docks, all the stone used, whether for rubble masonry or concrete, has been obtained from the excavations, while the bricks have been made of clay obtained in the same manner. The excavation was principally in the sandstone and conglomerates of the carboniferous series, with a little trap dyke, good for filling, and the remainder boulder clay. Of the 1,500,000 cubic yards of excavation, more than a third, or 567,000 cubic yards, were rock. Steam navvies were largely employed in excavating the clay, and steam haulage was adopted wherever possible.

About 150 acres of shore and shallow water have been reclaimed by these works from the Estuary of the Clyde, which originally came up to the line of warehouses above-mentioned. The central portion of the channel, up to the entrance of the new works at Garvel, has been 23ft. deep from time immemorial; and the last Bill, under which the Clyde Lighthouse Trust is working, provides that this depth be maintained; while dredging operations are now going on opposite the old Greenock Harbour, to form a channel 600ft. wide and of 18ft. minimum depth at low water, which it is believed will be preserved by the scour.

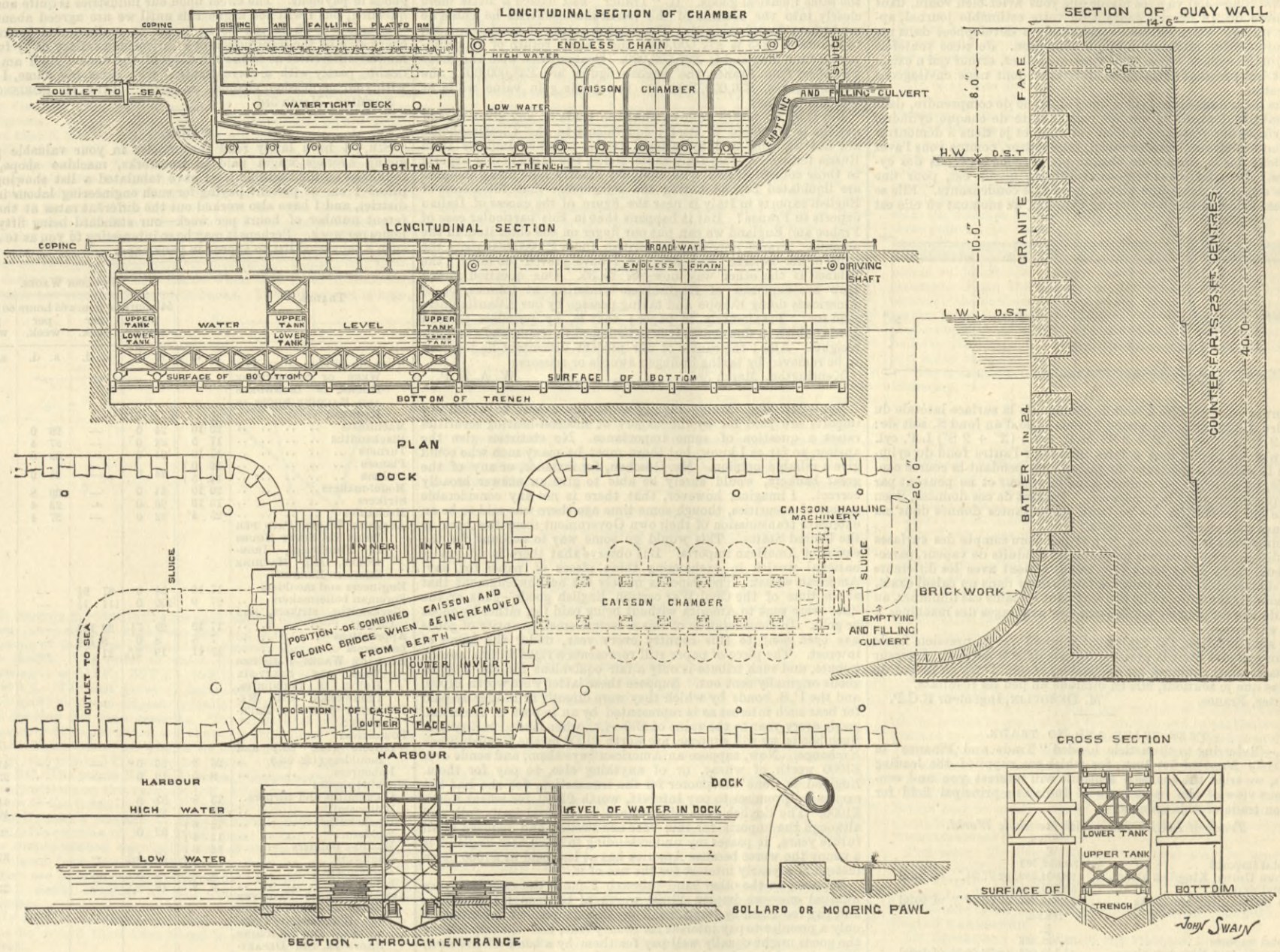
The general contractors are Messrs. John Waddell and Sons, of Edinburgh, who are also contractors to the Metropolitan Board of Works and for the new Putney Bridge; and their resident engineer is Mr. Duncan. Under Messrs. Waddell's contract the works have already cost upwards of £400,000, but it is anticipated that, including the land and the graving dock with extension, the total cost will amount to £800,000, if not, indeed, to a million sterling.

The warehouses extend along the south side, as seen on the plan above, of the James Watt Dock for a length of 1700ft., while the shedding occupies a frontage of 275ft. at the east end. They have been constructed by Messrs. J. and R. Houston, Cartsburn Foundry, Greenock, at a cost of £27,500. Underneath the sheds and warehouses there is a subway for the gas and water pipes, and others for water under pressure for working the hydraulic cranes. The latter are made with luffing jibs for taking goods out of the holds of vessels lying alongside, and delivering them even to the upper floors of the warehouses, over the railway trucks, and without landing them on the quay. Two lines of way run along the centre line of the blocks of warehouses, and two others on either side of them.

The caissons for the James Watt Dock and for the graving dock, constructed in the dock itself by Messrs. Kincaid and Co., Clyde Foundry, Greenock, are on Mr. Kinipple's combined travelling caisson and folding bridge system—shown in the illustrations, page 207—which is intended to save the construction of heavy swing bridges with their costly foundations. The caisson, provided with keels, travels on two lines of rollers at the bottom of the chamber; and the folding bridge at the top of the caisson is supported by a series of levers, having adjustable tail weights, which together form a parallel motion. The raising or lowering of the platform is effected by rollers, fixed on the nose of the platform, working against curved plates in the abutment. Only three minutes are required to open or close the entrance to a dock at any level of water; and the caisson may be drawn into or out of its recess in almost any weather and with a considerable current through the dock entrance, while it may also be floated out of its berth like an ordinary caisson. A water-tight deck is placed about low-water mark, dividing the caisson into two parts, of which the lower is an air-tight chamber of sufficient capacity to reduce to a minimum the weight on the rollers. Above the deck, water is allowed to flow freely in and out through the valves, as the tide rises or falls, so that a nearly uniform weight is maintained on the rollers at any state of the tide. Abrasion of the meeting faces of the caisson and granite

THE JAMES WATT DOCK, GREENOCK—CAISSONS.

(*For description see page* 206.)



cills and stop quoins is prevented by the keels being of tapered form, which insures a clearance of an inch or more between all the meeting faces when the caisson is being hauled into or out of its recess. A subway passes under the western entrance of the dock, so as to afford a passage from one side of the dock to the other when the entrance is open.

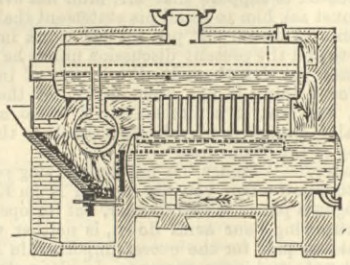
The members of the Iron and Steel Institute also witnessed the working of Mr. Kinipple's travelling and folding bridge, shown in the above longitudinal and transverse section. It affords communication across the entrance—103ft. wide—to the West Harbour, seen in the general plan, but not forming part of the Garvel Park works, and is claimed to be the cheapest moving bridge ever erected of such a span. In this case, a swing bridge would have been most inconvenient, besides costing at least three times the amount and occupying a large space of the quay, which by this arrangement is kept clear of any obstruction. The bridge, 20ft. wide and 32ft. high, weighs 375 tons, of which four-fifths are water. It runs on a roller path constructed of longitudinal and cross beams, with two iron rails about 213ft. long and 17ft. apart between centres, consisting of square bars rivetted to the plates, and screw-bolted down to the bearers. There is a depth of 16ft. of water over them at low, and 26ft. at high water, while the deck or platform is 6ft. above high water when in position. The construction is such that, in the event of an accident, which is not likely to occur, a rail may be replaced by divers. The roller path rests on the heads of heavy piles, which were driven to accurate levels, being just tapped as the desired level was approached. The roller path, previously built complete in the graving dock, was then floated out by means of three barges. The bridge itself was also built complete in the graving dock, floated out, and towed down to its position, when it was sunk on to the rails, being guided into position by the aid of divers as the tide fell. Scrapers are fixed in front of the rollers to clear off any obstacle; and it is found that the bridge will work with a considerable amount of thick mud, the rollers having far less to contend with than those under gates.

The bridge, which is constructed for heavy locomotive traffic, is moved along bodily backwards and forwards by means of endless chains running over sheaves on each side of the recess, 112ft. long by 24ft. wide by 30ft. high, under the quay, where it is received when the entrance is open. The chains are actuated by hydraulic hauling machinery in the nature of a winch, made by Tannett and Walker, of Leeds, the working pressure being about 750 lb. per square inch. The action of the rising and falling platform is exactly like that of a parallel ruler, motion being given to the members by the ends of the platform coming into contact with curved and inclined plates while the bridge continues to travel. As stated above, the weight of the moving bridge is 375 tons; and the effort required to draw it along is 70 tons. The superstructure is formed of three piers, tied together at the bottom by lattice work and at the top by girders. Like the caisson, the bridge can be opened in three minutes at any state of the tide, the handrails folding down with the platform. The total cost of the bridge was £12 000.

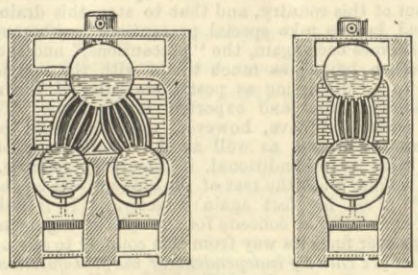
The steamboat quay, about 1000ft. long, has lately been straightened and considerably widened at a cost of about £40,000, the railway connections having been extended along the quay and across the bridge. Drawings are also being prepared for a new and extensive shed on the same quay. Mr. Methven, the assistant harbour engineer, has made an effective bird's-eye view in water colours of the whole works; and it has been skilfully reproduced by chromo-lithography by Messrs. Maclure and Macdonald, of Glasgow.

PREGARDIEN'S BOILER.

THE accompanying sections show two forms of an externally-fired boiler, designed and made by Herr Pregardien, of Deutz, near Cologne. The object of curving the pipes connecting the upper and lower cylindrical shells is to allow play for expansion and



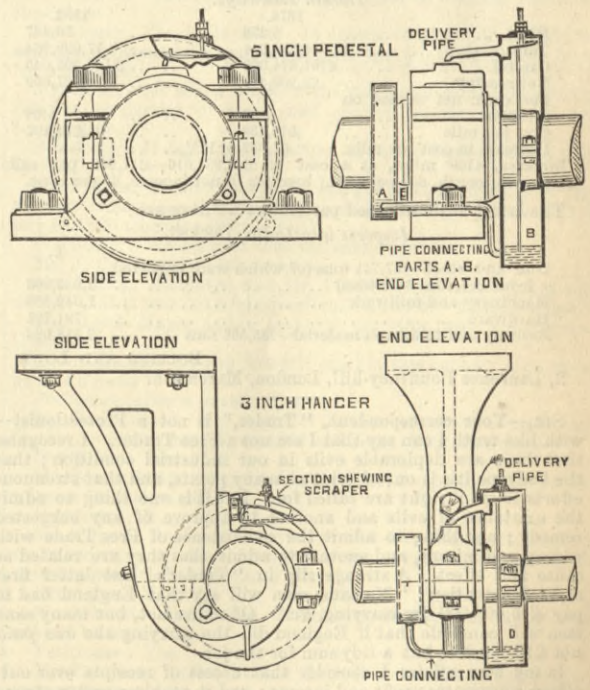
contraction, and also to afford better and more easily made joints by introducing the pipes normally instead of more or less tangentially. The grate, both single and double, is stepped with air spaces between the bars, for burning slack or inferior



fuel. Boilers of this kind have now been in use some years, some of the first having been exhibited at the Düsseldorf Exhibition in 1880, and high claims of economy and accessibility made for them. We are informed that one of these boilers is in use at Messrs. Van Der Zyppen's ironworks, Deutz, where the Brunon process of making railway wheels by hydraulic pressure with closed dies is carried out on a large scale.

LAUDER'S LUBRICATOR.

THE sight-feed lubricator, illustrated by the accompanying engravings, is made by Mr. Lauder, of Seedley-grove, Pendleton, Salford. It consists of a light metallic drum surrounding the shaft to be lubricated. Within this revolves a disc attached to the shaft. This disc revolves in oil in the drum, as seen at B and D, Figs. 1 and 2. Within the upper part of the drum is a small tray, to which is attached a delivery pipe. A scraper is placed near the upper part of the disc—as seen in Fig. 2—and this scrapes oil off the disc as it revolves, and drops it into the small trays, whence it passes to the delivery spout. On the other side of the bearing is an amular case into which the used



oil passes, and is re-conveyed to the main case by a connecting pipe. The lubricator is in use in several places, and as it gives no trouble is favourably spoken of.

STEAM POWER FOR ELECTRIC LIGHTING AT THE COLONIAL AND INDIAN EXHIBITION.—Messrs. Davey, Paxman, and Co., engineers, Colchester, who supplied the whole of the steam power for driving the electric light machinery at the last three exhibitions at Kensington, have been retained for the same purpose for the whole of the indoor lighting at the approaching Colonial and Indian Exhibition. The steam power required amounts to 1200 indicated horses, and will be supplied by nine sets of engines comprising six types, namely, one compound semi-fixed engine whose boiler has 670 square feet of heating surface, and working at a pressure of 120 lb. per square inch; two sets of compound horizontal engines, three sets of vertical compound high-speed engines, all of different sizes; one compound horizontal girder engine; two pairs horizontal simple engines. The steam will be supplied to the semi-fixed engine by its own boiler, while that for the other eight will be generated in five boilers at 120 lb. pressure for the compound engines, and in six boilers at 90 lb. pressure for the simple types. Twelve boilers in all. Although 1200 is the power estimated for, the engines and boilers supplied will, without any difficulty, give considerably more than this. There is every reason to feel confident that the eminent success of the machinery at the last three exhibitions will characterise it this summer.

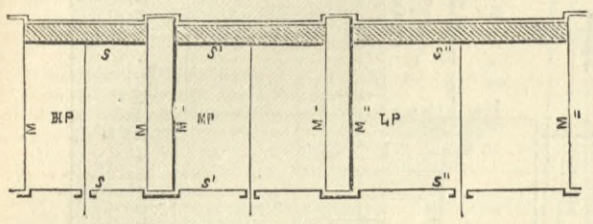
LETTERS TO THE EDITOR.

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

TRIPLE EXPANSION ENGINES.

Monsieur,—J'ai vu avec plaisir que vous aviez bien voulu, dans le numéro du 19 Février courant de votre estimable journal, apporter quelqu' attention aux considérations developpées dans ma brochure sur les machines à triple expansion. Je tiens toutefois à me justifier d'une erreur dont vous m'accusez, erreur qui n'existe pas, et qui provient de la façon différente dont nous envisageons la question.

Vous dites dans votre article que j'ai oublié de comprendre, dans mes calculs donnant la surface condensante de chaque cylindre, les surfaces des pistons. Il n'en est rien, et je tiens á démontrer que l'on ne doit pas, dans ce calcul, faire entrer, comme vous l'avez fait, deux fois la surface de chaque piston, plus les fonds des cylindres. En effet, nous voulons rechercher quelle est, pour une course complète de chaque piston, la surface condensante. Elle se compose évidemment pour chaque cylindre, au moment où elle est



maximum—c'est à dire à bout de course—de la surface latérale du cylindre Σ, plus celle du piston S, plus celle d'un fond S, soit de: $(\Sigma + 2\,S)$ H.P. cyl.; $(\Sigma' + 2\,S')$ M.P. cyl.; $(\Sigma'' + 2\,S'')$ L.P. cyl. Nous n'avons pas du tout à faire intervenir l'autre fond du cylindre ni la surface supérieure du piston, qui, pendant la course considerée, ne sont pas en contact avec la vapeur et ne peuvent par conséquent agir pour la condenser. Partant de ces données, il en résulte que les chiffres des surfaces condensantes donnés dans ma brochure sont absolument corrects.

Comme vous le remarquez, je n'ai pas tenu compte des surfaces refroidissantes que peuvent présenter les conduits de vapeur, parceque leur longueur et leurs dimensions varient avec les différents types de machine, on ne peut les faire entrer dans un calcul exact. Je reconnais toutefois qu'ils peuvent dans certains cas diminuer, au point de vue du pouvoir condensant, les avantages des machines à triple expansion.

Par simplification, j'ai également supposé que la pression finale dans un cylindre était la pression initiale dans le suivant. L'erreur volontaire ainsi commise est négligable, et loin d'être en faveur de la thèse que je soutiens, elle en diminue un peu les résultats.

Nantes, France. M. Demoulin, Ingénieur E.C.P.

FREE TRADE AND NO TRADE.

Sir,—Referring to the article headed "Trade and Finance" in the *Daily News* of 1st inst., for which we supplied the leading figures, we trust the enclosed schedule will interest you and confirm our view of the importance of India as a principal field for the iron trade of this country:—

Trade of British India with the whole World.

	1873-4. £.	1882-3. £.
Total imports	39,612,362	65,548,868
From United Kingdom alone	28,904,389, or 77·24 % of total	45,149,633, or 72 55 % of total
Total exports	56,910,081	84,527,182
To United Kingdom alone	28,832,281, or 50·73 % of total	35,620,484, or 42·21 % of total

During the decade 1873-83 the foreign trade of Bombay increased by 57 per cent., while in the same period that of Karachi increased by 89 per cent.

Indian Railways.

	1874.	1883.
Miles	6,278	10,447
Tons carried	4,696,624	17,089,264
Capital	£101,324,000	£148,305,646
Net receipts	£3,969,439	£8,427,609
Per cent. net earned on capital	3·92	5·68
Cost per mile	£16,139	£14,197
Decrease in cost per mile.	£1,942, or 12 %	—

Increase, 4169 miles, at a cost of £46,981,646—£11,269 per mile; increase in length, 66½ per cent.; increase in net income, 31 per cent.

The latest authenticated particulars we have are:—

Imports into India, 1882-83.

	£.
Iron and steel—167,741 tons (of which were imported from Belgium 3553 tons)	2,033,906
Machinery and millwork	1,342,398
Hardware	791,791
Railway and telegraph material—935,566 tons	2,118,086

Bolling and Lowe.

2, Laurence Pountney-hill, London, March 4th.

Sir,—Your correspondent, "Trader," is not a Protectionist—with like truth I can say that I am not a Free Trader. I recognise that there are deplorable evils in our industrial condition; that the body politic is out of joint at many points, and that strenuous efforts to set it right are called for. But it is one thing to admit the existence of evils and another to approve of any suggested remedy; one thing to admit the co-existence of Free Trade with widespread misery, and another to admit that they are related as cause and effect. A strange slip in "Trader's" last letter first attracts attention: "No sane man will say that England had to pay £45,000,000 for carrying, &c." Of course not, but many sane men will conclude that if England did the carrying she *was paid* not £45,000,000, but a tidy sum for the job.

In my own affairs I consider that excess of receipts over outgoings constitutes profit and income; and it requires pretty strong proof to believe that it is the exact opposite with a nation. But let us examine the figures. In ten years, 1874-83, British imports exceeded exports by £1,105,000,000; and besides, we imported more bullion than we exported by £13,000,000; total, £1,118,000,000. Does Mr. Muir think that in, say, the last fifteen years, we have sent abroad securities equal in amount to the whole capital of our railway system and the whole national debt? Or does "Trader" suppose we sent abroad "gold in the larger sense of money," whatever that sense may be, to any such amount? And further, it must be remembered that the process has, on the same showing, been going on for the whole of the current century. Again, sending capital abroad is the exact contrary of sending interest-bearing securities abroad. "Trader" seems to confuse the two operations.

Returning to the figures: According to the latest available returns, the total of the imports of all the countries in Europe is valued at 1277 million pounds; the exports, at 1036; showing what "Trader" calls an adverse balance of £241,000,000. Looking more into detail, the three countries selected by "Trader" are little better off than ourselves, with a collective deficiency of some £85,000,000. Germany does better with over £2,000,000 excess of exports, though her satisfaction must be alloyed by finding that the excess is made up by exports of bullion; other commodities balancing within £500,000. Russia and Austria are better off (?), but it is not till we come to Montenegro that we find the real thing—exports ten times the value of imports! What a blessed country! European exports, we have seen, are £241,000,000 to the bad. Africa slightly increases this total. But the rest of the world, the new countries, the colonies, and dependencies, to some extent redress the balance, which remains for the whole world £115,000,000. A most impossible result.

The plain meaning of it is, that when the whole world is taken into account the two sets of figures are two different valuations of the same identical goods. If "Trader" had looked a little more closely into the returns of the particular countries he chose he might have found this out. The English return of goods exported to France in 1883 is £17,600,000; the French return of goods imported from England is £27,600,000. Contrariwise with the goods we import from France, the English figures are £38,000,000; the French figures, £36,000,000. Do the goods gain value while at sea, Mr. Trader?

But it by no means follows that the trade of any given pair of nations is complete in itself; equivalents to the Clearing-house are not wanting to international trade. France imports from Russia ten times, from Italy three times, the value of her exports to those countries, and who shall say exactly how these amounts are liquidated beyond noting the coincidence that the excess of English exports to Italy is near the figure of the excess of Italian exports to France? But it happens that in this particular case of France and England we can put our finger on one chief item in the account. France imports from British India £9,000,000 above the value of her exports. But, dear me, I have proved too much; the balance is the other way now—37 to 36. One question more: How are expenses of Englishmen wintering at Cannes, or of Americans doing Europe and taking passage by our Atlantic liners paid for? Proximately in paper; that is, by promises to send goods, which in due course it is to be hoped do come and swell our freights. Alas! the causes of our present discontent lie too deep to be removed by taxing Solingen swords or scissors.

Kensington, March 3rd. W. A. S. P.

Sir,—Mr. Wm. Muir's inquiry as to the extent to which our imports are paid for by the export of interest-bearing securities raises a question of some importance. No statistics give the answer, so far as I know, but there must be many men who could give a reliable opinion. Mr. Goschen, for instance, or any of the great bankers, would surely be able to give an answer broadly correct. I imagine, however, that there is *not* any considerable export of securities, though some time ago there was said to be an extensive transmission of their own Government securities back to the United States. This would go some way to account for the excess of American imports. But observe that there is no loss of national wealth in exchanging these pieces of paper for, say, American wheat. The paper is merely the acknowledgment that at the time of the Civil War certain English goods—guns or the like—were sent to America without being paid for, either by goods or gold. In consideration of this a certain small quantity of goods has been sent to this country every year, under the name of interest. The piece of paper still represents a right to this annual tribute, and such tribute is only a fair equivalent for the English goods originally sent out. Suppose these latter were worth £1000, and the U.S. bonds by which they were directly or indirectly paid for bear such interest as is represented by an import of American goods every year to the value of £50—*i.e.*, when landed in England. Such bonds, we will suppose, are worth £1000 on the English Stock Exchange. Now, suppose an American buys them, and sends over £1000 worth of wheat, or of anything else, to pay for them. England is none the poorer for the transaction, for she has but exchanged promises to pay interest, worth £1000, for wheat worth £1000. The English guns of 1862 are at last paid for in full, and although the imports for this year are swelled and reduced in all future years, it passes my understanding to learn how England is a penny the worse because America has at last paid us £1000 down instead of a yearly interest for the use of it.

Suppose, on the other hand—though I fancy the case is a very unusual one—we import £1000 worth of German manufactures and pay for them by English railway debentures. A debenture is only a promise to pay interest for money lent, and the importer of the goods might equally well pay for them by a bond of his own, drawn up *ad hoc*, though, as a matter of convenience, he buys and sends away someone else's bond instead of his own. The interest is but fair equivalent for the goods which represent a sum down. The German has obligingly invested capital in England to the extent of £1000; in fact, he has lent us money in the form of goods, the price realised for which, in England, will be at once invested by us, after our manner, in appliances for making more goods than are wanted. Year after year our exports will be swelled by the goods we send away as interest for the loan, and "Trader" will be happy, though it is possible that after a time he will get slightly wiser, and exchanging a very large fallacy for a rather smaller one, will begin to grumble that we are sending goods out of the country without getting anything in exchange.

I have no reason to suppose that Mr. Muir has overlooked these facts, but I must ask him to recall his statement that "M. H. R.'s demonstration that we do not pay for our excess imports in gold will do little to end the present discussion unless he can also show that we do not pay for them by the export of interest-bearing securities," for I think it has been shown, not that we make no such exports, but that it is immaterial if we do, and that their existence, real or supposed, need be no obstacle to the much-to-be-desired ending of the discussion.

As to "Trader." "Trader" is not an edifying person to argue with. Not to know when you are beaten is an English quality most becoming in a patriotic Fair-Trader, but to open fire on your enemy after throwing your arms down, is neither war nor logic. "Trader" said we paid for the excess imports "in English gold." I said we did not, and gave reasons. In alternate sentences he accepted the refutation, and went hammering on at his arguments. This time—Feb. 26th—he begins by denying that he ever said that "huge sums of English gold go out of this country and never return to it." Of the ingenuousness of this denial your readers can judge. Then—next sentence—"I do say that gold is very often drained out of this country, and that to stop this drain the Bank of England has to take special precautions"—whereupon I may add, it all comes back again, the "precautions," and the "drain," and the return, having as much to do with the question we are supposed to be discussing as postal statistics of the number of love letters imported and exported might have. Then—next sentence again—"I have, however, used the word gold in the larger sense of money, as well as the smaller one of precious metal." Here is unconditional, if dignified, collapse, and one begins to wonder what the rest of the column will be about. But "Trader" is on his feet again directly. "If it will simplify matters I am willing to concede for the sake of argument that not a sovereign ever finds its way from this country to any other. *My propositions are entirely independent of the gold question.*" Why, they were based upon it. "Trader" really seems unable to separate his own arguments, for his letter ends with the sentence, "I have waived the gold question, in deference to your correspondent's wishes. Will he, in return, confine his attentions to explaining what is the meaning of the statement that £33,000,000 worth of goods exported sufficed to buy £78,000,000 worth of goods imported?"

"Trader" has just before argued at length that no allowance for freight or profit taken off the value of the imports can make a balance between such figures as these, and it is difficult to believe that he does not still suppose us to pay in some way for the difference. In spite of the express disclaimer, his gold-ghost is *not* laid, or even "waived." He evidently attaches no importance to the explanation that the difference is the tribute we receive in the shape of interest upon investments abroad—that is, rent for the use of English goods long since sent abroad without payment. If he did he would surely allude to it here. The explanation that some of it may be the payment of old debts—goods sent to redeem old promises to pay interest—is not likely to impress him more strongly. Neither, I suppose, will it avail to tell him that he must take the total imports and exports, not those from and to particular countries, because in the course of international exchange many transactions with one country may be balanced by transactions with another owing to dealings between the two. Surely "Trader" means to ask, not what is the "meaning" of an excess of imports, but what is its effect upon our industrial population. The *meaning* is plain enough. Other countries owe us, and send goods in payment. The effect upon our industries is quite another question, but I will not argue this until we are agreed about the "meaning." There can be no profit in a discussion broken at every step by the resurrection of a thrice-slain fallacy or by fundamental differences as to the meaning of the facts. As I am now dealing partly with a correspondent who signs his name, I will, with your permission, abandon initials. Mark H. Robinson.

Surbiton, March 3rd.

WAGES.

Sir,—I have lately read the articles in your valuable paper giving average wages paid in ironworks, machine shops, and foundries on the Continent. I have tabulated a list showing the prices I am at present paying for such engineering labour in this district, and I have also worked out the different rates at the different number of hours per week—our standard being fifty-four hours per week. Perhaps it may be so interesting to you as to allow such a tabulated list to appear in your paper.

Trades.	English Wages. 54 hours per week.	60 hours per week.	63 hours per week.	66 hours per week.
	s. d.	s. d.	s. d.	s. d.
Average Wages Paid per Week of Sixty-three Hours in Ironworks and Machine Shops in Barmen:				
Machinists	20 10	24 0	28 0	—
Blacksmiths	17 5	32 0	37 4	—
Turners	17 10	34 0	39 8	—
Planers	16 0	24 0	28 0	—
Drillers	14 5			
Model-makers	20 10	34 0	39 8	—
Strikers	15 10	20 0	23 4	—
Mechanics	25 4	32 0	37 4	—
Average Wages Paid per Week of Sixty Hours in Foundries, Ironworks, and Machine Shops in Bremen:				
Engineers and moulders	17 10	34 0	37 9⅓	—
Foreman boilermakers	27 9	100 0	111 1⅓	—
Blacksmiths, strikers, and turners	17 10	29 7⅓	32 10⅔	—
Apprentices	7 4	8 0	8 10⅔	—
Labourers	13 11	19 2 4/10	21 4	—
Average Wages Paid per Week of Sixty-six Hours in Foundries, Ironworks, and Machine Shops in Thuringia:				
Foundries:				
Casters (14s. 2d.) and moulders (12s. 6d.)	26 8	35 0	—	42 9⅓
Labourers	9 5	19 0	—	23 2⅔
Machine shops:				
Locksmiths and turners	13 8	34 0	—	41 6⅔
Boiler-smiths	13 2	33 3	—	40 7⅓
Blacksmiths	12 6	32 0	—	39 1⅓
Welders	12 4			
Machine builders	12 6	30 4 8/10	—	37 1 9/10
Engineers	15 5			
Apprentices	8 3	8 0	—	9 9⅓
Labourers	9 2	19 2 4/10	—	23 5 9/10
Average Wages Paid per Week of Sixty Hours in Foundries, Ironworks, and Machine Shops in the Department of the Gironde, Marseilles, and Rouen:				
Department of Gironde:				
Boilermakers	22 6	25 5 1/10	28 3	—
Blacksmiths	23 7	32 0	35 6⅔	—
Foremen (machine shops)	67 7	70 0	77 9⅓	—
Foremen (foundries and ironworks)	42 7	45 0	50 0	—
Moulders	21 4	35 0	38 10⅔	—
Pattern-makers	26 9	34 0	37 9⅓	—
Strikers	29 0	20 0	22 2⅔	—
Labourers	14 5	19 2 4/10	21 4	—
Marseilles—Foundries:				
Moulders	31 4	35 0	38 10⅔	—
Labourers	14 6	19 0	21 1⅓	—
Boys	4 0	8 0	8 10⅔	—
Machine shops:				
Blacksmiths	20 3	32 0	35 6⅔	—
Fitters	21 2	30 4 8/10	33 8⅔	—
Boilermakers	19 4	25 5 1/10	28 3	—
Rouen:				
Blacksmiths	25 0	32 0	35 6⅔	—
Strikers	20 10	20 0	22 2⅔	—
Millwrights	37 6	32 0	35 6⅔	—
Average Wages Paid per Week of Sixty Hours in Foundries, Ironworks, and Machine Shops in the District of Brussels:				
Blacksmiths	24 2	32 0	35 6⅔	—
Strikers	14 6	20 0	22 2⅔	—
Turners	24 2	34 0	37 9⅓	—
Boilermakers	20 1	25 5 1/10	28 3	—
Model makers	24 2	34 0	37 9⅓	—
Moulders	19 4	35 0	38 10⅔	—
Antwerp:				
Platers	26 6	36 0	40 0	—
Rivetters	21 6	32 0	35 6⅔	—
Average Wages per Week or Sixty-six Hours in Foundries, Ironworks, and Machine Shops in Amsterdam:				
Turner's shop	20 0	34 0	—	41 6⅔
Blacksmiths' shop	22 11	32 0	—	39 1⅓
Boilermakers' shop	22 9	25 5 1/10	—	31 0 1/10
Labourers in yard	15 0	19 2 4/10	—	23 5 9/10
Average Wages per Week of Sixty-three Hours in a Leading Zurich Machine Factory				
Founders	24 3	24 9	—	28 10½ —
Turners	24 3	34 0	—	39 8 —
Moulders	19 3	35 0	—	40 10 —
Smiths	24 3	32 0	—	37 4 —
Strikers	17 0	20 0	—	23 4 —
Boilermakers	21 9	25 5 1/10	—	29 8 —
In Foundries, Ironworks, and Machine Shops in St. Gall:				
Smiths	16 6	32 0	—	37 4 —
Turners	19 3	34 0	—	39 8 —
Founders	22 0	24 9	—	28 10½ —

Geo. Heaton-Daglish,
Mem. Inst. C.E. and M.E.

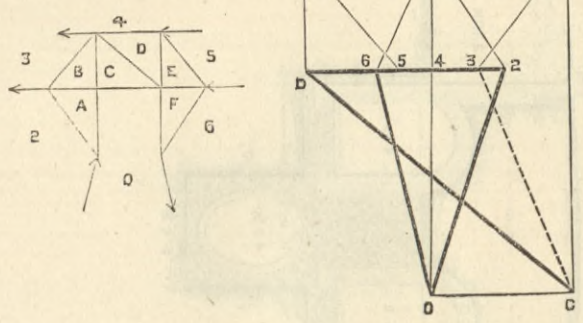
St. Helens, Lancashire, March 2nd.

AMERICAN BRIDGES.

Sir,—I am not specially concerned to defend Professor Waddell. His attack on European bridge building, as compared with American, can only make those smile who know that nearly all the calculations for American bridges are made by imported German "Teckniker." But if his attack is considered of enough importance to need a reply, it would surely be well to select for

the defence of English engineering a man who at least knows how to draw a stress diagram, and also knows the distinction between + and −. The *naiveté* of "R. H. G.'s" constructions in graphics is now well understood by the British public, and we all enjoy them heartily as good jokes; but your paper is read extensively on the other side of the water, and this article of last week may be taken seriously by some American engineers who do not know Mr. Graham as we do, and it may thus bring discredit on us.

In Fig. 2 Professor Waddell assumes that the tie rod J H is so constructed as to be incapable of resisting any thrust of a magnitude worth taking into account in the calculation. He also assumes that there are no bending moments at the bases of the columns. On these assumptions his solution of the problem is strictly correct. Mr. Graham attempts to disprove it by one of his fancy stress diagrams. He proceeds to draw a diagram based on the assumption that K is a pin joint at which are jointed not only J K and G K, but also F K and B K as separate links. That is, he overlooks the fact that F K H is a beam, which reacts at the joint K against the force P^1, altering by the amount of this reaction the resultant of the forces along J K and G K, and also transmitting some of the wind force P^1 to the joint H. Mr. Graham's structure in which F K H is not a beam but two separate links pinned together at K would, I fear, have just as little stability as his wonderful theories of graphic construction. The true graphic solution of this problem may be interesting, because the method of dealing graphically with beams when they occur in beam structures is not commonly shown in books. I therefore give it here.



It consists in substituting for each beam a triangulated pin joint frame, such as E F on the one side and A B on the other. The drawing of the stress diagram then becomes easy. It is shown in the sketch. The order in which the joints have been taken in drawing it is 6 O F; 5 6 F E; 4 5 E D; D E F O C D; 3 4 D C B 3; 2 3 B A 2. The last point A determined should lie on the line through O in stress diagram parallel to O A in frame diagram if the drawing has been accurate. The stress lines belonging to the imaginary triangles added are shown in light lines. Those of the actual beam frame are shown in heavy lines. To complete the latter, the points 3 C have to be joined. This is the resultant of 3 B, B C. The points E F A B in stress diagram are only imaginary, their positions on the verticals D E, 4 F and C B depending on the shapes of the triangles E F A B imagined added.

Mr. Graham's mistake in his attempted disproof of Professor Waddell's solution of Fig. 4 is still more wonderfully elementary. His simple-minded unconsciousness of the fact that the moments calculated from the applied forces on the two opposite sides of a section are of opposite signs will amuse Professor Waddell so much that I doubt whether he will even lose his temper over the criticism.

Mr. R. H. G. should have written $-(V s - \frac{1}{2} P d) = V(b-s) - \frac{1}{2} P d$. This he would then have found to reduce to $P d = V b$, which is correct.

ROBERT H. SMITH.

Mason College, Birmingham, March 8th.

PILE DRIVING.

SIR,—In answer to Mr. Donaldson's letter in your issue of February 26th, I should like to put before him a few expressions showing my method of calculation with reference to the strains in piles, and apply them to one or two of his numerical questions. My former letter was not a treatise on pile driving, but a reply to a so-called "problem" of his, to show the absurdity of the suggestions contained in it, and that there was really no problem. I hope by this time Mr. Donaldson has been able to grasp my sentence, which he calls "unintelligible." Let W = weight of monkey, h = height of fall, A = sectional area of pile, E = its modulus of elasticity, P = maximum pressure between monkey and pile, L = length of pile. The greatest value of P will occur when the resistance of ground is so great that there is no advance of the pile, in which case

$$W \times h = \frac{P^2 \times L}{2 \times E \times A} \quad . \quad . \quad . \quad . \quad . \quad (1)$$

all the quantities being taken for the same units of weight and size.

Applying this equation to Mr. Donaldson's numerical questions:—

(*a*)	W = 2	h = 4	A = 1	L = 16
(*b*)	W = 1	h = 16	A = 1	L = 16
(*c*)	W = ½	h = 4		
(*d*)	W = ¼	h = 16		

we have from above equation

$$P = \sqrt{\frac{2 W h E A}{L}},$$

which gives, taking E = 72,000,

(*a*) P = 268 tons; (*b*) P = 380 tons; (*c*) $P = 536 \sqrt{\frac{A}{L}}$;

(*d*) $P = 760 \sqrt{\frac{A}{L}}$,

which answers the questions, showing that in (*a*) and (*b*) the piles could not bear the strain, and that (*c*) would be less severe to a pile than (*d*).

From the above I hope Mr. Donaldson can see that the circumstances are limited, not by the momentum of the monkey which varies with $W \times \sqrt{h}$, but are limited by the product $W \times h$.

When a pile is driven a distance d by the blow, we have approximately

$$W \times h = \frac{F^2 \times L}{2 \times E \times A} + F \times d \quad . \quad . \quad . \quad (2)$$

taking F = resistance of the ground during the advance. This equation gives

$$F = \sqrt{\frac{2 W L E A}{L} + \frac{E^2 A^2 d^2}{L^2}} - \frac{E A d}{L}$$

During the advance of the pile it will accelerate, reach a maximum velocity, and finally be arrested, F being less than P calculated from (1). And in reality the resistance of the ground will be somewhat less than F_1 in equation (2), and the maximum pressure between monkey and pile somewhat greater than F. Hence I have called equation (2) approximate.

In answer to another question, I may say that in writing $m v = W \sqrt{\frac{2 H}{g}}$ (which equation is quite true) we do not equate a momentum with a weight.

SCRUTATOR.

March 8th.

GOOD AND BAD WORK.

SIR,—In your this week's issue I read with great interest the continuation of discussion on good and bad work. I wish to correct some reflections of "Fair Play" on my remarks.

(1) The price of good work: I referred to machine work, and feel convinced I am right. By working with a proper system of cutters, the finishing cutter always coming in for first or second cutter, interchangeable work, such as described by your correspondent "Fuse," is easily and readily turned out at cheaper prices than any work which your correspondent "G. B." so justly condemns. In fact, his letter so thoroughly rehearses my past experience that I think he must have had the same difficulty as I in putting down the use of the inevitable file and the hammer to bring things into shape.

Another point on which "Fair Play" misunderstands me is the remuneration to foremen. I did not wish to imply that a young man should be satisfied with his position, but that salary should be no object to his employers. I pay my foreman and assistant-foreman very high wages, comparing the hours which they work.

A point raised by "Fair Play" is the piece-work basis for turning out work. This accounts for a lot of bad work. Whatever price is set down, the men will always wish to have more money. Some may be behind with petty obligations, family troubles, &c., and will strive their utmost to make it up by higher weekly receipts through piece-work. The work must suffer in consequence. Viewing is all very well, but good viewers are scarce, and a conscientious piece-work viewer would have many a difficult and cruel task at the end of a week. My belief is that if the viewers of some of the piece-work factories that I have seen were to do their duty, there would be an end of paying wages for that week. Your article on "Work and Wages" touches up a good many points in connection with good and bad work. I would advise Mr. Swift and his society to provide their members gratis with a set of rules or gauges, divided to decimals of an inch. The men would then have a much better chance of showing what they could do. Some men engaged in my factory to do work, &c., where thousandths of an inch were in consideration had common blacksmiths' rules, some 2ft. long, and to cure this evil I provide henceforth every man with a rule or gauge of latest pattern.

I have just completed my catalogue, and send you one thinking it may interest you. It was in the press when your article on "Catalogues"—which was quite correct—appeared. However, I think you will find I come very close to your description.

A WORKER.

Aston, March 8th.

THE WATT AND THE JOULE PRACTICAL ELECTRIC UNITS.

SIR,—Allow me to correct an error of terminology in the valuable article on "Testing the Commercial Efficiency of Dynamo Machines," in your last issue.

Mr. Kapp says, since the unit of current is 10 ampères, and the unit of electro-motive force 10^{-8} volts, and since the product of the two must be equal to the erg, we find that one watt equals 10^7 ergs. Now the product of 10 ampères into 10^{-8} volt is correctly $\frac{1 \text{ erg}}{\text{time in seconds}}$, or one absolute electro-magnetic unit of power on the C G S system—a unit which has not received a name. The volt-ampère or watt, which is the practical electric unit of power, or $\frac{\text{work}}{\text{time}}$ is therefore $\frac{10^7 \text{ ergs}}{\text{time in seconds.}}$ It is the volt-ampère second, or joule, *i.e.* the practical electric unit of work, which is equal to 10^7 ergs.

Electrical work is very commonly expressed in watt-hours, and thus the joule or $\frac{\text{watt hour}}{3600}$ is a unit not often used. The distinction between power and work is so often lost sight of that the present correction may be of value to some of your electrical readers.

DESMOND G. FITZ-GERALD.

Brixton, March 9th.

TESTING THE COMMERCIAL EFFICIENCY OF DYNAMO MACHINES.

SIR,—In Mr. Kapp's description of the tests carried out at Messrs. Mather and Platt's works on the two Edison-Hopkinson dynamos, which appeared in THE ENGINEER of last Friday, he gives at page 195, second column, the E.M.F. of Latimer Clark's cell as 1·453 volts. Now, in the report issued by Messrs. Mather and Platt it is stated that Lord Rayleigh's determination of the ohm and of the volt have been taken and not the B.A. units, consequently if he accepted their resistances of the armature and field-magnets, &c., as stated in legal or in true ohms, the E.M.F. of the Clark cell used in connection with the experiments would of necessity also require to be reckoned in legal or in true volts, or about 1·12 per cent. less, say 1·441 legal volts. See Lord Rayleigh's latest communication to the Royal Society, January 21st, 1886, wherein he gives the E.M.F. of a standard Clark cell as being on August, 1885 = 1·4537 B.A. volts.

ANDREW JAMIESON,
Principal.

College of Science and Arts,
Glasgow, March 8th.

GOOD AND BAD CHAINS.

SIR,—I should be glad if any of your readers would say to what extent small chains are weakened by galvanising in the first instance. Also to what extent when re-galvanised year after year.

K.

March 10th.

PHYSICAL SOCIETY.

At the meeting of the Physical Society, held on February 27th, the following communications were read:—"The Relations of Pressure, Temperature, and Volume in Saturated Vapours," by Profesor W. C. Unwin. In the first part of this paper certain formulæ given by Messrs. Ramsay and Young, in a recent communication on "Some Thermodynamical Relations," are criticised. The most important of these is the statement that for different saturated vapours at the same pressure $t \frac{dp}{dt}$ is constant. Professor Unwin finds, however, that $t \frac{dp}{dt}$ is less constant than $t^2 \frac{dp}{dt}$, while $\frac{t^2}{p} \frac{dp}{dt}$ is nearly a constant quantity for one, and has a nearly constant ratio for different saturated vapours. This result suggested that $\frac{t^{n+1}}{p} \frac{dp}{dt}$ might be more nearly constant, and the integration of this gives

$$\log. p = a - \frac{b}{t^n}$$

a formula to the examination of which the second part of the paper is devoted. From it may be derived the following relations, in which for convenience in calculation the logarithms given are to the base 10:—

$$t = \left(\frac{b}{a - \log. p}\right)^{\frac{1}{n}}$$

$$\frac{1}{P} \cdot \frac{dp}{dt} = 2{\cdot}3025 \frac{n b}{t^{n+1}}$$

$$= 2{\cdot}3025\, n \frac{(a - \log. p)}{b^{\frac{1}{n}}} \frac{n+1}{n}$$

$$\frac{t}{p} \cdot \frac{dp}{dt} = 2{\cdot}3025 \frac{n b}{t^n}, \text{ &c.}$$

These formulæ have been examined in the case of steam from −30 deg. to 230 deg. C., and with pressures varying from ·4 to 20,000 millimetres. The constants were found to be

$$a = 7{\cdot}5030; b = 7579; n = 1{\cdot}25,$$

and the differences between the calculated results and the observations of Regnault and Zeuner rarely exceeded 1 per cent., while generally much smaller. a, b, and n have also been found for some other substances, with the following results:—

Alcohol	$a = 7{\cdot}448$	$b = 8784$	$n = 1{\cdot}29$.
Ether...	$a = 6{\cdot}9968$	$b = 3047$	$n = 1{\cdot}153$.
Mercury	$a = 9{\cdot}8651$	$b = 597{\cdot}5$	$n = {\cdot}69$.
Carbonic acid ...	$a = 8{\cdot}4625$	$b = 302{\cdot}8$	$n = {\cdot}77$.

Professor Perry offered some criticisms upon this paper, and believed that for practical purposes the expressions given would not be found superior to Rankine's formula:—

$$\text{Log. } p = a - \frac{b}{t} - \frac{c}{t^2}$$

which gives p in terms of t, and a quadratic expression for obtaining t in terms of p. He also observed that the chief aim of Ramsay and Young's paper was to obtain relations between the pressure and temperature of different saturated vapours, so that the connection between temperature and pressure having been observed and recorded for one vapour, that for any other vapour could be at once deduced from it.

"On a Map of the World in which the Proportion of Areas is Preserved," by Mr. Walter Baily. The author had devised a method for constructing such a map, but has subsequently found that one precisely similar was employed by Flamsteed in 1729 for charting the stars in his "Atlas Celestis." The construction applied to the earth is briefly as follows:—Draw a straight line to represent the meridian that is to occupy the centre of the map. Divide this line into equal parts, representing upon a convenient scale the distance between the parallels of latitude, and through these points draw a series of lines at right angles to the original line. These are the parallels of latitude. Mark off on these the actual distances at which the meridians cut them; through the points so found the meridians may be filled in and the map constructed. From the method of construction it is evident that, although the outlines in the map are distorted, the amount of distortion increasing with the distance from the central meridian, the proportionality of areas is preserved—a fact which the author believes will render the map useful for recording rainfall, depth of sea, ocean currents, &c.

"On a Delicate Calorimetric Thermometer," by Professor S. U. Pickering.

TOWER BRIDGE—BRITISH OR FOREIGN IRON.

A CURIOUS discussion took place at the Court of Common Council on Thursday week. We find a report of the discussion in the *City Press*, and reproduce it here. We do not hesitate to confess that in this matter our sympathies are with the petitioner. It is to be regretted, however, that he did not possess sufficient information to enable him to speak with authority.

The Town Clerk read a petition of citizens and inhabitant ratepayers of the City of London, praying that the new Tower Bridge may be constructed of iron produced and manufactured in Great Britain, as it would greatly benefit the iron trade of the country, now in a very low condition. The Town Clerk said the petition was signed by about four thousand people and firms. Six petitioners attended at the bar of the Court.

Mr. Deputy Fry asked whether the petitioners attended there in their individual capacity as ratepayers and citizens of London, or as representatives of any constituted authority.

A Petitioner: As representing the ratepayers.

Mr. Deputy Fry: In what way?

Petitioner: We believe that this matter will be for the benefit of the people in general and the unemployed in particular, and we venture to ask the Court to give the work to a British manufacturer.

Mr. Deputy Fry: That is not answering my question whether you are here representing any constituted authority.

Petitioner: No.

Mr. Deputy Fry: In your petition you pray that the new Tower Bridge may be constructed of iron produced and manufactured in Great Britain. What is the difference between "produced" and "manufactured?"

Petitioner: To distinguish it from what may be produced in foreign countries.

Mr. Deputy Fry: Do you make any difference between being produced and manufactured?

Petitioner (after consulting with Mr. Pannell): English ore and English manufacture.

Mr. Brookman: One is in the raw state and the other in girders.

Petitioner: Quite so.

Mr. Lyon asked whether the petitioners, whenever they went to an ironmonger, asked whether the iron was made in England or abroad. (Laughter.)

Mr. Deputy Edmeston: Was it not true that Belgian manufactured iron would not bear the same tests as English manufactured iron?

Petitioner: Yes, quite true. In answer to Mr. C. T. Harris, he said the petitioners had not considered the question of free trade for a moment.

Mr. H. Greene asked whether the petitioner could explain the relative proportion of value and quality between English and foreign iron.

Petitioner: It depends altogether upon the tests specified to be applied.

Mr. J. Cox: If the Corporation can get an equal quality of iron at some other place than England at £10,000 less, do you ask us to pay £10,000 more for British iron?

Petitioner: We contend that you cannot get it.

Mr. J. Cox repeated his question.

Mr. Deputy Shephard and Mr. Under-Sheriff Rose-Innes submitted that it was not a fair question. (Cries of "Fair question!")

The Lord Mayor ruled that the question was not regular. (Laughter.)

Mr. Atkinson: Do you know if steel in this country is as cheap as it is abroad?

Petitioner (after a pause): Yes.

Mr. G. E. Wood: Are there not different qualities of iron made in this country; some of superior and some of inferior quality?

Petitioner: Yes.

Mr. Scott: Is there any foreign steel that can be as well depended upon as English steel?

Petitioner: No.

Mr. Deputy Bedford: Do you come here asking the Court to make a certain sacrifice of money for the purpose of benefiting the working people of this country?

Petitioner: Yes.

Mr. Morton: Would you be satisfied if the iron is purchased subject to tests?

Petitioner: Yes.

Mr. Bertram: Is it not a fact that the iron trade of this country is very depressed?

Petitioner: It is a very favourable time to obtain a contract.

Mr. Bertram: That is to say, the competition would be so keen that the Corporation would get full value for their money?

Petitioner: Yes.

Mr. Deputy Fry: Is the best foreign iron inferior to the best English iron?

Petitioner: Yes.

Mr. Alderman Isaacs was about to move, "That it be an instruction to the Bridge House Estates Committee that the ironwork to be used in the construction of the new eastern bridge shall be of British iron and British manufacture," when

Mr. Stoneham rose to ask a question of the chairman of the Bridge House Estates Committee, as to whether the committee had not already decided to use only British iron or steel in the construction of the bridge.

The Lord Mayor ruled that Mr. Stoneham was out of order.

Mr. Waller expressed surprise that the chairman of the Bridge House Estates Committee had not made a statement; and Mr. Deputy Burnell, amidst considerable noise and interruption, disputed the ruling of the chair.

Mr. Stoneham thereupon moved the adjournment of the Court, which was declared to be lost.

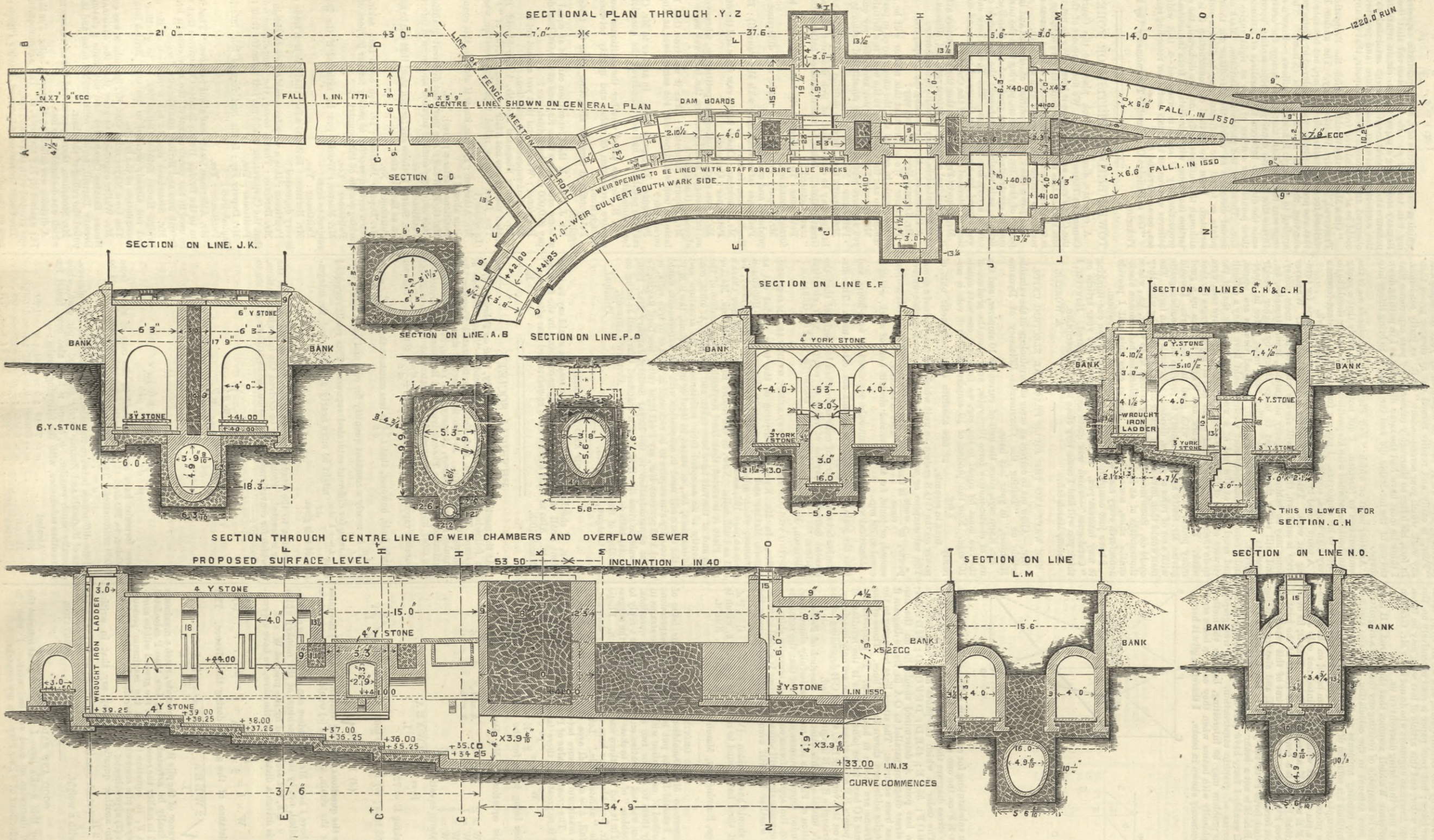
A division was called for, the result being: For the adjournment, 74; against it, 71; majority, 3. The announcement of the figures was greeted with cheers and laughter.

The Court thereupon adjourned, leaving a large amount of business on the paper.

NEW SEWERS IN CLAPHAM, BATTERSEA, WANDSWORTH, AND PUTNEY.

SIR JOSEPH W. BAZALGETTE, M.I.C.E., ENGINEER.

(*For description see page* 213.)



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CONTENTS.

THE ENGINEER, March 12th, 1886. PAGE

THE PRICE OF LABOUR AND WORK IN AUSTRIA .. 201
PANHELLENIC STEAM NAVIGATION .. 201
CONTRACTS OPEN—Locomotive Boilers for Sind, Punjab, and Delhi Railway. (Illustrated.) .. 203
THE RIVER SEINE .. 204
RAILWAY MATTERS .. 205
NOTES AND MEMORANDA .. 205
MISCELLANEA .. 205
GREENOCK NEW HARBOUR WORKS. (Illustrated.) .. 206
THE JAMES WATT DOCK, GREENOCK. (Illustrated.) .. 207
LAUDER'S LUBRICATOR. (Illustrated.) .. 207
PREGARDIEN'S BOILER. (Illustrated.) .. 207
LETTERS TO THE EDITOR—Triple Expansion Engines—Free Trade and no Trade—Wages—American Bridges .. 208
Pile-driving—Good and Bad Work—The Watt and the Joule Practical Electric Units—Testing the Commercial Efficiency of Dynamo Machines—Good and Bad Chains .. 209
PHYSICAL SOCIETY .. 209
TOWER BRIDGE—BRITISH OR FOREIGN IRON .. 209
SEWERS IN CLAPHAM, BATTERSEA, WANDSWORTH, AND PUTNEY. (Illus.) 210
LEADING ARTICLES—Foreign Competition—Dilatancy .. 211
The Future of the Steam Engine—The New Electric Lighting Bill—Steamships' Earnings and Expenses—The Control of Railways—Engineers in the Navy .. 212
"Sheffield" and Sheffield Trade-marks—German Engines—French Torpedo Boat Experiments .. 213
LITERATURE .. 213
THE EFFICIENCY OF DYNAMOS .. 213
ROBERT CHARLES RANSOME .. 213
POLE ROAD LOCOMOTIVE. (Illustrated.) .. 214
TRIALS OF IMPROVED RAILWAY COUPLINGS .. 214
DENISON'S TESTING MACHINE. (Illustrated.) .. 214
TENDERS .. 214
CURTIN'S BOILERS. (Illustrated.) .. 215
HALL'S GRADUAL REDUCTION ROLLS FOR HARD SUBSTANCES. (Illus.) 215
AMERICAN STEAM ENGINES .. 215
PRIVATE BILLS IN PARLIAMENT .. 215
THE INSTITUTION OF CIVIL ENGINEERS .. 216
ELECTRIC LIGHT AT MUNCASTER CASTLE .. 216
LAUNCHES AND TRIAL TRIPS .. 217
AMERICAN NOTES .. 217
THE IRON, COAL, AND GENERAL TRADES OF BIRMINGHAM, WOLVERHAMPTON, AND OTHER DISTRICTS .. 217
NOTES FROM LANCASHIRE .. 217
NOTES FROM SHEFFIELD .. 218
NOTES FROM THE NORTH OF ENGLAND .. 218
NOTES FROM SCOTLAND .. 218
NOTES FROM WALES AND ADJOINING COUNTIES .. 218
NEW COMPANIES .. 219
THE PATENT JOURNAL .. 219
SELECTED AMERICAN PATENTS .. 220
PARAGRAPHS—The Tower Bridge, 204—Naval Engineer Appointments, 204—Electric Lighting at the Colonial and Indian Exhibition, 207—Mrs. Templeton, 214.

TO CORRESPONDENTS.

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MEETINGS NEXT WEEK.

THE INSTITUTION OF CIVIL ENGINEERS, 25, Great George-street, Westminster, S.W.—Friday, March 12th, at 7.30 p.m.: Students' meeting. Paper to be read, "The Process of Coining Gold, as carried on at the Melbourne Branch of Her Majesty's Mint," by Mr. V. W. Delves-Broughton, Stud. Inst. C.E. Mr. Joseph Newton, Assoc. M. Inst. C.E., in the chair. Tuesday, March 16th, at 8 p.m.: Ordinary meeting. Paper to be further discussed, "On the Explosion of Homogeneous Gaseous Mixtures," by Mr. Dugald Clerk, F.C.S. And, time permitting, three papers will be read "On the Economical Construction and Operation of Railways in Newly-developed Countries, or where Small Returns are Expected," by Mr. Robert Gordon, Mr. J. R. Mosse, and Mr. G. C. Cuningham, MM. Inst. C.E.

KING'S COLLEGE ENGINEERING SOCIETY.—A general meeting will be held on Tuesday, March 16th, at 4 p.m., when Mr. A. F. Moore will read a paper "On the Lighting of Mines."

ROYAL METEOROLOGICAL SOCIETY, 25, Great George-street, Westminster, S.W.—On Wednesday, March 17th, at 7 p.m., the following paper will be read:—"Brief Historical Account of the Barometer," by Mr. William Ellis, F.R.A.S., President. After the reading of this paper the meeting will be adjourned in order to afford the Fellows and their friends an opportunity of inspecting the exhibition of barometers, and of such new instruments as have been invented and first constructed since the last exhibition. The exhibition will, at the request of the Secretary of the Institution of Civil Engineers, be open in readiness for their meeting on Tuesday evening, the 16th inst.

PARKES MUSEUM OF HYGIENE, 74A, Margaret-street, Regent-street, W.—Thursday, March 18th, at 8 p.m.: Lecture by Captain M. P. Wolff "On the Rational Alimentation of the Labouring Classes."

SOCIETY OF CHEMICAL INDUSTRY.—London Section: Chemical Society's Rooms, Burlington House.—Monday, March 15th, at 8 p.m.: Paper to be read "On Ice Making and Cooling Machinery," by Mr. T. B. Lightfoot, M.I.C.E., M.I.M.E.

SOCIETY OF ARTS, John-street, Adelphi, London, W.C.—Monday, March 15th, at 8 p.m.: Cantor Lectures. "Petroleum and its Products," by Mr. Boverton Redwood, F.I.C., F.C.S. Lecture II.—Production, transportation, and storage of crude petroleum. Well drilling. Use of the torpedo. Pipe-line system. Bulk transportation. Wednesday, March 17th, at 8 p.m.: Fifteenth ordinary meeting. "Eastern Carpets," by Mr. Vincent Robinson. Sir George Birdwood, M.D., C.S.I., will preside. Friday, March 19th, at 8 p.m.: Indian Section. "Experiences on the Afghan Frontier," by Mr. William Simpson, F.R.G.S. Colonel Henry Yule, C.B., will preside.

DEATHS.

On the 1st inst., FRANCIS THOMAS BEAUFORT, C.E., of Belrath Cottage, Ealing, aged 72.

On the 5th inst., ROBERT CHARLES RANSOME, of the firm of Ransomes, Sims, and Jefferies, Ipswich, aged 55.

THE ENGINEER.

MARCH 12, 1886.

FOREIGN COMPETITION.

A FRUITFUL source of trouble between labour and capital is the ignorance of labour concerning the conditions under which capital is employed. A notable example of this is supplied by Mr. Swift's annual report to the Steam Engine Makers' Society. To one aspect of that report we referred last week; another section of it supplies the example we wish to place before our readers. Mr. Swift maintains that there is practically no foreign competition in steam engines worth the name. "The advocates of foreign competition doctrine," says Mr. Swift, "never forget to tell us that it is accounted for by the long hours and low wages of the foreign artisans, but forget to tell us that, if *there is* any foundation for it, the chief cause is low royalties, low railway charges, and capitalists satisfied with less profits than they are in this country. The most practical test to prove the reality of cheap continental labour would be to bring some of it over here, and place the individuals alongside our men, and test the vigour and abilities of the two persons on the same class of work. This could easily be done, as this cheap labour is but about forty-eight hours' sail from our shores, and human nature is the same all the world over, each being prompted to get the best pay they can as a means to the great end of getting a living. This cheap continental labour flocks to this country in large numbers for clerical work, and ousts our sons who have been trained for mercantile work; but for bodily labour or mechanical skill they do not deem it wise to test their powers with the British artisan. In times of strikes they have been shipped here like cattle to take our places, but the last batch we know of came as boiler-makers in 1871, and were only here a short time, when they were taken back by steamer, and, as was caustically remarked by one individual, they could not make a boiler that would hold bricks, let alone steam or water." It is very likely that nonsense has been talked about foreign competition because, in too many cases, the masters are just as ignorant regarding it as the men. Competition means a great deal more than low wages. In years gone past our present competitors in France, Germany Belgium, &c., had to come to England for steam engines, because they could not make such things for themselves. If they did not get them from us they must go without. The operation of protection; the spread of information; the ample instructions supplied by international exhibitions, have, however, effected a tremendous change, and countries in which we formerly found our best markets now want nothing from us. As Mr. Swift seems to have missed the point of the whole matter, no doubt it has escaped many others of less intelligence, and it is, therefore, worth while to speak very explicitly about it.

Let us suppose that in a back wood settlement there is but one grocer. The little town grows, and with it the grocer. There are a hundred families to be supplied, and they rely on him for the supply. He makes a very good thing of it indeed. He charges his own price, and sells just what he likes. Such shops as his exist to this day in out-of-the-way country towns in Great Britain. After a time, however, new blood is imported into the town, and not one but three or half a dozen grocers are to be found within its precincts. Then times become extremely bad for the original grocer. He feels competition very keenly. It is not a question of what wages his rivals pay, it is in the fact he has lost a monopoly that his discomfiture lies. Now Great Britain is in precisely the predicament of the original grocer. Mr. Swift apparently denies the existence of grocers No. 2 and No. 3. To him they are idle dreams, inventions of malicious capitalists, to be despatched by the first touch of common sense. Going back to our primitive village, we find living at one end of it the oldest inhabitant—he is in the service of grocer No. 1; he goes to his work every morning, he leaves it every night—he is told that new grocers' shops have been started, and he refuses to walk down the street to see them. He does not believe that they are there at all; why should he trouble himself about them? Now Mr. Swift is in the condition of the oldest inhabitant—he will not cross the Channel to see for himself what foreign competition really means. In 1884 there was a very fine departmental exhibition held at Rouen, a place that can be reached in about eight hours from London. Did Mr. Swift go to it? Last year there was a splendid exhibition at Antwerp. Did Mr. Swift go to it? If he did from what point of view did he regard Mr. Van den Kerchove, Messrs. Cockerill and Co., M. Bollinckx, and a dozen other steam engine makers? In 1878 there was an exhibition in Paris. In 1873 there was one in Vienna. Did Mr. Swift visit these? If so did he find any difference between the steam engines shown at Vienna and Paris and those exhibited at Rouen and Antwerp? Unless he was wilfully blind he must have discovered one. We have been at all the exhibitions named, and we found the difference something enormous. Say what he will about foreign labour, the fact remains that Belgians at all events can now build steam engines as good as it is possible to build them. Is it likely that under the circumstances Belgium will come to us for steam engines? They will get from us nothing better than they can make themselves, and they will have to pay heavy duty on the English engine. Of course they will not buy from us. There is but one solitary inducement to buy that can be held out to them, and that is low price. In a word, we must pay the duty and something more if we are to sell engines in Belgium. To that extent we are handicapped, and it is contended that it is impossible for us to do this and pay high wages as well. We have already said our say concerning wages and we shall not repeat ourselves.

Our principal object in writing now is to urge on Mr. Swift, and on many capitalists as well, the vital importance of going abroad into foreign markets, and seeing for themselves what is being done. Not a few of our engineers make a summer trip, and naturally enough they get away as much as they can from steam engines and machinery. In one sense this is to be regretted. They should avail themselves of their opportunities to learn what their rivals are doing. There are still in existence backward places, such as Greece, Turkey, and Spain, in which we can sell, because they cannot make for themselves; but this will not last. Germany and Belgium are no longer content to supply their own wants; they will supply others as well. We do not want Mr. Swift to take these things on hearsay. He and many other representative men are really guilty of a neglect of duty if they do not avail themselves of every means of learning what are the true relations of capitalists abroad and at home to each other. He deals in his report with little more than the relations of men with each other. But this will not do. The adjustment of the relations of labour, and capital, and markets, all round is a tremendous problem; and there is no chance of its solution by anyone who is in possession of only a few of the conditions which determine the flow of the tide of commerce in this or in that direction.

DILATANCY.

To Professor Osborne Reynolds is due the credit of making a discovery which promises to be of some importance. The discovery appears to have resulted from experiment, guided as much by inductive reasoning as pure curiosity. It is a remarkable discovery in that it was quite unanticipated, and is, indeed, apparently opposed to past experience. Of course, it is not really opposed, for nature does not contradict herself; but the precise conditions necessary have never before been secured properly by a philosopher, though no doubt they have been present scores of times when the philosopher was absent. The discovery referred to at the last meeting of the British Association, was more fully described at the weekly evening meeting of the Royal Institution on the 12th of February. A special word has had to be coined for dealing with the discovery, which word we have used at the head of this article. The title of Professor Reynolds' paper given at length is "Experiments Showing Dilatancy, a Property of Granular Material, possibly connected with Gravitation."

If we ask any of our readers what will occur if an india-rubber bag containing sand and water, and communicating with a bucket of water by means of a tube, be pressed between two flat boards, the answer will be that the water in the bag will be squeezed out into the bucket. Broadly stated, Professor Reynolds' discovery is that this is not what will happen, but that, on the contrary, water will at once rise up the pipe from the bucket and enter the bag. Paradoxical as it may seem, the bag becomes larger, up to a certain limit, the more it is squeezed. Professor Reynolds began his discourse by telling his hearers something about the mysterious ether by which light is transmitted to us from the sun; by shearing which in two, according to Dr. Lodge, we get electricity; the possible cause of cohesion and gravitation; an elastic homogeneous jelly pervading all space; more rigid, in one sense, a million times than cast steel, and yet so tenuous that it does not sensibly retard the motion of planets moving through it. Whenever a phenomenon presents itself which cannot be otherwise explained, it is referred to the ether, and there are nearly as many ethers as there are philosophers. It has been said, indeed, that no less than six different ethers are needed to satisfy the predicates of the vibratory theory of light. Maxwell found no comfort in the ethers; on the contrary, he maintained that they were like the glasses of the dram-drinker—one always led to another, necessary to explain the existence of the first. "As the result," says Professor Reynolds, "of a long-continued effort to conceive a mechanical system possessing the properties assigned by Maxwell, and further, which would account for the cohesion of the molecules of matter, it became apparent that the simplest conceivable medium—a mass of rigid granules in contact with each other—would answer not one but all the known requirements, provided the shape and mutual fit of the grains were such, that while the grains rigidly preserved their shape, the medium should possess the apparently paradoxical or anti-sponge property of swelling in bulk as its shape was altered."

No one ever dreamed that the cubic content of sand in a sack was affected by the shape given to the sack. Yet, now that we are told all about it, we wonder that we did not see the truth before. If the grains interlock, their alteration of form must, under given conditions, augment the space occupied. For example, if we shake or disturb a brick wall it is evident that we increase its dimensions, because the bricks are no longer so close to each other as they were. In an ordinary mass of brickwork or masonry well bonded without mortar, the blocks fit so as to have no interstices; but if the pile be in any way distorted, interstices appear, which shows that the space occupied by the entire mass has increased, as was shown by a model. At first it appeared that there must be something special and systematic, as in the brick wall, in the fit of the grains together, but subsequent consideration revealed the striking fact "that a medium composed of grains of any possible shape possessed this property of dilatancy so long as either of two important conditions was satisfied." The conditions are that the medium should be continuous, infinite in extent, or that the grains at the boundary should be so held as to

prevent a re-arrangement commencing. All that is wanted is a mass of hard smooth grains, each grain being held by the adjacent grains, and the grains in the outside prevented from re-arrangement.

Professor Reynolds obtained the necessary conditions by using a thin india-rubber bag holding six pints. This bag being filled with clean dry sand, such as is used for hour glasses, served for many experiments. The bag was coupled to one leg of a mercury pressure gauge, and it was only necessary to flatten the bag to make the mercury rise 7in. in the leg next the bag ; in other words, a partial vacuum was established by squeezing the bag. The reader will naturally ask what would take place if no air found its way into the bag by the way of the mercury. In that case, the resistance to squeezing would be much increased, and when water is used, which is non-elastic, the shape of the bag cannot be altered at all.

"Taking," says Professor Reynolds, "the same bag, the sand being at its closest order—closing the neck so that it cannot draw more water, a severe pinch is put on the bag, but it does not change its shape at all ; the shape cannot alter without enlarging the interstices, these cannot enlarge without drawing more water, and this is prevented. To show that there is an effort to enlarge going on, it is only necessary to open a communication with a pressure-gauge, as in the experiment with air. The mercury rises on the side of the bag, showing when the pinch is hardest—about 200 lb. on the planes—that the pressure in the bag is less by 27in. of mercury than the pressure of the atmosphere; a little more squeezing and there is a vacuum in the bag. Without a knowledge of the property of dilatancy such a method of producing a vacuum would sound somewhat paradoxical. Opening the neck to allow the entrance of water, the bag at once yields to a slight pressure, changing shape, but this change at once stops when the supply is cut off, preventing further dilation."

Professor Reynolds has as yet drawn few deductions. He prefers to continue his experimental researches, and some of the results are very curious. "Putting a bag filled with sand and water between two vertical plates, and slightly shaking while squeezing, so as to keep the sand at its densest, while it still has a free surface, it can be pressed out until it is a broad flat plate. It is still soft as long as it is squeezed, but the moment the pressure is removed, the elasticity of the bag tends to draw it back to its rounded form, changing its shape, enlarging the interstices, and absorbing the excess of water ; this is soon gone, and the bag remains a flat cake with peculiar properties. To pressures on its sides it at once yields, such pressures having nothing to overcome but the elasticity of the bag, for change of shape in that direction causes the sand to contract. To radial pressures on its rim, however, it is perfectly rigid, as such pressures tend further to dilate the sand ; when placed on its edge, it bears 1 cwt. without flinching. If, however, while supporting the weight it is pressed sufficiently on the sides, all strength vanishes, and it is again a rounded bag of loose sand and water." By shaking the bag into a mould, it can be made to take any shape; then, by drawing off the excess of water and closing the bag, the sand becomes perfectly rigid, and will not change its shape unless the envelope be torn ; no amount of shaking will effect a change. In this way bricks can be made of sand or fine shot full of water, and the thinnest india-rubber envelope, which will stand as much pressure as ordinary bricks without change of shape ; also permanent casts of figures may be taken. When we walk along a wet beach, round each footprint the sand is seen to change colour for some distance. This is because the pressure of the foot has changed the shape of the mass under it, and the water is sucked in, drying the sand all round. It seems a paradox that instead of squeezing the water *out* of that portion of beach rigid under foot it is sucked in.

Although Professor Reynolds has not drawn deductions, we cannot resist calling attention to one or two which suggest themselves. May we not find here the cause of rigidity? The bag of sand is stable, because to change its form would augment its bulk. May not a bar of steel be stable for the same reason? Our readers will not be slow, we think, to see that Professor Reynolds has left a good deal to be explained. For example, to state that a cake of sand and water is stable, because a change of form would augment its dimensions, is only to reason in a circle. We naturally ask : Well, why should it not increase its dimensions? and to this Professor Reynolds supplies no answer. It is true that an increase in volume would lead to the production of a partial vacuum inside, and that in so far the pressure of the air outside would tend to promote stability; but this stability ought to be elastic or dynamic stability, not static. Concerning this, no doubt Professor Reynolds will have more to say. The apparatus required is extremely inexpensive, and there is no reason why a whole army of workers should not attack this subject with excellent results. Meanwhile, we may say that it has long been known to engineers that sand, unlike water, exerts under suitable conditions no lateral pressure. For example, bags of dry sand have been employed instead of wedges to carry the centering of bridges. The loads may be very heavy, yet these canvas bags will not burst. If the sand behaved like a liquid, they would be rent in a moment by a hundredth part of the load. To strike the centers it is only necessary to open a small hole in a bag and let as much or as little sand run out as may be needed. A paper plug will suffice to stop the flow.

THE FUTURE OF THE STEAM ENGINE.

The steam engine of to-day differs materially from that of even twelve or fifteen years ago in some important points, the difference being due partly to a change of views on the part of men so leading in their profession as to be able to set the fashion, partly to increased experience and the spur of competition, and finally in no small degree to improved materials, and better tools available now, but only so of recent years. The steam engine at the present time is probably the most universally employed servant of all work in existence. Whether for construction or destruction, it is alike needed. In the science of warfare and the arts of peace it occupies an important place. It therefore deserves, and ought at all times to receive a large share of thoughtful attention ; not alone to devise improvements about it, but even to prevent its receding from its best existing forms back to cheap trade rubbish.

As regards the future improvement of the steam engine, those who devote themselves to this consideration must, if they really desire to do good, bear ever in mind that improvement is essentially a relative phrase, and that a contrivance justly calculated to improve an engine working under one set of circumstances may be a retrograde step under another. At present all men who seek for additions to the existing stock of knowledge of the laws governing, and the phenomena attending, the derivation of work from steam acting on a piston in a cylinder, turn their eyes and their hopes to the marine engine as the most likely source from which to expect light. Nor is this to be wondered at. The modern conditions of social as well as of cosmopolitan and financial life have placed steam navigation and its accessories more before public notice than any other branch of mechanical engineering, save locomotives on railways. No other application of steam power demands for its successful employment so many combined excellences under, perhaps we may also say, equal difficulties; but, on the other hand, it has the advantage of being placed above what we may fairly designate as the more degrading influences of competition. Large capital, independent supervision, and — defective though they certainly are in some points—Board of Trade regulations, contribute to maintain sound materials and good workmanship, while a healthy form of competition prevents the use of any but first-class machinery, to the design of which the best theoretical science and practical experience have been brought, and both of which show that, however great an advance has been made, there is yet room for further progress.

Two points peculiar to modern steam navigation render the marine engine room the leading steam school. First, the yearly more accentuated necessity for fast steamers, and for obtaining maximum powers in very limited spaces, and from every bushel of coal. Secondly, the fact that there is plenty of capital available to aid the marine searchers after excellence, and the stimulating conviction that none other than excellent machinery will or can pay. The prospects of much advance towards excellence in land steam engines are less promising. It is true the problem of locomotive improvement attracts some attention, but not widely extended so far as practically tried devices are concerned ; engineers rather seem inclined to await the results of Mr. Webb's and Mr. Worsdell's compounding system.

In fixed engines the least prospect of all, of energetic attempts at improvement, is to be found. Many things contribute to cause this. The action of home steam users themselves, displayed in their intense desire to buy cheap engines, and the rough-and-ready conditions of colonial working operate to hinder advance. There are too many steam users who simply want something that will work, men who resemble Tottie in "Helen's Babies," and, like the child, simply say to an engine maker, "Me wants to see the wheels go round," and care for little else, to encourage the expenditure of money on costly experiments and expensive patterns. We are ourselves of opinion, while willingly subscribing to the dogma that engine makers, like all other traders, must try and please their customers, that they ought in their own interests to refrain from spoiling them, and degrading their own business or driving it entirely away into other hands by, for sake of a temporary gain, supplying really worthless articles. For although such a policy may endure successfully for a time, it is certain ultimately so to damage their reputation that when a "winter of discontent" comes in the shape of trade depression, they will perish through having forfeited their good name in an attempt to get orders at any price. In times of depression the cheap firms are usually the first to fail, having neither capital nor credit. Steam users in many cases also do much to discourage the manufacture of really good and economical machinery by the reckless ill usage they give their engines, even the plainest types speedily giving up their lives under every cruelty. Of course makers are not to blame for this so long as they impress upon their customers the necessity for taking care of a good engine when they get one. The evil still remains, however, that a remembrance of the sort of folk who will get charge of their best engines often deters makers from attempting progress or improvement.

THE NEW ELECTRIC LIGHTING BILL.

The Bill introduced in the House of Lords by Lord Rayleigh to amend the Electric Lighting Act of 1882, consists of sixteen clauses in all, and is of a comprehensive nature. Its object is to amend the Act of 1882, which has given so much dissatisfaction, and to which is to be attributed the non-development of electric lighting in this country ; and to amend it in such a way as to place electric lighting undertakings in the same position as gas undertakings in regard to both privileges and obligations. Briefly summarised, its chief provisions are these :—Clause 4 proposes to enact that every person who attaches a conductor to an electric lighting wire without the consent of the undertakers—or owners—or fraudulently injures a meter used for ascertaining the amount of electricity consumed, or, where a meter is not employed, uses any other lamp than that provided by the undertakers, or any lamp calculated to consume more electricity than has been contracted for, or otherwise improperly expends the electricity, or supplies the electricity to any other person, shall forfeit £5 for the offence, and £2 for every day the offence continues. The 18th Section of the existing Act prohibits undertakers from prescribing any special form of lamp; but this Bill proposes (by Clause 7) to repeal that provision, and to enact that where electricity is supplied by meter no local authority or person shall be at liberty to use any form of lamp, or use the electricity supplied, so as to interfere with the proper supply to other persons, is re-enacted substantively. The 8th Clause proposes to repeal the 27th Clause of the present Act, whereby local authorities are empowered at the end of twenty-one years to compulsorily acquire lighting undertakings at the then value of the land and works, without paying anything for profits, goodwill, or compulsory purchase. In regard to this question it may be remembered that originally fifteen years were proposed as a limit, but after much discussion in the Select Committee, twenty-one years were adopted. This power being repealed, it is proposed by Clause 15 that a local authority may, by agreement with the undertakers, purchase an undertaking "upon any terms," and thereupon the powers of the undertakers shall vest in the local authority. Clause 9 proposes to limit the profits of undertakers to the rate prescribed by the Provisional Order, or Special Act, "or, where no rate is prescribed, to 10 per cent. per annum." The principle whereby dividends are increased or diminished in inverse ratio to increase or diminution of price, is introduced on the method of the sliding-scale applied to gas undertakings, except that having regard to the small price charged per electrical unit as compared with the price charged for 1000ft. for gas, the dividend is increased or reduced by 5s. per £100 in respect of every farthing, instead of every penny as in the case of gas. By the subsequent clauses it is provided that new or additional capital in the undertaking is to be offered to the public by auction, in accordance with the usual auction clauses applied to gas undertakings ; the undertakers are to furnish a sufficient supply of electricity to owners or occupiers situate within twenty-five yards from the main ; the undertakers are to supply electricity for public lamps ; mains are to be kept fully supplied ; and penalties similar to those of the Gas Acts are provided in case of default by the undertakers.

STEAMSHIPS' EARNINGS AND EXPENSES.

The condition of the steam shipping industry has of late been much canvassed, but it has been rather too hastily assumed generally that the depression now existing is due to the decreased earning power of the steamer. Unquestionably that is part of the cause, but only part. A balance-sheet of a Cardiff vessel for about seven months ending in January shows that the earning power of steamers is still enormously large. In that time the steamer, which carries about 1900 tons of coal cargo, earned in the three voyages £839, £1893, and £3824 respectively. The amount of the expenses at ports for coals, port charges, wages, and stores cannot be given in detail, but out of the £839 there was left the sum of £157 ; out of the £1893 there was left £338 ; and out of the £3824 there remained £1391. The port charges include heavy amounts—Baltimore port charges alone being £173 for one entrance, Nicolaieff port charges £163, and so on. Brokerage again is heavy ; address commission, and other commissions are also considerable. But from these sums we have stated to remain after what may be called the working charges—sums amounting to £1887 odd shillings — there was to be deducted the cost of the insurance—£1378. This enormous sum was paid in seven months. The steamer was partly insured at Lloyd's, and partly also in fourteen clubs and organisations ; and it must only be believed that the largeness of the sum paid for insurance, and the large number of the associations in which the steamer was insured, are alike excessive. There remains, therefore, out of £6500 only £500, and out of these is to be deducted the cost of any repairs which fall to be borne by the steamer, and any replacements needful, and thus it will be seen the large earnings are wholly expended, and if there were due placing of reserve for the depreciation of boilers and of the vessel there would be nothing left for the shareholders. It is tolerably clear that even with the greatly depressed freights there is a vast earning power for the steamship, and that it is to the fact that the expenses have not been brought down concurrently with the earnings that the want of dividend for the owners is due. It is possible that some of the items of the cost of working cannot be brought down ; but as the cost of the vessel has been reduced there ought to have been a corresponding reduction of the amount insured, and therefore of the cost of insurance, because the losses are those of less valuable vessels. It is to be expected that the range of freight will increase, but there is no likelihood of a return to the high rates of the past; and if steam shipping is to be more remunerative than it has been of late, there must be a reduction of the expenses, and especially of that of the cost of marine insurance.

THE CONTROL OF RAILWAYS.

The Bill which Mr. Channing and several other members have introduced into Parliament, to make further provision for the safe working of railways, is a short measure, but if passed into law it will effect something like a revolution in railways, in the interest of passengers and employés. There are practically only two clauses, but the first is to the effect that the Board of Trade shall have power to order a railway company, within a limited period, to adopt the block system throughout its lines ; to provide for the interlocking of points and signals ; to provide all passenger trains with continuous brakes complying with the existing Board of Trade rules, and all goods and mineral engines with powerful and efficient brakes ; to affix to all vehicles working in goods and mineral trains such improved coupling apparatus as shall obviate the necessity for men to go between the vehicles for coupling and uncoupling ; to raise all platforms to a standard height, to fit all passenger carriages with continuous foot-boards, and to provide all passenger trains with efficient means of communication between the passengers and the guard and driver ; to provide adequate accommodation and proper spaces for the safety of employés wherever the Board of Trade inspector considers it necessary ; and to provide such subways, bridges, or foot-bridges at stations or railway crossings, as the inspector may report as requisite for the public safety. Failure to comply with such an order is to entail a fine not exceeding £20 for every day of default. The second of the two principal clauses proposes to enact that, when any railway servants whose duties involve the safety of trains, passengers, or employés, are on duty for more than twelve hours at a time, or have been allowed to resume duty without an interval of nine hours, the company shall make a monthly return to the Board of Trade, giving particulars as to dates, men employed, and so on, under a penalty of £5 for every day of default. The exercise of this proposed law is to vest in the Railway Commissioners, and the Act if passed will operate from the 1st of January, 1887. Considering the reluctance shown hitherto by railway companies to adopt the suggestions in these directions frequently urged by the Board of Trade, and considering also the strength of the railway representation in Parliament, it is perhaps too much to anticipate success for this Bill in the present session, but the measure is certain to receive a large amount of support from unbiassed members, and is a valuable step towards reforms long and loudly demanded.

ENGINEERS IN THE NAVY.

The Admiralty are about to make another—and this time a more satisfactory—attempt to settle the vexatious question of the relative rank in the service of the engineer and accountant branches of the Navy. Hitherto, chief engineers under ten years' seniority and engineers of eight years' seniority have ranked with lieutenants of eight and under eight years' seniority respectively, but have had the mortification to take a position

after the youngest of the several grades. In order to place the question on a satisfactory footing the Admiralty are about to introduce three new ranks into the engineer and the accountant departments respectively, and to substitute periods of six years for the existing distinguishing periods of eight years. Although the changes have not been as yet officially notified, their lordships are understood to have approved of the following order of relative ranks:—Chief engineers of eight years—to be called fleet engineers—and paymasters of twelve years—to be called fleet paymasters—will rank with commanders in the Navy and junior lieutenant-colonels in the army. Chief engineers of over four and under eight years—to be called staff engineers—and paymasters of over six and under twelve—to be called staff paymasters—will rank with lieutenants of eight years and with majors in the Army. Chief engineers of under four years and paymasters of under six years—who are to retain the present titles—will rank with, but after, lieutenants of eight years and with junior majors in the army. Engineers of six years and assistant paymasters of twelve years will rank with lieutenants under eight years and with captains in the army. Engineers under six years and assistant paymasters over six and under twelve years will rank with, but after, lieutenants under eight years and with junior captains in the army. Assistant engineers and assistant paymasters under six years will rank with naval sub-lieutenants and with lieutenants in the army.

"SHEFFIELD" AND SHEFFIELD TRADE MARKS.

THE Cutlers' Company, of Sheffield, has laboured incessantly for years to cause successive Governments to adopt diplomatic action in regard to the interests of British trade abroad. It has been pointed out with regard to Spain that although England takes 60 per cent. of the entire products which leave her shores, that country declines to put her on the most favoured-nation treatment, and, indeed, claps duties on English industries running as high as 70 per cent. France, when similarly treated, brought Spain to her knees in a fortnight. The mere threat of retaliation by America caused Spain to take second and wiser thoughts; but feeling that England would neither retaliate practically nor remonstrate diplomatically, the burden was piled on the back of much-enduring Britain. Another gross instance is the audacity displayed in forging and imitating Sheffield trade marks and names, as well as in the use of the word "Sheffield" itself. Time was when "Sheffield" stamped on a blade was accepted as undoubted testimony of its excellence. But in these days, and for years past, vast quantities of German-made wares have been marked "Sheffield," and, branded with imitations of Sheffield names and trade-marks, exported direct to foreign markets, where they have been sold as Sheffield articles. The effect, of course, is to damage the reputation of Sheffield in foreign markets. An International Convention is to meet at Rome in April, at which the question of trade-marks will be fully considered. It is the intention of the British representatives to secure, if possible, the recognition of honest dealing in industry by making it an offence to put goods upon any market with an intention to deceive the buyer. This intention will be held to be manifested, for example, by striking "Sheffield" on goods not made in Sheffield; or by striking an imitation of the word "Sheffield," or of the names, or imitations of the names, or trade-marks, of Sheffield manufacture. And what the Sheffield delegates ask from foreign countries they will be prepared to concede on behalf of their town and of English industry in general. Unfortunately, Germany is not in the Convention, and it is from Germany that English industry suffers most by unscrupulous dealing; but that Germany is outside the Convention is largely due to the fact that no diplomatic action has ever been taken to induce Germany to come in. It is high time that English diplomacy and English commerce ceased to be strangers, and the holding of the International Convention at Rome may be the means of the two getting upon talking terms. By and bye, when they know each other sufficiently well, commerce may issue a call to action which diplomacy will obey in the interests of English industry.

GERMAN ENGINES.

THERE is constantly a great increase in the number of engines and locomotives in use in Germany. Not including those in use by the military and naval services, there were in use last year 39,646 fixed boilers, 8312 movable boilers and traction engines, 36,812 fixed engines, 1091 marine boilers, and 906 marine engines. The increase in fixed boilers since 1879 was 4·5 per cent.; portable boilers and traction engines, 9·7 per cent.; fixed engines, 4·6 per cent.; marine boilers, 11·1 per cent.; and marine engines, 9·1 per cent. The sale of engines during the year aggregated more than 2,971,500 marks—a mark being about 1s.—and for general machinery and war material 5,669,212 marks. The number of men employed in the industries is variously estimated, but is at least 52,000. The American Consul at Chemnitz has written to his Government urging that there is in Germany a good opening for American engines, and gives the history of some recent tenders, in order that American manufacturers may know the competition they have to meet. It is equally useful for English manufacturers. Recently the Roumanian Government invited tenders for contracts to furnish 212 passenger coaches, 30 tender engines, and 12 express-train engines, together with more than 300 freight cars and other rolling stock for railways. There were many bids from many parts of Europe. The contract for the engines was awarded to the "Hanoverschе Maschinenbau Gesellschaft," at the price of 1·14f. gold per kilogramme of metal used. At this rate the price of a tender engine would be about 24,000f. in gold, or about £960. The locomotives to be delivered at Bucharest. The contract for the twelve express engines fell to the "Machinenfabrik Linden," of Hanover, at 47,200f., or about £1880, and the contract for the freight cars was given to the Deutz firm of Zypen and Charlier for 550,000f.—£22,000. For the latter the highest bid was 880,012f.

FRENCH TORPEDO-BOAT EXPERIMENTS.

ADMIRAL AUBE, the new French Minister of Marine, is taking full advantage of his new position to bring into effect his belief in the very important part to be played in modern marine warfare by torpedoes and torpedo-boats. Experiments have recently been made under him which seem to indicate that some of the difficulties which attended the direction of torpedoes at Bantry Bay are not necessarily met with when the torpedoes are properly handled. With the ship Amiral Duperré moving at 14 to 14½ knots, six torpedoes were launched from two fixed torpedo-boats at different angles, and every one hit and exploded. With the Amiral Duperré steaming at the same speed and the torpedo-boat at 9 knots in the opposite direction, making a combined speed of about 23 knots, a torpedo was launched when within 500 yards of the ironclad, and struck it 11 metres behind the spur, and exploded; and, with the boat moving at 12 knots, the torpedo also struck. It was found that no change of direction of the torpedo was observable when the torpedo entered the bow wave made by the ironclad at full speed. The trials are thus held to contradict the Bantry Bay trials, as well as to show that torpedoes can be discharged from moving torpedo-boats at a vessel moving at 15 knots with every probability of hitting. It remains, however, to be seen whether the trials conducted by the French have been as much like work under practical warfare as those of Bantry Bay.

LITERATURE.

The Combined Number and Weight Calculator, containing upwards of two hundred and fifty thousand separate calculations, showing at a glance the value at 421 *different rates, ranging from* $\frac{1}{12}$*th of a penny to* 20*s. each, or per cwt. and* £20 *per ton, of any number of articles consecutively from* 1 *to* 470, *any number of qrs., lbs., from* 1 *cwt. to* 470 *cwt., any number of tons, cwts., qrs., and lbs. from* 1 *to* 23½ *tons.* By W. CHADWICK, Accountant. London: Crosby Lockwood and Co. 1886. 421 pp.

IT may be hoped that the author of this saver of two hundred and fifty thousand calculations had a calculating machine, or a Bidder, or a Colburn, so that there may be some chance that now his book is published he may enjoy the benefits accruing from his labours, instead of their going to support one who has proved what the schoolboy rhyme says about fractions. The title quoted shows what the book is, and it leaves little for us to say as to its purpose. We might quote more of the title-page, which tells for whom the book is intended; but we may cut this short by saying that it is for everybody and every company that either buys or sells materials or labour, or who is concerned with the transport of materials, and therefore includes all our readers. It is a number and weight calculator by which 250,000 calculations may be saved, and by which, with some combinations of these calculations, about twenty-five millions of calculations may be made with a fraction of the time usually required. This would not be the case from our point of view, if any ingenuity were necessary to learn how to use the tables of which the book consists. The book contains the answers to questions, and not simply a set of ingenious puzzle methods of arriving at results almost as quickly arrived at by simple arithmetic labour. It is as easy of reference for any answer or any number of answers as a dictionary, and the references are even more quickly made, because the edges are coloured and numbered, showing the separate divisions, as a dictionary might be, so as to open it directly at K or S or any other part without hesitation.

For making up accounts or estimates the book must prove invaluable to all engineers, ironfounders, builders, contractors, timber merchants, and others who have any considerable quantity of calculation involving price and measure in any combination to do.

The Civil Engineers' Pocket-book. By J. C. TRAUTWINE, C.E. Revised and enlarged by J. C. TRAUTWINE, jun., C.E. New York: J. Wiley and Son; London: E. and F. N. Spon. 1885.

IT is scarcely necessary to say much concerning a book which has reached its twenty-second thousand. Although it has not been very widely adopted in England—the general arrangement and selection of matter addressing itself more attractively to American than to English engineers—it is really a very valuable *vade mecum*. It contains 866 pages of closely printed matter on thin paper, with good type, and has nicely executed engravings. A difference between it and books most favoured by English engineers consists in its being more of the educational character than ours, and correspondingly less of the general reminder for well-trained engineers, such as is provided by our books of formulæ, tables, and rules. Mr. Trautwine's book is more complete than any we have on those branches of engineering which do not embrace the construction of machinery, but it is a book which we should like to possess as well as our own, and not instead of any. It deals chiefly with those matters for calculation and proportion which are involved in waterworks or hydraulic works generally, bridges of all kinds, roofs, drainage, earthworks, dams, retaining walls, and, to some extent, with railway work, preceded by mensuration, trigonometry, and surveying.

It is arranged in a manner and with type intended to be very easy of reference, and credit is due to the excellence of the book in this respect; but the system of writing formulæ in words instead of in letters takes up a good deal of room, which makes very small type necessary. There is also a good deal of crowding, which does not seem necessary, as there are many quarter and half-page blanks.

The Theory and Action of the Steam Engine. By W. H. NORTHCOTT, C.E. Fourth edition. London: Cassell and Company. 1885. 170 pp.

THIS is said to be for practical men, a notification which often means that the book so recommended is deficient in theoretical accuracy. This, however, is not the case with Mr. Northcott's book, and "for practical men" seems to mean only that the subjects are treated without the use of anything more than plain arithmetic and the simplest algebraic formulæ. The introductory chapter is followed by others on laboratory combustion; furnace combustion, or combustion under practical conditions; transfer of heat; heating surfaces; generation and properties of steam; motive power from steam, including the behaviour and operation of steam in the steam cylinder; action and influence of the mechanism of steam engine; varieties of engines and their comparative efficiency (a part, by the bye, so much appreciated by one American writer on the steam engine indicator, that he has taken, without acknowledgment, whole paragraphs word for word in a recent article) and testing steam engines.

This is the fourth edition of the book, and it is one of the most useful on steam and steam in the steam engine, apart from the design and construction of the steam engine or boiler, with which we are acquainted. It is one which should be in the hands of every steam engine maker or user, and will be found to contain information in text and tables which will save a great deal of calculation and reference to a great many books.

THE EFFICIENCY OF DYNAMOS.

BY DR. HOPKINSON.

IN Mr. Gisbert Kapp's article in the last issue of THE ENGINEER, on the experiments to determine the efficiency of the Edison-Hopkinson dynamo recently undertaken by Messrs. Mather and Platt, there is an error in his data which is important, as it materially affects the results deduced from the figures. Mr. Kapp has assumed that the zero of the dynamometer scale employed was the point at which the index would stand when the machine was at rest. Such, however, was not the case, as the scale was placed arbitrarily, and all the experiments made by taking the difference of two readings—the one when the machines were working with a known load and at a known speed, and the other when the machines were running at the same speed without load and with the magnets unexcited. The dynamometer readings, therefore, in the three sets of experiments quoted by Mr. Kapp were 29, 27·5, and 23 respectively, and the efficiency in the case selected by Mr. Kapp for discussion is—efficiency of generator, 93·23; efficiency of motor, 93·37; of the double conversion, 87·05.

It is true, as Mr. Kapp points out, that this does not include the friction of the bearings and of bending the belt round the driving pulley. This was intentionally excluded as being essentially a variable quantity depending on lubrication and the kind of belt employed, but at the same time it was determined accurately for the two machines in question by the following device:—The dynamos were run at their proper speed without load, and the dynamometer reading noted, the driving engine was then reversed, and the dynamometer again read; clearly the difference in readings is twice the friction of the two machines plus twice the work done in bending the belt. By this method these losses for one machine were found to amount to 628 watts = 0·84-horse power when running at 800 revolutions. This is materially different from Mr. Kapp's calculation of 5·18-horse power for the two machines.

Again, Mr. Kapp desires to take into account also the variation in the friction, if the belt were transmitting the full power required to drive one dynamo. Here, again, in any comparative results, this would be better omitted, as it depends entirely on the angle which the belt makes with the horizontal, and under certain circumstances the friction might be actually less when the larger power was being transmitted. Following, however, Mr. Kapp's suggestion that the mean of the results with and without friction should be taken, there is a loss of 314 watts not taken account of in Messrs. Mather and Platt's figures, amounting to 0·73 per cent. Hence the commercial efficiency of the generator is 92·5 per cent., and of the motor 92·6 per cent., as against 91·5 per cent. and 88·5 per cent., the figures calculated by Mr. Kapp.

It would, perhaps, have been unnecessary to have entered into the above discussion in regard to a difference so small, but in the case of dynamos so perfect as converters of energy that the total loss is under 8 per cent., a matter of 1 per cent. is no small proportion of the whole waste.

EDWARD HOPKINSON.

Salford Ironworks, Manchester, March 10th.

ROBERT CHARLES RANSOME.

WE very much regret to have to announce the death, on the 5th inst., of Mr. Robert Charles Ransome, the senior partner of the firm of Ransome, Sims, and Jeffries, of the Orwell Works, Ipswich. He had been suffering for some months, and died of aneurism of the heart, in his 56th year.

Mr. Ransome was born on June 1st, 1830, in Ipswich; was educated at the Friends' Schools, Hitchin and York; at sixteen entered the foundry of the old works which preceded the Orwell works, and at twenty-four became a partner in the firm and the then new Orwell Works. He subsequently devoted his attention and energies chiefly to the commercial development of the great trade that was then opening up and followed for many years with such remarkable energy by the Ipswich firm, both in the works and outside them. The firm adopted several specialities in the construction of ploughs, cultivators, and other agricultural implements and wearing parts, threshing machines and engines, and displayed the greatest energy in entering the competitive trials of the Royal Agricultural and other societies. Mr. Ransome was at this time a most energetic man, and, by repeated visits covering the whole of the Continent, early opened up a very wide Continental connection, which, with the great and growing fame of the Orwell Works and their achievements, developed in every country, and provided work for constantly increasing numbers of workmen and of workshops.

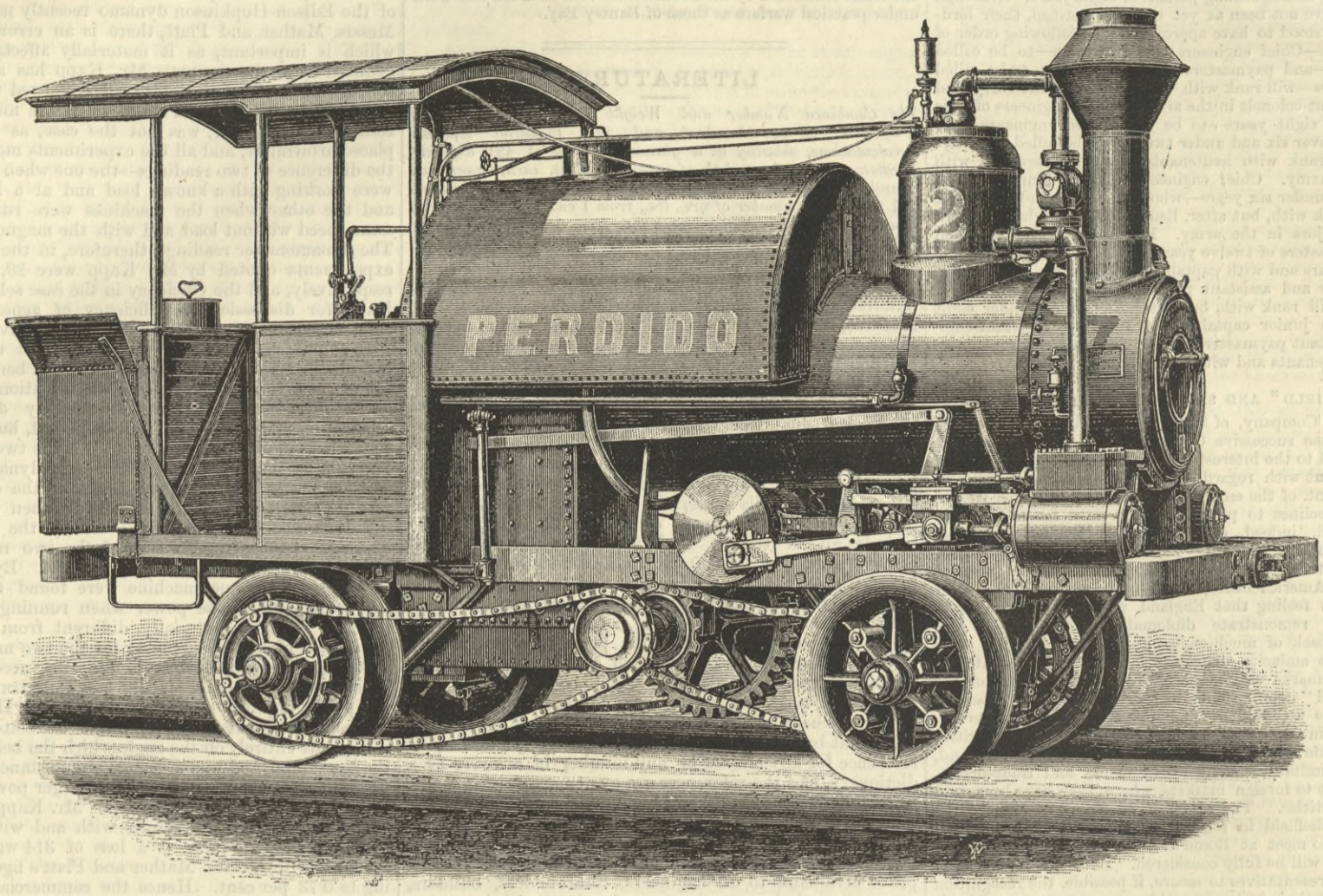
For many years Mr. Ransome had been one of the most prominent men in the municipal affairs of Ipswich, and was an alderman for some years. He took great interest in education, and was chairman of the School Board for about twelve years. He was many times pressed to enter Parliament for Ipswich, but always refused this, although as chairman of the Ipswich Liberal Association, and in many other ways, he was a political leader in the town. Mr. Ransome married, in 1854, the daughter of Mr. R. W. Baker, of Cottesmore, Rutland, who died in 1856, leaving a daughter, now Mrs. Moberly. In 1864 Mr. Ransome married the daughter of Mr. James Gibb, by whom he leaves two sons and three daughters.

SEWERS IN CLAPHAM, BATTERSEA, AND WANDSWORTH.

ON page 110 we publish the first of several pages of engravings illustrative of the important series of sewers now approaching completion in Clapham, Battersea, Wandsworth, and Putney, including the sewer aqueduct at Wandsworth across the Wandle Valley. Of this aqueduct we now give some sections and plan of the western approach, showing a junction weir and penstock chambers. In another impression further engravings and particulars will be given.

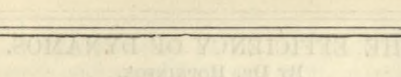
FOREIGN COMPETITION.—It is pleasant to find English firms beating continental on their own ground. We have much pleasure in stating that Messrs. Hadfield's Steel Foundry Company has recently secured a large order for steel wheels and axles in Spain, in competition with German firms. The wheels have been carefully tested alongside German wheels, and have been adopted in preference to the latter as being cheaper and superior in every way. This is of special interest at the present time, in face of the numerous reports of English manufacturers being unable to compete with Germans, and also from the fact that the Germans have the special advantage of less duty on their imports into Spain as compared with English productions.

POLE ROAD LOCOMOTIVE.



POLE ROAD LOCOMOTIVE.

The accompanying illustration represents a logging locomotive built by the Adams and Price Locomotive and Machine Works, Nashville, Tenn. The engine is specially adapted to run on a pole road, the tread of the wheels being curved for this purpose, as shown in the illustration. The "Perdido" was finished in November, 1885, and was immediately put to work at Wallace, Sandford, and Co.'s mill at Wilson's Station, Ala. She pulls seven cars with three to four logs on each car, with an average of 120 cubic feet per car load. The road is constructed of pine poles, 30ft. long and from 8in. to 12in. diameter, laid 5ft. from centre to centre of poles. No cross ties are used. The joints are made with a lap, as shown in the accompanying cut, the small end being laid on the lap of the larger end and pinned with a 2in. pin made of any suitable wood for the purpose.



Pole Road Joint

The carrying wheels—four in number—are sheave shaped, and have a lateral play on their axles, which are stationary so far as revolving is concerned, but are free to work up and down in pedestals. Spring seats and springs are provided, and the engines ride remarkably easy considering the material of which the track is made.

The cylinders are 7in. by 12in. The engine shaft carries a 10in. pinion, with 6in. face. This pinion runs into a 30in. spur wheel on the master shaft, which is provided with sprocket wheels, which are two-thirds the size of those on the carrying or driving wheels, which are 24in. in diameter. The chain used is a steel roller chain made by the Lechner Company, of Columbus, Ohio. Each carrying wheel is driven separately. The valve gear is of the shifting link type. The valves have 2¼in. travel, ½in. lap, $\frac{1}{32}$in. lead, at full gear, and $\frac{1}{16}$in. inside lap. The steam ports are $\frac{5}{8}$in. by 6in.; exhaust port 2in. by 6in., water tank capacity, 550 gallons. The fuel used is pine.

The makers inform us that the "Escambia"—a similar engine to the "Perdido"—is at work on a pole road belonging to C. S. Lowell and Co., of Wallace, Ala., and pulls a train over grades of 200ft. to the mile.

As the engines are geared 4½ to 1 they are very powerful, but do not run over five miles per hour. Messrs. Adams and Price are about to build some engines with 9in. by 16in. cylinders and 36in. drivers geared 3 to 1. These dimensions give a tractive force of 108 lb. per lb. average pressure on the pistons. These engines will have six driving wheels, and are calculated to run at twelve miles per hour. The wheels will be fast on the axles, which will revolve. The chain gear will be of an improved form, and will work wholly inside the frame. These engines will have plate frames similar to those used in Great Britain and Europe generally. These locomotives will be built for a combination track, wood and iron, and will be able to run on poles, square timbers, or ordinary rails.—*Railroad Gazette.*

TRIALS OF IMPROVED RAILWAY COUPLINGS.

A circular has been issued stating that trials of wagon couplings promoted by the Amalgamated Society of Railway Servants will commence on Monday, March 29th, at noon, in the Nine Elms Goods-yard of the London and South-Western Railway Company, by permission of Mr. Charles Scotter, general manager.

The inventions, which have been selected for competition by the executive committee, will be divided into two classes, viz., automatic and non-automatic; and three prizes will be awarded in each class of £100, £50, and £25 respectively. The jurors for awarding the prizes will be Mr. C. E. Stretton, Mr. Laurence Saunders, Mr. Joseph Stephenson, of the North-Eastern Railway; and the executive committee of the society. The following are the conditions decided upon by the executive committee as essential to efficiency:—

Class I.—*Non-automatic couplings.*—(1) The operations of coupling and uncoupling must be performed quickly and with ease on either side of the wagon. (2) The apparatus should be equally efficient for coupling or uncoupling with a wagon fitted with ordinary hook and links. (3) Accidental uncoupling must be impossible. (4) If the apparatus should be out of order it must be possible to couple or uncouple the wagons as at present. (5) There must not be any projection at the sides or otherwise, with which the men might be accidentally struck. (6) The present draw-bar hook should not be disturbed. (7) The parts must be capable of rough usage, and not liable to get out of order.

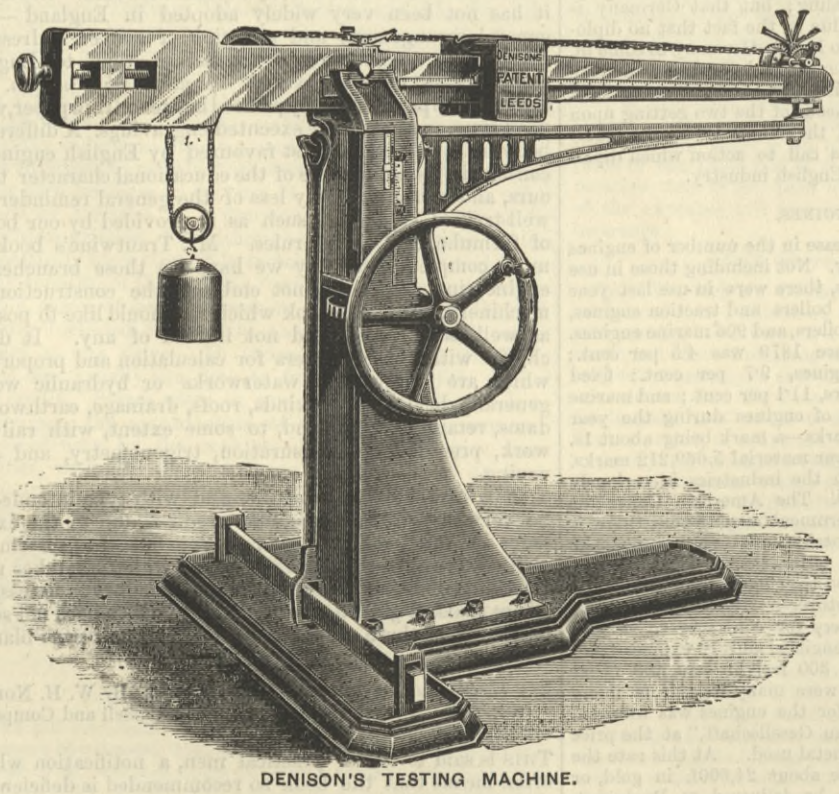
Class II.—*Automatic couplings.*—(1) It must be possible to couple two or more wagons instantaneously on coming in contact with each other, and without the assistance of the shunters. (2) It must not be possible for wagons to couple on coming in contact with each other unless required to do so. (3) It must not be possible to uncouple accidentally. (4) The operation of uncoupling must be performed with quickness and ease on either side of the wagon. (5) It must be possible to couple easily with a wagon fitted with the ordinary draw-bar hook and links. (6) It must couple or uncouple, if required, on curves. (7) The links or shackles must be flexible and admit of wagons running together without the possibility of uncoupling. (8) The flexibility of the present links must be provided for to prevent accidents or injury to the apparatus or otherwise from rigid projections or parts. (9) There must not be any projections whatever liable to cause accident or injury to shunters. (10) The apparatus, as a whole, must be strong, durable, and reliable. (11) The operation of putting the apparatus in position to couple, as also the operation of uncoupling, must be possible with one hand.

The wagons will be placed in position in a reserved siding ready for inventors to affix their apparatus, on Wednesday, March 17th, and the necessary work must be completed and the couplings ready for trial by twelve at noon on Saturday, March 27th. Those forwarding their own or other wagons must also comply with the latter condition.

The necessary authority to visit the siding for this purpose must be obtained at the office of the society, 306, City-road, by application to Mr. E. Harford, the general secretary.

DENISON'S PATENT TESTING MACHINE.

At the present time when brands, qualities, and prices of pig iron are so numerous, it has almost become imperative for every ironfounder to be provided with a testing machine. The machine we illustrate this week has been specially constructed to meet this want, and the inventors claim for it that it will be found simple, efficient, convenient, and, above all, perfectly accurate. It does not require a skilled operator to use it, the recording mechanism for both strain and deflection being entirely automatic. The strain is applied to the test-piece by turning a hand wheel in front of the machine, which actuates a worm, worm wheel, and screw, raising the upper part of the machine carrying the indicating steelyard on planed slides. The test bar is fixed, as shown, in suitable clips on the base-plate of the machine, 3ft. apart, and is connected to the back centre of the steelyard by a suitable rod. The travelling weight or counterpoise is propelled by a hanging weight, and its chain passes round a toothed wheel driving an air brake or fan. When the steelyard is in equilibrium, the air brake is prevented from working by means of an intervening stop, and is only released when the free end of the steelyard is raised consequent upon a strain being applied to the test-piece, through the connecting-rod. It will easily be seen that the counterpoise can only travel so far as is necessary to bring the steelyard into equilibrium, and the amount of strain indicated can be accurately read off on the graduated bar upon which the counterpoise travels; no shock, jerk, or unrecorded strain can possibly occur. The amount of extension or deflection of the specimen is indicated by a scale fixed on the rising part of the standard. The machines are verified by standard weights before being sent out of the works. They are compact and supply a very efficient method of making a class of tests hitherto carried out for the most part in a lumbering and inaccurate way.



DENISON'S TESTING MACHINE.

TENDERS.

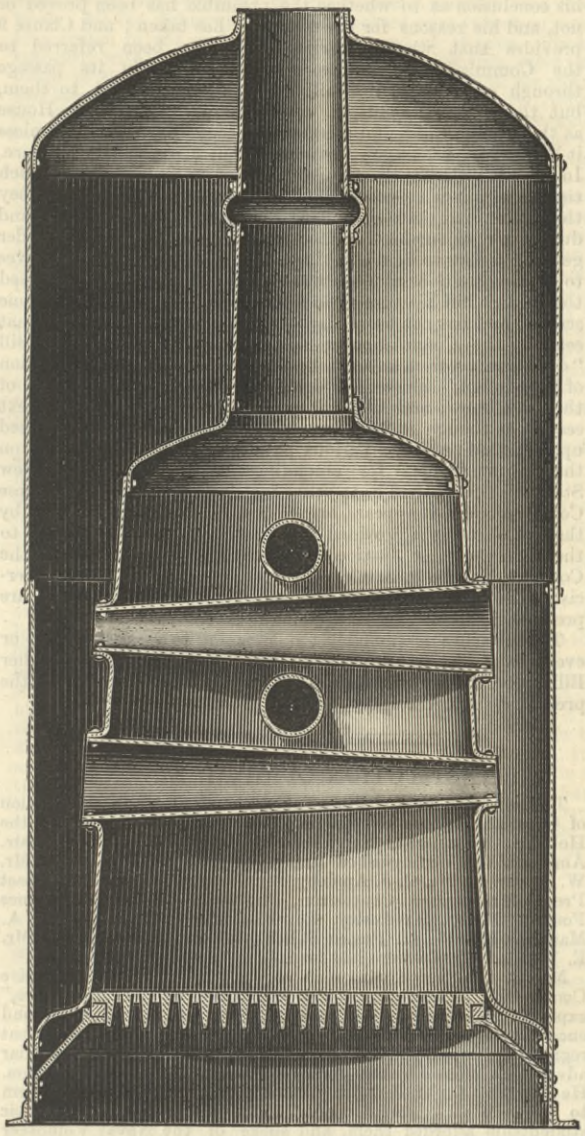
BARMOUTH.

For extension of slipway at Lifeboat Station for the Royal National Lifeboat Institution. Mr. Thomas Roberts, Assoc. M. Inst. C.E., engineer.

	£	s.	d.
W. Williams, Barmouth	235	10	0
H. Jones, Barmouth—accepted	227	0	0
Engineer's estimate	223	3	4

Mrs. Templeton.—With much regret we have to record the death—after a long and painful illness—of the aged widow of the late William Templeton, author of many mechanical books. The poor old lady died at the humble abode of her eldest surviving daughter, 24, London-street, London-road, S., on the 28th ult., and was buried at Nunhead Cemetery on the 6th inst. It is very painful to have to state also that the last illness of poor Mrs. Templeton was borne under pressure of great pecuniary difficulties, and that her bereaved family are suffering at this moment from the same sad circumstances. We understand that Mr. Joseph Newton, late of H.M. Mint, and who has long been a friend of the Templetons, would willingly receive and transmit to the survivors any donations that might be sent to him at the Institution of Civil Engineers.

CURTIN'S FLUE AND FURNACE TUBES.



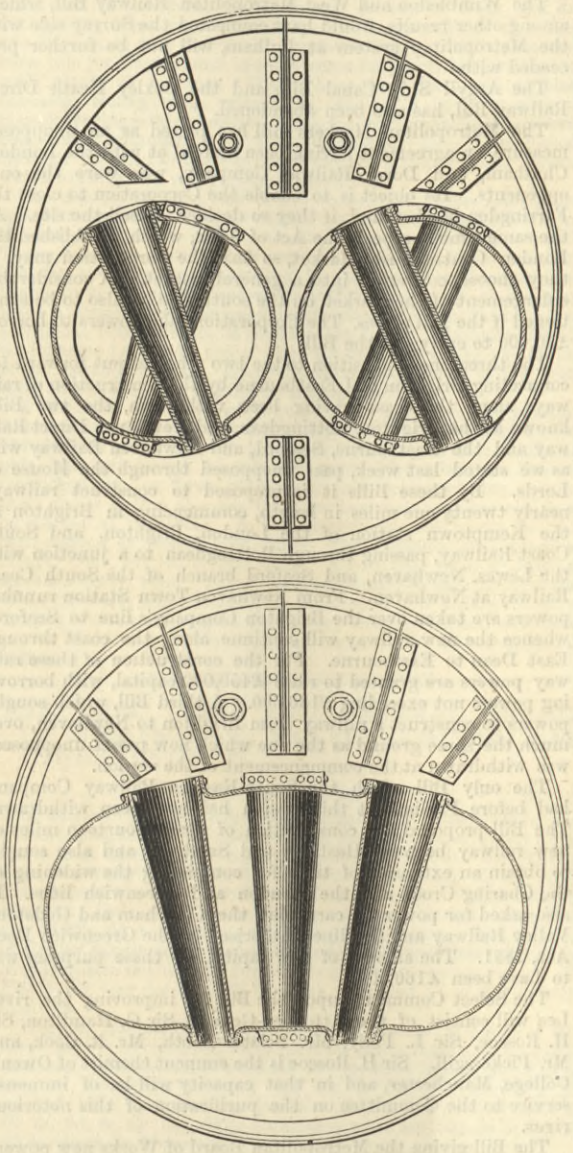
CURTIN'S BOILERS.

We illustrate above a method of fixing cone and parallel tubes in the flues of Cornish, Lancashire, and "Galloway" boilers, and also in the fire-boxes of vertical boilers, as patented by Mr. Edward J. Curtin, of Bristol. The tubes are made without flanges, and are by preference rolled and lap welded, or solid drawn steel, and the boiler flues or furnaces are flanged to receive them, thus removing all the rivets from the action of the fire or heated gases. The advantages claimed are that a thinner tube can be used, say $\frac{3}{16}$in. or $\frac{1}{4}$in. thick, and of uniform thickness throughout. A large number of tubes can be used in a boiler of given dimensions, thus increasing the heating surface; fully one-third less rivetting, and all rivets in the water; the tubes expanded in their respective holes before being rivetted, thus making a perfect joint. In case of renewals the cost is greatly reduced, as the tube is cheaper and much easier fitted than the flanged tube; it will pass through any manhole, and therefore does not require the boiler front to be removed or the flues to be withdrawn.

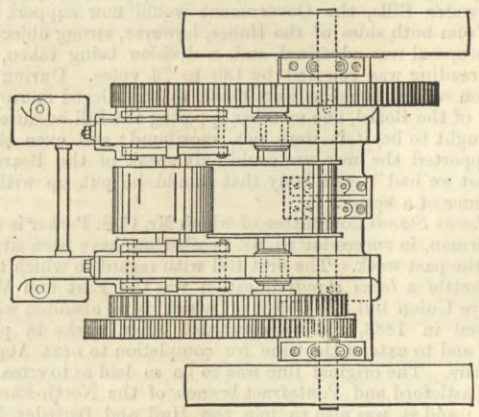
It is claimed that to vertical boilers, where the fire is so close to the tubes, the invention is particularly applicable, as the double substances of the flanges of the old form of tube, and of the fire-box of the boiler, with the rivets connecting them, all exposed to the most intense heat, are often the cause of much trouble and many stoppages. For replacing the patent tubes in boilers, from which flanged tubes have been withdrawn, loose collars of steel of suitable shape are supplied and rivetted to the old holes in the boiler flues, and the parallel tube can then be fixed as before described. Our illustration shows Curtin's tubes as applied to a vertical boiler and a Cornish or Lancashire boiler. The engravings explain themselves.

HALL'S GRADUAL REDUCTION ROLLS FOR HARD SUBSTANCES.

Broadly speaking, there are two systems of reducing hard and refractory substances in use at the present time. The first, for the treatment of ores quartz, consists of a series of stamps operated by any convenient prime mover, and used principally by the mining interest throughout the world. Under this mode of working the material to be reduced is pounded between a falling weight or stamp-head and a fixed anvil-shoe. The second system is by trituration, or by grinding under French or other burr stones. This latter method is most favoured by the manufacturing interest, and used chiefly in the production of Portland and other cements, phosphates, gypsum, lime, and other equally hard substances in use in various chemical processes. Modifications of the above for roughly preparing such hard substances have been adopted, such as, for instance, Cornish rolls, edge runners, &c. Of late years there have been many attempts to introduce machines more or less based on percussion at high speeds, but they have been generally abandoned by experienced men. The marvellous success of the roller system of milling induced Mr. Hall to extend the method of working to the more refractory materials dealt with in mining operations. Of course a very different construction and strength of machine is required for the treatment of ores to that adopted for milling purposes. It has nothing in common with the roller mill except the principle of uniformity and gradual reduction, the material passing automatically as it is reduced from one machine to the other until the desired comminution of particles is obtained. The ore is first crushed between the jaws of a stone-breaker so as to bring it down to the size of road metal. It afterwards may pass to a second breaker, where large quantities are required, as in the case of mining. This machine brings it down to $\frac{3}{4}$ cubes and less. It then follows by gravitation to the pulveriser, which has a special arrangement

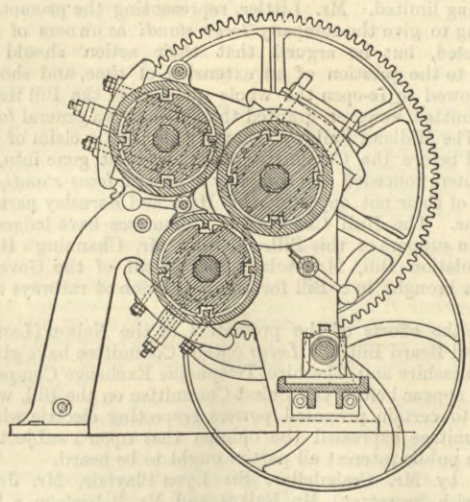


of rolls for treating the products of the breaker, reducing the same to the size that passes through $\frac{1}{4}$in. mesh. This is further treated by a second and third machine, where a fine degree of grinding is required, such as is necessary for tin ore or quartz. The material is now either classified in the usual manner by jigging or passed over the amalgamating apparatus, but for



GROUND PLAN

either gold or tin the degree of comminution must be exceedingly fine. From the stone-breaker the material passes through the upper crushing rolls, which are suitably grooved so as to grip the stuff, and of sufficiently large a diameter as to be thoroughly effective. The bottom roller is of the same diameter, and rotates



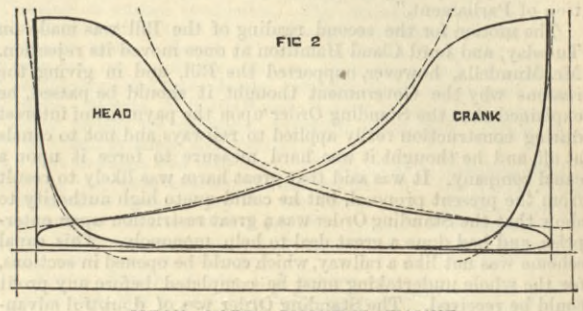
CROSS SECTION

from two to three times as fast as the top ones, thus clearing away the ore as it falls. Weighted scrapers are used to prevent the adherence of the particles of ore. It is also better to turn the third or pulverising roll by a belt or motion independent of the two upper ones. The machine following may, according to Mr. Hall, be run at a rather higher speed with plain rolls, the third roll having its circumferential speed increased to four times that of the upper rolls, and the finishing machines should be run five to six times as fast, so as to produce impalpable powder or something approaching it. As the machines are now constructed the axle-boxes of each journal converge to one common centre, *i e.*, to the main driving roll against which the work is done. Very powerful elastic steel trussing springs are attached to the axle-boxes of the expanding rolls, these being instantly adjustable for finer or rougher crushing, and capable of exerting a pressure on each roll of from a few pounds up to twelve tons.

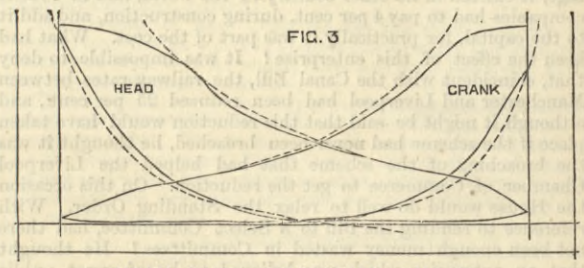
The machines described are made by Mr. C. E. Hall, of the Standard Ironworks, Sheffield.

AMERICAN STEAM ENGINES.

In our last impression two diagrams were inadvertently transposed, with the effect of rendering a portion of the article on



MEAN CARD, BUCKEYE ENGINE.



MEAN CARD, SOUTHWARK ENGINE.

American steam engines, page 188, obscure. We therefore reproduce the diagrams with their proper titles.

PRIVATE BILL LEGISLATION.

Once more the Manchester Ship Canal Bill has come before the House of Commons upon a direct issue, and a most important decision—one which will probably have considerable effect upon many other schemes in the future—has been arrived at. Most people are aware by this time that the purpose of the Bill of this year is to enable the Canal Company to pay a dividend of 4 per cent. out of the capital during the construction of the canal, the limit of capital so utilised to be £750,000. As the deputation to Mr. Mundella, which we mentioned last week, pointed out, the work could not be carried through without this power, because it was found that people in Lancashire would not subscribe when they would have to wait some years—certainly four years, and possibly five or six—for any return upon their investment. The opponents of the canal—strong bodies, such as the Liverpool Corporation, the Liverpool Chamber of Commerce, the Mersey Docks Board, the London and North-Western Railway Company, &c.—having failed to defeat the original scheme in the Committee rooms, saw in the new Bill another opportunity of attack, and a few days ago they in their turn waited upon Mr. Mundella to obtain his alliance against the measure. They favoured the right hon. gentleman with a number of strong speeches, and described the Canal Bill as having been passed last year only on these condition:—(1) That the line of the canal was altered; (2) that clauses were inserted in the Bill providing to the effect that, unless £5,000,000 of the share capital was subscribed for within two years from the passing of the Act, the canal works should not be commenced at all, exclusive of the Bridgewater Canal purchase; and also that the deposit, amounting to £276,000, should be impounded for three years from the passing of the Act; and other conditions and penalties were imposed with regard to the engineering works; and they contended that the new Bill ought not to be passed by Parliament—(1) Because it is distinctly a breach of the Parliamentary settlement of last year, and of which the opponents are entitled to take the benefit; (2) because the Bill is contrary to the spirit of the Standing Orders of the House relating to payment of interest out of capital during construction of works; (3) because it is contrary to the best interest of the community at large that payment of interest out of capital during construction should be allowed in any case. Mr. Mundella of course promised all consideration to their views, but he intimated that the Board of Trade could take no action on one side or the other on the question of giving the opponents a *locus standi*.

Following upon this deputation Lord Claud Hamilton, one of the Liverpool members, gave notice that he would move the rejection of the second reading of the Bill in the House of Commons on Monday last, and would further move, if the second reading were carried, first, that the Bill be referred to a Select Committee; and next, this unusual resolution:—"That all petitions against the said Bill already presented, or which may be presented not later than three clear days before the sitting of the Committee, be referred to the Committee; and that such of the petitioners as pray to be heard by themselves, their counsel, agents, and witnesses, be heard upon their petitions, if they think fit, and counsel heard in favour of the Bill against such petitions." A few days later both promoters and opponents interviewed Mr. Courtney, who was Financial Secretary to the Treasury in the last Liberal Government, and is now Chairman of Ways and Means; and the result of their representations appeared in the debate on the second reading.

In the meantime, a report upon the question had been issued by the Board of Trade, in which the following statements were made:—"The promoters inserted in each of their Bills a clause enabling them to pay interest during construction. In the first Bill, which began in the House of Commons, the clause was passed, but the preamble of the Bill was lost in the House of Lords. In the subsequent Bills, both of which commenced in the Houss of Lords, the Chairman of the Committees of that House struck out the clause as objectionable in principle, and substituted the clause—section 214—which it is now sought to repeal. In the session of 1882 a Select Committee of the House of Commons were appointed to consider and report whether Standing Order 167, prohibiting the payment of interest or dividend on calls during the construction of a railway should be maintained or modified; and the Committee reported their opinion that, in special cases, they recommended that companies

should be permitted to pay interest upon capital during the construction of railways or tramways, subject to certain conditions which were, after debate in the House of Commons, inserted in Standing Order 167 at the end of session 1883. These conditions are still in force in the House of Commons, but have not yet been inserted in the Standing Order of the House of Lords. The conditions contained in Clause 3 of the present Bill are in accordance with Standing Order 167, and similar to those contained in the Regent's Canal City and Docks Railway Act, sanctioned by Parliament in the session of 1885." And then followed this important opinion :—"The provision proposed to be made by this clause with regard to the mode of raising the capital for the construction of this Canal, appears to the Board of Trade to be deserving of the favourable consideration of Parliament."

The motion for the second reading of the Bill was made on Tuesday, and Lord Claud Hamilton at once moved its rejection. Mr. Mundella, however, supported the Bill, and in giving the reasons why the Government thought it should be passed, he explained that the Standing Order upon the payment of interest during construction really applied to railways and not to canals at all, and he thought it was hard measure to force it upon a canal company. It was said that great harm was likely to result from the present proposal, but he could quote high authority to show that the Standing Order was a great restriction upon enterprise, and had done a great deal to help monopoly. This canal scheme was not like a railway, which could be opened in sections, for the whole undertaking must be completed before any profit could be received. The Standing Order was of doubtful advantage, it existed in no other country in the world, and in France companies had to pay 4 per cent. during construction, and add it to the capital, for practically it was part of the cost. What had been the effect of this enterprise? It was impossible to deny that, coincident with the Canal Bill, the railway rates between Manchester and Liverpool had been reduced 25 per cent., and although it might be said that this reduction would have taken place if the scheme had never been broached, he thought it was the broaching of the scheme that had helped the Liverpool Chamber of Commerce to get the reduction. On this occasion the House would do well to relax the Standing Order. With reference to sending the Bill to a Select Committee, had there not been enough money wasted in Committees? He thought that an enterprise which was believed to be of great public utility should not be obliged to pit itself in Committees against rich companies like the London and North-Western.

Other members spoke for or against the second reading, and Mr. Courtney, while not opposing the motion, urged that the Bill ought to be referred to a Select Committee, simply upon the alteration in the financial basis of the scheme. Eventually the Bill was read a second time without a division, and then the motion to refer it to a Select Committee was defeated on a division by 375 to 61. So far, therefore, as the House of Commons is concerned, the principle involved in this Bill is established, and the promoters are saved all the expense, trouble, and delay of another Select Committee. The third reading is not likely to cause further serious difficulty, but the prospect is hardly so bright in regard to the action of the House of Lords.

An interesting return ordered last session, relating to the time and money expended upon the Canal Bill—exclusive of fees to counsel and witnesses, which by themselves reached an enormous sum—has at length been issued. In the first year—1883—the Commons' Committee sat 39 days, and the Lords' Committee 10 days on the Bill; before the two Committees 204 witnesses were examined; and the promoters spent £1423, and the opponents £1432. In 1884 the Lords' Committee held 41 sittings, and the Commons' Committee 20; the witnesses examined were only 60, while the promoters spent £1216, and the opponents increased their expenses to £2139. In the final, and successful, effort last session the Commons' Committee devoted 35 days to the Bill, and the Lords' Committee 30 days; the promoters only expended £916, while the opponents' expenses fell to £1527. Only 40 witnesses were examined. From these figures it appears that 175 days were occupied on the Bill by Committees of both Houses, 300 witnesses were examined, the promoters spent £5099, and the opponents £8656. Considering the duration and nature of the struggle these sums will appear small, but it must be remembered that they only represent the Parliamentary fees, and not those of witnesses and counsel.

The poll of the ratepayers demanded by the opponents of the proposal that the Salford Corporation should invest £250,000 in the canal undertaking has been completed, and the result declared—16,653 ratepayers voted for the proposal, and only 2443 against it, thus giving a majority for the proposal of 14,210. Rather more than 30,000 voting papers were issued, but 5000 were returned owing to deaths, removals, &c.; and of the 21,000 brought in by the collectors, 4000 bore no mark either for or against, and 300 were rejected for defects. With all these deductions, the decision of the borough was remarkably clear and emphatic.

Mr. A. G. Lyster, C.E. (engineer to the Mersey Docks and Harbours Board) read a paper upon the Ship Canal at a meeting of the Liverpool Engineering Society on Wednesday.

In the House of Lords the following Bills have been read a second time since our last notice :—Manchester, Bury, Rochdale, and Oldham Steam Tramways Bill, Easton and Church Hope Railway Bill.

The Kensington Vestry Bill has been read a third time in the House of Lords and been passed.

The London, Chatham, and Dover, Midland Great Western of Ireland, and the Pewsey and Salisbury Railways Bills have become unopposed, and have passed the Unopposed Bills' Committee.

The Midland Railway Bill has, after all, been read a second time in the House of Commons, Sir Bernard Samuelson withdrawing his opposition at the last moment. Some of the objections that have been raised to the Bill in reference to preferential rates are to be met by special clauses to be introduced in Committee.

The promoters of the Beaconsfield, Uxbridge, and Harrow Railway, which was sanctioned by Parliament in 1882, having deposited two Bills, one asking for an extension of time within which to construct the railway as authorised, and the second for leave to abandon the railway and dissolve the company, have decided to drop the Bill for an extension of time, and to proceed only with the one for the abandonment of the railway, which, it is understood, will pass without opposition through the House of Commons.

In the House of Commons the following Bills have been read a second time without debate :—Leeds Hydraulic Power Company Bill, Lincolnshire Marshes and East Coast Railway Bill, Louth, Mablethorpe, Sutton, and Willoughby Railway Bill, Mersey Railway Bill.

The Bill authorising the Bristol Corporation to construct new docks has been passed by a Select Committee of the House of Lords.

The Channel Tunnel Bill, being persisted in despite the opposition of the Board of Trade, has been declared to have complied with the Standing Orders.

The Wimbledon and West Metropolitan Railway Bill, which, among other results, would have connected the Surrey side with the Metropolitan system at Fulham, will not be further proceeded with.

The Argyll Ship Canal Bill, and the Bexley Heath Direct Railway Bill, has also been abandoned.

The Metropolitan Markets Bill has passed as an unopposed measure, an agreement having been arrived at with the London, Chatham, and Dover Railway Company, who were the only opponents. Its object is to enable the Corporation to close the Farringdon Market, and, if they so decided, to sell the site. At the same time it repeals the Act of 1882, which established the London Central Fish Market, so that the Corporation may, if they choose, convert it into a general market. A considerable enlargement of the market on the south side is also to be sanctioned if the Bill passes. The Corporation take powers to borrow £50,000 to carry out the Bill.

The threatened opposition to the two schemes put forward for connecting Brighton and Eastbourne by the construction of railways along the coast having been withdrawn, the two Bills known as the Brighton, Rottingdean, and Newhaven Direct Railway and the Eastbourne, Seaford, and Newhaven Railway will, as we stated last week, pass unopposed through the House of Lords. By these Bills it is proposed to construct railways nearly twenty-one miles in length, commencing in Brighton at the Kemptown station of the London, Brighton, and South Coast Railway, passing through Rottingdean to a junction with the Lewes, Newhaven, and Seaford branch of the South Coast Railway at Newhaven. From Newhaven Town Station running powers are taken over the Brighton Company's line to Seaford, whence the new railway will continue along the coast through East Dean to Eastbourne. For the construction of these railway powers are granted to raise £450,000 capital, with borrowing powers not exceeding £136,600. A third Bill, which sought powers to construct a railway from Brighton to Newhaven, over much the same ground as the one which now passes unopposed, was withdrawn at the commencement of the session.

The only Bill which the South-Eastern Railway Company had before Parliament this session has now been withdrawn. The Bill proposed the construction of nearly fourteen miles of new railway between Hastings and Sandgate, and also sought to obtain an extension of time for completing the widening of the Charing Cross and the London and Greenwich lines. It also asked for power to carry out the Caterham and Godstone Valley Railway and the line authorised by the Greenwich Dock Act, 1881. The amount of new capital for these purposes was to have been £160,000.

The Select Committee upon the Bill for improving the river Lea will consist of the Attorney-General, Sir G. Hamilton, Sir H. Roscoe, Sir L. Pelly, Mr. Sclater-Booth, Mr. R. Cook, and Mr. Pickersgill. Sir H. Roscoe is the eminent chemist of Owen's College, Manchester, and in that capacity will be of immense service to the Committee on the purification of this notorious river.

The Bill giving the Metropolitan Board of Works new powers with regard to water supply Bills for London, has been summarily and effectively disposed of. The debate having been interrupted by the quarter to six Wednesday rule, was resumed on a subsequent day, and then Mr. Broadhurst, who on the previous occasion opposed the measure, announced that the Board of Works having agreed to relinquish the proposed power to initiate legislation of this kind, and simply to take power to oppose water Bills, the Government would now support the Bill. From both sides of the House, however, strong objection to the proposal was advanced, and, a division being taken, the second reading was rejected by 130 to 76 votes. During the discussion several allusions were made to the alleged moribund position of the Board, one member opposing the Bill because the Board ought to be, if it were not, moribund; and even those who supported the measure could only speak of the Board as "the best we had"—as a body that should be put up with in the absence of a better.

The *Locus Standi* Committee of which Mr. C. S. Parker is now the chairman, in succession to Mr. Pemberton, have been sitting during the past week. The first Bill with regard to which they had to settle a *locus standi* question was the East and West Yorkshire Union Bill, the object of which is to abandon works authorised in 1883, and to construct other works in place thereof, and to extend the time for completion to next August three years. The original line was to be so laid as to cross the Leeds, Castleford and Pontefract branch of the North-Eastern Railyay; and it was also to join the Hull and Barnsley line. From various causes the work has been delayed, and at the same time certain alterations have been found necessary. The land has not been acquired, as sanctioned by the Act of 1883; hence the new Bill. Before the *Locus Standi* Committee, Mr. Bidder on behalf of the North-Eastern Railway Company, some of whose land is to be purchased, claimed a right to appear against the Bill before the Select Committee, and without their *locus standi* being limited. Mr. Littler, representing the promoters, was willing to give the company *locus standi* as owners of the land affected, but he argued that their action should be restricted to the question of an extension of time, and should not be allowed to re-open the whole question of the Bill itself. The Committee, however, granted the petitioners a general *locus standi*. The Midland Railway Company also had a claim of the same kind before the Committee, but it was not gone into, as the promoters conceded the company a general *locus standi*, on condition of their not opposing the Hull and Barnsley part of the scheme. The Hull Chamber of Commerce have lodged a petition in support of this Bill. Besides Mr. Channing's Railway Regulation Bill, Mr. Acland, on behalf of the Government, has brought in a Bill for the regulation of railways and canals.

Despite the efforts of the promoters of the Nelson (Lancashire) Local Board Bill, the *Locus Standi* Committee have given to the Lancashire and Cheshire Telephonic Exchange Company a right to appear before the Select Committee on the Bill, with reference to certain proposed powers respecting electric wires. The Committee expressed the opinion that upon a subject of such large public interest all parties ought to be heard.

Backed by Mr. Craigdellar, Sir Lyon Playfair, Mr. John Morley (Irish Secretary), Mr. Raikes, and Mr. Robertson, a Bill has been introduced for the amendment of the present system of Private Bill Legislation in the United Kingdom. The measure contains in all twenty-one clauses, but we can only refer to some of the principal provisions which by themselves would completely revolutionise the existing method of procedure. It is proposed, in the first place, that her Majesty shall appoint three Commissioners, who shall be styled Parliamentary Commissioners, and shall receive a salary of £3000 a year each. To these Commissioners all Private Bills, which now would be referred to Select Committees, are henceforth to be referred. They will decide among themselves by which one or more of their number a Bill shall be considered, and each Commissioner shall possess all the powers and authority now exercised by Select Committees. Every Commissioner shall report to both Houses of Parliament how he has dealt with each Bill, giving his conclusion as to whether the preamble has been proved or not, and his reasons for the course he has taken; and Clause 9 provides that when a Private Bill has been referred to the Commissioners and so reported upon in its passage through one House, it shall not be again referred to them, but their report shall be accepted by the second House as though the Bill had undergone a second examination, unless it be referred back upon any amendment made in the measure. In the next place the Commissioners are to sit and act at such times and in such places, and to proceed in such manner as they think best, and shall sit during the whole of every session, and during all adjournments, except holiday adjournments, under general orders to be made. The Commissioners are themselves to decide questions of *locus standi*; and it is further proposed that if any Bill has been referred to the Commissioners in one session, and has not been heard and reported upon during that session, the Commissioners shall sit and examine the Bill "during any period covered by the prorogation and dissolution of Parliament," unless the delay has been due to the fault of the promoters; and the Bill shall then proceed in the next session as though it had been introduced, heard, and reported upon in that session. Various powers are to be conferred on the Commissioners for amending existing, or making new Standing Orders, and as to other matters of procedure. These Commissioners, it appears, are to act only in England, for by the last clause it is provided that Irish Bills shall be referred to the High Court of Justice in Ireland, and Scotch Bills to the Court of Session in Scotland, the judges of these courts exercising the same powers and following the same procedure as are prescribed for the English Commissioners.

This measure is probably too sweeping to pass this year, or even next; but following as it does upon motions and other Bills upon the same subject, it indicates that sooner or later the present system will undergo a radical reform.

THE INSTITUTION OF CIVIL ENGINEERS.

The eleventh annual dinner of the Students of the Institution of Civil Engineers took place on Thursday, the 4th inst., at the Holborn Restaurant, Sir Frederick Bramwell in the chair. Amongst the distinguished guests were Mr. J. W. Barry, Mr. W. Anderson, Mr. C. J. Appleby, Mr. W. H. Barlow, F.R.S., past Pres.; Mr. George Chatterton, Mr. John Dixon, Mr. James Forrest, Mr. C. Hawkesley, Dr. Hopkinson, F.R.S., Mr. J. A. Manning, Mr. W. H. Preece, F.R.S., Mr. Hy. Robinson, and Mr. E. Woods. Covers were laid for 166.

Mr. R. H. Thorpe, chairman of the Student's Representative Committee, in proposing "The Institution of Civil Engineers," expressed the gratitude of the students for the kindness and encouragement always accorded to them by the Institution, but regretted that they did not avail themselves fully of the peculiar advantages offered by the library and meetings of the Institution. He reminded the students that union is strength, and urged them to embrace all opportunities of social intercourse which their studentship afforded them, and spoke of the Naval Volunteer Corps, which they were asked to join. He alluded to the satisfactory increase of the average attendance at the students' meetings, and the successful formation of kindred associations at Glasgow, Hull, Liverpool, and Manchester. After touching on various other matters, he proposed "Health and Prosperity to the Institution of Civil Engineers." Sir Frederick Bramwell, in replying, said that he, in occupying that chair three times, had been trebly favoured by the students, whom he complimented on their attention at their meetings, and the lively interest in their welfare which they had excited in the Council, and he called attention to the wisdom of the Institution eighteen years ago in forming the class of students. Mr. R. von Lengerke having neatly proposed "The Guests," Mr. W. H. Barlow replied, giving an interesting description of the great changes which had taken place during his life. Mr. C. T. Clifton, hon. sec. of the Students' Representative Committee, in proposing the health of the "Secretaries of the Institution," regretted the absence of Dr. Pole and Mr. Eaton, and described the great assistance Mr. Forrest had bestowed on the students. In reply, Mr. Forrest said that the students ought to be congratulated for having had Mr. W. Stokes to so ably represent their wishes. Regretting the absence of his colleagues, Dr. Pole and Mr. Eaton, he expressed the strong interest that he felt for the students, whom he congratulated on having more papers to read, better attendance at the meetings, and better papers. Whilst congratulating the Students' Representative Committee on the establishment of local associations, he warned the London students that at some of these meetings excellent papers had been read, and that they must take care lest they be outstripped in the race. Mr. Preece, in proposing the "Students of the Institution," called them the backbone of that body, and Mr. Thorpe, one of the engineers of the Worthington Pumping Engine Company, in reply, said that as Pitt was but twenty-three when Prime Minister of England, the students were old enough for positions of great trust. He then, after describing how much the students had flourished of late, and how much it was due to the industry, influence, and intelligence of Mr. Wilfrid Stokes, formerly hon. sec. of the Students' Representative Committee, presented him with a gold chronometer as a token of esteem from his fellow students. Mr. W. Stokes replied in characteristic terms, and the evening was successfully brought to a close.

THE ELECTRIC LIGHT AT MUNCASTER CASTLE.

On the 2nd inst., at Muncaster Castle, near Ravenglass, a new installation of the electric light was, by permission of Lord Muncaster, inspected by a number of those interested in electric lighting. Some experiments were made to test the efficiency of the "Richardson-Nevile" Electric Regulator, described and illustrated in The Engineer of July 17th last. The installation at Muncaster Castle was carried out by Messrs. Edmondson, and consists of two Elwell-Parker shunt wound machines, each capable of supporting 120 lights of 16-candle power each. The machines are driven by a steam engine of 14-horse power nominal, made by Messrs. Robey and Co. It has two cylinders, 8¾in. diameter and 14in. stroke, fixed on a heavy cast iron base-plate, which also supports the boiler, and is of the "Robey engine" type. There are, further, fifty secondary batteries, which are charged by the dynamo so as to avoid the necessity of running the engine late at night. The engine is not only used for electric lighting, but also for sawing wood for the estate, for which purpose it is fitted with an ordinary high-speed governor, controlling a double-beat valve. When used for electric light purposes, this governor does not come into play, the engine being controlled entirely by the Richardson-Nevile electric regulator. It was set to work over six months ago, and, although left in the hands of an ordinary engine driver, it has continued to work most satisfactorily, and was found by those who made the tests in a state of the highest efficiency.

The tests made were as follows :—The engine was started, running the dynamo with one lamp only burning in the engine-room. A man was then sent round the castle to turn up the lights, as would be done in ordinary use, while the volt-meter was carefully watched to see the effect upon the electro-motive force. This remained constant at 120 volts, it being impossible to detect the slightest variation. The engine, as the lamps were turned on, increased in power and speed, the intensity of each light remaining

absolutely constant. Groups of lights on the brackets and electroliers, in tens, twenties, and thirties were turned in and out without making perceptible change in the electro-motive force. A most severe test—probably the most severe possible—was then tried. All the lights which could be lighted were turned on, and, by a switch in the engine-house, all turned off at once. Simultaneously with turning the switch the click of the slide valve was heard in the steam chest, showing conclusively that all the steam had been shut off, and that the engine was running empty. When all the lights were turned on the effect on the engine was equally instantaneous. These experiments were many times repeated, always with the same results. It is certain that a momentary change must really take place when large numbers of lamps are switched in or out, else no effect could be produced upon the engine. To ascertain this amount was the next object. The volt-meter was kept in the circuit and carefully watched by one observer, another as carefully observing the time, whilst a third manipulated the switch. A signal being given, the lamps on all switched out, the volt-meter needle was seen to make a sudden upward movement, instantaneously change its direction, and come gradually to rest again. The maximum variation, and that only for an instant, was not more than 5 per cent., and the whole time occupied by the regulator in shutting off steam from the engine, and bringing the electro-motive force to its normal intensity, did not exceed three seconds, the speed of the engine being reduced from 143 to 123 revolutions within that time.

Similar experiments were then tried with the accumulators with equally satisfactory results. The next test was made to show how far the boiler pressure could be raised without affecting the speed of the engine, the load remaining constant. Steam was allowed to run down from 75lb. to 40lb. pressure, and run up again to 80lb., the speed of the engine remaining constant within one revolution. It was remarked that though the regulator acted with most remarkable promptitude or suddenness there was not the slightest tendency to overrun or hunt. After making the foregoing test the visitors were conducted round the Castle and inspected the electric light in the various rooms and the fittings. The electroliers in the library are made of polished copper in the form of sprays and flowers, in each of which is an incandescent lamp. These are arranged with their switches so that one-third, two-thirds, or the whole number can be lighted at once. The effect was beautiful. The electroliers, together with most of the fittings, were made by Messrs. Edmondson and Co. from designs by Mr. Ferguson, the architect to the Castle. One man, we are informed, attends to the whole installation, occasionally leaving it for about half-an-hour to attend to itself. Messrs. Edmondson and Co. and Messrs. Robey and Co. are both proud of the success they have achieved in this installation, and expect it to serve as a model for others of a similar character.

LAUNCHES AND TRIAL TRIPS.

On the 1st inst. Mr. W. B. Thompson launched from the Caledon Shipyard, Dundee, the steel screw steamer Eddystone, the latest and largest addition to the fleet of the Clyde Shipping Company, Glasgow. Owing to the ways being frozen, the launch, which was to have taken place on Saturday, had to be postponed, and a large number of spectators assembled to witness the ceremony. With the view of ensuring a successful launch, most of the ways were taken out and fresh grease introduced, and after the trigger had been drawn the vessel glided smoothly into the water. She was subsequently towed to the crane berth in Victoria Dock to get her boilers and engines on board. The principal dimensions of the new vessel are: Length, 243ft.; breadth, 33ft.; depth—in hold—15ft. 9in. She is provided with poop deck, 151ft. long, and a topgallant forecastle, 52ft. long. She has been built to the highest class at Lloyd's, and is intended for the company's London and Glasgow passenger trade. In designing the vessel special attention was given to ensure ample room at the after end for the saloon and state-rooms, so that these are as large as it was possible to make them in a vessel with the Eddystone's breadth of beam, the result being that she has larger and better passenger accommodation than any of the other vessels of the company's fleet. There are five water-tight bulkheads, and three holds with three steam cranes and two steam winches conveniently placed for the rapid loading and discharge of cargo. Steam for the cranes and winches is supplied from a special boiler fired from the main deck. Water ballast is fitted under the after hold and in the fore peak to ensure a suitable trim for the vessel, irrespective of the quantity and nature of the cargo carried. Steam stearing gear—by Messrs. Muir and Caldwell, Glasgow—is fitted in an iron wheel-house at the fore part of the poop deck. The bulwarks, which are carried up to the same height as the poop and forecastle decks, are of massive construction, every frame being carried up the full height, and further strengthened by closely spaced dog-leg stanchions rivetted to the deck and to the top and centre of the bulwarks. Under the after end of the poop deck handsome and roomy accommodation is provided for sixty-four first-class passengers. The main entrance to the saloon is from an iron deckhouse, containing the smoking-room and saloon staircase. All the internal woodwork of this house is of solid teak, French polished. Protection to this house in stormy weather is provided by outside iron doors, in addition to the sliding teak doors for use in ordinary weather. At the foot of the staircase is a passage leading at the after end to the saloon, and at the fore end to the pantry, steward's room, &c. The state cabins, of which there are nine, including the ladies' cabin, are unusually large, and are ranged on each side of the saloon, from which they are entered through thwartship lobbies—one between two rooms. On the fore part of the poop deck, immediately abaft the wheelhouse, a comfortably fitted apartment has been arranged for the use of the captain. Below the forecastle deck rooms are fitted for the petty officers and deck passengers. The seamen and firemen's quarters are on the 'tween deck forward, and contain accommodation for sixteen men. On the main deck, along the ship's side, from the fore part of the poop to the after part of the forecastle, the deck space is occupied by stalls, for the conveyance of about 100 head of cattle, and under the fore part of the poop horse stalls have been erected. Around the vessel's side an elm fender faced with iron is carried, and at the quarters similar fenders are fitted for the protection of the propeller. The Eddystone is rigged as a topsail schooner, the masts being of steel to Lloyd's requirements. She carries four boats—two of which are lifeboats—supported on wrought iron skids, 6ft. above the deck, so as not to interfere with the deck space for promenading. The specifications of the hull and machinery were drawn by Mr. Hamilton, engineer to the company, under whose superintendence the work has been carried out. The engines have been built at Mr. Thompson's Tay Foundry, Dundee, and are of the triple expansion type, having cylinders 23in., 37in., and 58in. diameter respectively, with a piston stroke of 48in., each engine working on a separate crank. The crank shaft is made of wrought iron on the built principle, having three cranks set at an angle of 120 deg. to each other. The ordinary slide valves are adopted for all three engines, with the usual link motion, the high-pressure engine only having an arrangement for the variable cut off. A Drysdale's centrifugal circulating pump and engine combined is provided for circulating the water through the condenser, and Weir's patent feed heater apparatus and automatic pumps are also adopted. Steam is supplied by two multitubular boilers constructed of steel, to Board of Trade and Lloyd's rules for a working pressure of 135 lb. per square inch, each boiler having three of Fox's patent corrugated flues.

AMERICAN NOTES.

(*From our own Correspondent.*)

New York, February 27th.

A great deal of new work by way of extension of iron and steel-making capacity is being undertaken and projected in the New England and Middle States. Within the past week or ten days some fifteen or twenty companies have been incorporated for manufacturing purposes, with an aggregate capital of a million and a-half dollars. The manufacturers of the States are exhibiting a great deal of confidence in the future growth of trade, and are anticipating these requirements by liberal expenditure of money at a time when they feel that material is cheap. Mills that have been idle for months, and in some cases for years, have started up with plenty of business. Wages have been advanced at blast furnaces, rolling mills, wire mills, and at a large number of manufacturing establishments. In some cases these advances have been made voluntarily; in other cases they have been forced, through the mediumship of the compact organisation of labour, which extends into every State in the Union.

The scarcity of coke, due to the Connelville strike, has caused several furnaces to bank up within the past week, and is reducing the output of those which are obliged to depend upon raw fuel. The puddle mill of the Bethlehem Iron Company, which has been idle for several years, started up last week. Work has just been begun in the Republic Ironworks at Pittsburgh, and at the same place a Bessemer and an open-hearth plant are to be built, and an additional blast furnace is to be erected. In Alleghany County six furnaces have gone out of blast within a few weeks, on account af the scarcity of coke. Quite a number of furnaces in the West have also banked up, waiting for a supply of fuel.

A structural ironworks are to be built at Union Town, in Western Pennsylvania. Natural gas in that region is attracting a great deal of industrial enterprise. A large manufacturing firm in Philadelphia has just leased a valuable gas-making plant in Eastern Ohio, and two or three glassmakers are contemplating moving their plants within the gas belt. A new merchant bar mill is to be erected at Scottville. A new co-operative nail works has just been started at Steubenville, Ohio. The Junction steel plant at Mingo, Ohio, started up last week. A wire mill is to be built at Martin's Ferry, Ohio. These are given simply as samples of scores of similar enterprises projected. Architects and builders in all of the larger cities are preparing for a very active year, and enterprise is not likely to be discouraged by any material enhancement of values.

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

(*From our own Correspondent.*)

The dulness which has come over the galvanised sheet trade, and which is seen in the circumstance that the galvanisers are not doing more than about half work, sufficiently accounts for the existing lack of activity in the black sheet business. Many of the sheet ironmasters are only running half their mills. Prices are no stronger. Galvanised sheets of 24 gauge, f.o.b. Liverpool, bundled, are £10 7s. 6d. to £10 10s., and 27 gauge £12 easy. Black sheets of similar gauges are quoted £6 5s. and £7 5s. respectively, delivered to galvanisers' works. Common sheets of 20 gauge are easy at £6. Plates are very quiet, at £7 for tank sorts and £8 to £9 for boiler qualities.

Shipping trade is by no means up to the average, although of late there have been some fair inquiries from Continental and American markets. Moderate requirements are reported in best qualities of iron on Australian account. £7 10s. is still the standard for marked bars, and medium qualities find rather a slow sale at £6 2s. 6d. to £6 5s., while commoner sorts are bought as low as £5 5s. down to £5 per ton.

The marked bar makers continue to offer a second quality of iron in addition to their best branded sort, and for this they are content to accept £1 to £1 5s. per ton under the list which regulates wages. This condition of things is exemplified, for instance, in the current basis prices at works of the New British Iron Company. These are: "Lion" bars, £7 10s. per ton; best Corngreaves ditto, £6 10s.; steel ditto, £7 10s.; Corngreaves patent compound ditto, £9. Lion slit rods, £7 10s.; C.G.C., £7; best Corngreaves, £6 5s. per ton. Lion plates, £9; best Corngreaves, £8; tank, £7. Lion angles, £8 5s.; and best Corngreaves, £7. Lion tees, £8 10s.; and best Corngreaves ditto, £7. Lion hoops, £8; and best Corngreaves, £7.

Steel is offered at very favourable prices, particularly for qualities made in other districts. Tin bars, blooms, and billets, of Welsh and Sheffield make, are now all to be had at £4 15s., delivered here; and plating bars at £5 2s. 6d. to £5 5s.

In the pig iron trade, consignments are going forward on account of contracts, but new business is not extensive. Best mine pigs range in quotation from 55s. to 52s. 6d.; part-mine, 40s.; and common or cinder pig iron, 30s. to 32s. 6d. per ton. Midland pigs are going off in small lots. Northamptons are 36s. 6d. to 37s. at railway stations in this district, and Derbyshires, 37s. 3d. to 38s. The Wellingborough brand of best gray forge pig is quoted at 39s. 6d. Hematites are mostly 53s. to 53s. 6d., and the Blaenavon Company is making some good sales here to steel masters, and best iron masters at the latter figure.

The Blaevanon Company is getting some extraordinary prices for special quality hematites, for chilled roll making, and other best founders' work. The iron is smelted from charcoal coal, and thus obtains its superiority. For chilled roll making, the firm are getting £6 for their hematites. No. 1 foundry they quote £5 15s. 6d.; No. 2, £5 12s. 6d.; No. 3, £5 10s.; and No. 4, £5 7s. 6d. on trucks at works in Wales.

The Ironmasters' Association is in receipt of returns which have been obtained from the firms connected with the Iron Trade Wages Board showing the relative proportion in tonnage which is borne by the outturn of sheets compared with bars. The operative section of the Board has of late been urging that sheets constituted 60 or 70 per cent. of the present outturn, and that, therefore, wages should be upon a higher basis than at present. The masters, however, contend that the men are utterly wrong, and that the tonnage of bars and other merchant sections is still in excess of that of sheets.

The strike which has occurred at a couple or so of the Shropshire ironworks against an attempt by the masters to reduce wages to a larger extent than the arbitrator in South Staffordshire recently awarded is continued. The operatives concerned are subscribing members to the Staffordshire Wages Board, but the Shropshire masters are not members, though they contribute donations towards the expenses.

The annual meeting of the Ironmasters' Association was held at Birmingham, at the close of last week. Mr. Benjamin Hingley, M.P., chairman, presided, and the majority of the principal firms were represented. From the annual report it appears that the members now number 66. Among other business, the Rating Committee was reappointed, with power to employ professional assistance, in the case of appeals in their several stages being necessary.

Coal and iron masters have watched with much interest the opposition which Mr. Alfred Hickman, the member for West Wolverhampton, who is one of the largest iron and steel masters and colliery proprietors in this district, has, in common with Sir Bernard Samuelson, been leading in the House of Commons against the second reading of the new Midland Railway Bill. The breach of faith which the Midland Company committed in 1879 with the South Staffordshire traders, in refusing to reduce the rates upon minerals, notwithstanding its distinct promise, when in 1872 it obtained the Wolverhampton, Walsall, and Midland Junction Railway Bill, has long been a matter of serious complaint.

Those machinists and engineers in Birmingham who are busy occupy an exceptional position, and their activity results mainly from Government orders. The fitting up of the gun factory at Sparkbrooke, which has been recently acquired by the Government from the National Arms and Ammunition Company, and which, when in full work, will, it is reported, find employment to some 1500 or 2000 workpeople, is furnishing Messrs. James Archdale and Co. with some capital machinery orders. Messrs. Archdale are also turning out machine work of a similar class for the Birmingham Small Arms Company, who have contracted for a supply of rifles to our Government which will necessitate a full employ for a couple of years or so. Engineering work of a dockyard and an arsenal sort for our own and for foreign Governments is likewise being turned out by Messrs Archdale, who are running their establishment overtime.

Admiralty orders, including launch engines, compressed air reservoirs for torpedoes, and special machinery for torpedo catchers, are affording Messrs. George Belliss and Co. full employment even now that the firm have largely increased their means of production and extended their premises.

Engineers in Birmingham engaged in the gas engine trade are fairly well employed as times go, and makers of horizontal engines and hydraulic machinery are finding out the competition, and are having to curtail production. The demand for lathes and for machine cutting tools of an ordinary description is not brisk at the present time. Messrs. Hughes, Johnson, and Co. are well engaged on hydraulic, lifting, pumping, and brick-making machinery, and have lately extended their fitting and erecting shops. Messrs. A. Shirlaw and Co. have in hand Government and other orders for capstans, hydraulic machinery, lifting jacks, twist drill grinders, and the like.

The wrought iron tube trade is in so quiet a condition, and the prices so unsatisfactory, that certain of the makers have determined upon giving the operatives notice for a 10 per cent. reduction. The movement has been initiated at Wednesbury, and the fitting and socket makers at certain of the works there have this week come out on strike.

Messrs. Bayliss, Jones, and Bayliss, engineers, of the Victoria Ironworks, Wolverhampton, have just secured the contract for the supply of railway fastenings for the Belfast and Northern Counties Railway Company, Ireland.

The Director of Navy Contracts has this week sent into this district inquiries for a supply of black ironmongery and boat ironwork, iron plate workers' wares, brass and iron locks and hinges for the ensuing twelve months.

The expenditure on a new deep sewerage scheme at Wednesbury, which was estimated by the engineer to cost £30,120, has been exceeded by £5844. This is due to provisions which were laid down by the Local Government Board to meet the objections of property owners and which has involved an extra outlay in sludge pressing machinery, the deepening of works, and the substitution of iron for earthenware pipes.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—Continued stagnation of trade is still the general report throughout the iron market here, and the persistent downward movement in prices completely checks buying beyond absolute hand-to-mouth requirements. As regards Glasgow warrants, the lowest price since 1852 has been recorded during the past week, and other brands of pig iron that have only made their appearance in this market since the above date have touched a lower price than has ever before been known. The absence of any further definite information with reference to the recently proposed general restriction of the output of pig iron—which tends to confirm the opinion I have recently expressed in these "Notes" that a combined blowing-out of furnaces throughout the principal iron-producing centres of the country would be found impracticable—has necessarily had a weakening effect upon the market, to the extent that it has operated towards dispelling any anxiety which buyers might previously have entertained as to the possibility of any immediate advance in prices. Indeed, the want of confidence in the future is but too clearly indicated by the fact that even in the face of the abnormally low prices now ruling in the market, merchants, emboldened by the success of bear operations in the past, are still prepared to undersell. The present weakness shown by makers certainly encourages this policy on the part of dealers, who, as their deliveries to customers are required, have little difficulty in placing orders to cover these on terms favourable to themselves, and the only question is whether there is so large a weight of uncovered bear sales that an accidental combination of otherwise unimportant circumstances, producing a temporary upward movement in the market, might bring in a sudden rush of buying which would create a period of panic prices. The continued depressed condition of the iron-using branches of industry places beyond the bounds of probability any largely increased weight of requirements coming forward unexpectedly from consumers; but with the very close buying to the bare limits of only immediate requirements that has been going on for some time past, heavy uncovered engagements on bear accounts on the basis of present prices would seem to be certainly a hazardous species of speculation.

The Manchester iron market, on Tuesday, brought forward only an excessively dull demand for any description of iron. During the previous week or so there seems to have been rather more inquiry stirring, probably in anticipation of a possible blowing out of furnaces; merchants being a little more anxious to cover "bear" sales, and consumers showing less hesitation in giving out any small orders they might have to place. When, however, business has resulted, it has been only at the lowest possible prices; now, however, that the blowing out of furnaces seems to have become so improbable a contingency, and prices show so decided a downward tendency, buyers are again holding back any orders they are not absolutely compelled to place. Lancashire makers of pig iron, who still quote nominally 38s. to 38s. 6d., less 2½, delivered equal to Manchester, report practically little or no business doing at these figures, and where there are actual orders to be got they are open to offers. In district brands, where there is any business doing, it is at extremely low prices; there is no difficulty in buying Lincolnshire iron at about 36s. 6d. to 37s., less 2½, delivered here, and makers who hold for higher figures than these are really out of the market, except for occasional special transactions, or where buyers have a preference for some particular brand.

For hematites there is still only a very restricted inquiry. On small occasional sales about 52s., less 2½, delivered here, is got for good qualities of No. 3 foundry, but for anything like quantities, sellers are prepared with concessions, and prices are a matter of arrangement.

In the manufactured iron trade business remains in as depressed a condition as it is almost possible to be. In some cases portions of works have been closed entirely, and at others plant is only being run on half production, owing to the scarcity of orders. Quoted prices remain at about £5 2s. 6d. for bars, £5 10s. for hoops, and £6 12s. 6d. for local-made sheets delivered into the Manchester district. Makers, however, generally are so anxious to secure orders, that there is little or no adherence to quoted rates where prompt specifications are to be got, and bars delivered equal to Manchester can be bought without difficulty at £5 per ton.

In the engineering trade general slackness still characterises most branches of industry, and there is almost a complete absence of any orders of weight giving out. In the large locomotive building establishments, which have been exceptionally well employed until recently, little or no new work is being got, and the necessity of going on short time is being forced under consideration. Some of the tool makers report rather more inquiry stirring, and here and there an increased weight of business is being got, but generally it cannot be said that there is any real improvement.

Messrs. Browett and Lindley, of Manchester, have just completed for a paint works in London an 18in. horizontal engine, to give about 120-horse power, which is fitted with a new arrangement of valves on the Rider principle. The cut-off is controlled direct by a high-speed Porter governor driven by gearing from a lay shaft actuated by a drag link, on which also the excentrics are carried, thus bringing all the valve gear to the front of the engine, and leaving the crank shaft, which is exceptionally massive—about 9in. diameter and 8ft. long—free for carrying the gearing, &c., and enables a large main bearing to be used without bringing the centres

of the valves a long way out. The special feature in the valve itself is the method of rotating the Rider valves, which is accomplished by a connection to the valve spindle that allows for the working up or out of line of the main valve in either plane, and greatly diminishes the power required to twist the valve. A horizontal air pump and condenser, with the air pump rod connected to the piston rod direct, are attached, and apart from its special features, the engine is of exceptionally high finish throughout, with the forged work all through of steel.

The passing of the second reading of the Manchester Ship Canal Bill—the object of which is to enable the company to pay interest out of capital on the amount of shares called up during the period of construction—has been received with general satisfaction in the district, and with the additional powers obtained through this Bill the promoters have every confidence in the undertaking being carried out to a successful completion. No difficulty is apprehended with regard to raising the requisite capital, and the engineers have no doubt as to being able to complete the construction of the canal and the requisite additional works well within the period specified by the Act of Parliament obtained last year. The borough of Salford has given practical proof of its interest in the project by recently authorising the Corporation to obtain the requisite powers for taking up £250,000 in shares, and it is anticipated that similar practical support will be received from other public bodies in the district.

Various appliances for either the prevention or speedy extinction of fire are so constantly being introduced to the public that it is difficult to decide as to the comparative merits of the many different inventions. On Tuesday the Lewis hand fire extinguisher, an American invention, which consists of about a quart of a specially prepared fluid contained in a round tin tube 20in. long, from which it can in case of fire be readily thrown upon the flames, was tested on Tuesday before a numerous company of spectators in the large yard of the Albert-street police station. Several wooden structures had been erected, and these containing highly inflammable material were each in turn set on fire. After the flames had obtained a tolerably good surface hold, they were in each case extinguished in a few seconds by means of the Lewis extinguisher, and so far as a public trial was concerned the results were certainly satisfactory. The conditions under which such trials as these are usually carried out do not, however, appear the best means of judging as to the real merits of a particular appliance. In the first place, the fire is not contended with under the conditions which would arise under ordinary circumstances, whilst the appliance is manipulated by an assistant constantly engaged in this special work, and there is little doubt that if a fire were as promptly and effectively attacked with much simpler means, its extinction would in most cases be a matter of no very great difficulty, so that the apparent success so far as the particular appliance itself is concerned is frequently misleading.

In the coal trade business continues fairly active, so far as the demand for house-fire consumption is concerned, the protracted severe weather bringing forward extra requirements for the better classes of round coal, which are keeping the pits on pretty well full time. Common round coals, however, continue very bad to sell for steam and forge purposes, requirements for which show a tendency to decrease rather than to increase. Engine fuel is in very fair demand, with prices hardening slightly in some instances. At the pit mouth best coal is firm at about 9s. per ton, good second qualities at about 7s. 6d., and common house coals at 6s. Steam and forge coals do not average more than 5s. to 5s. 6d., and burgy 4s. to 4s. 6d., but slack fetches from 3s. to 3s. 6d. for ordinary, up to 3s. 9d. and 4s. per ton for the best descriptions.

In the shipping trade house-fire coal is moving off pretty freely, but for steam coals there is still only a slow sale, and ordinary qualities delivered at the high-level, Liverpool, or the Garston Docks, can be got at 7s. to 7s. 3d. per ton.

Barrow.—There is a quieter tone in the hematite pig iron trade this week, and the demand may practically be reported—for the moment, at any rate—to be dead. The business doing in Bessemer is more than ordinarily quiet, and the trade in forge and foundry iron is absolutely *nil*. Makers are fairly at work, considering the number of furnaces they have in blast; but the orders held are chiefly those booked before Christmas. Prices are steady at 43s. per ton net, at makers' works, prompt delivery, for mixed parcels of Bessemer iron, and 41s. 6d. to 42s. for forge and foundry iron. The stocks of iron in the Furness district have been somewhat reduced, but in Cumberland there is still a large weight of metal in stock. Steel makers are booking no orders for rails, and it is not thought probable any contracts will be given until the decision of the Steel-rail Makers' Association as to whether they will dissolve or not is made known. That information is likely to be known on Friday next. A good demand is experienced for tin bars, but it is probable that during the next few days the basis of price will be altered, in order to enable makers to compete successfully with foreign producers. Shipbuilders are in receipt of no new contracts. Engineers are quiet, except in the marine departments. Iron ore in slow sale. Coal and coke dull, but at steady prices. Shipping remains indifferently employed.

The Maryport Iron Ore Company has commissioned Messrs. Orr, of Moor-row, to start another bore-hole for them at Pallaflat.

A notice has been posted at the Whitehaven pits this week intimating a further reduction of 5 per cent. in the miners' wages. The reduction is to take effect in a fortnight's time.

The owners of the Crosby and Gilcrux collieries, West Cumberland, owing to the heavy accumulation of coal at the mines, have found it necessary to sanction the building of additional coke ovens. In a field adjoining these collieries men are now busy excavating the sites for the new coke furnaces which will be erected forthwith. Kilns and other appliances for the manufacture of firebricks from the clay found in the mines are also being erected and finding employment for a large number of workmen.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

The Board of Trade returns for February enable us to obtain accurate information of the progress of British trade so far as the year has gone. The exports of iron and steel last month amounted to £1,612,102, as against £1,480,087 for February, 1885, and £1,892,565 for February, 1884. As compared with February, 1885, the exports of iron and steel, therefore, show an increase of £132,015. Taking the first two months of the year, the increase is £166,295 on the corresponding period of 1885.

In hardware and cutlery the exports last February reached the value of £213,494, as compared with £216,626 and £231,090 for February, 1885 and 1884 respectively. The decreasing markets are Russia, Germany, Holland, France, Spain and Canaries, Argentine Republic, British North America, and British Possessions in South Africa. The increasing markets are the United States, Foreign West Indies, Brazil, British East Indies, and Australasia, the latter showing the greatest improvement, viz., from £43,547 to £52,625. Unwrought steel has been exported to the value of £76,800, against £61,843 and £79,672 for the corresponding months of 1885 and 1884. France, the first time for many months, shows an improvement—from £6257 to £7985—and the call for the United States is exceedingly encouraging, the value exported last month to that country being £27,954, against £12,952 for February of 1885, and £22,720 for February of 1884. Sheffield sent in January, 1886, a value of £14,463 in steel to the United States, and as the supply of steel to that market is mainly in Sheffield hands, it is presumed that the Sheffield houses have benefitted by the revival.

Steel rails do not show such a heavy decline, the value last month being £159,276, as compared with £170,382 for February, 1885. Taking the corresponding period of 1884 there is, of course, a great decrease, as a value of £230,886 was then exported. In railroad material of all sorts there was a great improvement, the value being £310,870 last month against £248,678 for the corresponding month of 1885. It is interesting to note that Russia, Germany, and Holland continue to take no rails from us. Egypt is again a customer to the extent of £1344; the United States has increased from £130 to £5560; the Argentine Republic from £5973 to £19,057; British North America from £11,478 to £15,118; Spain and Canaries from £28 to £2783; Italy from £7 to £1198; Peru from £1651 to £2841. On the other hand, Brazil has fallen from £12,401 to £400; Chili from £1817 to £779; British East Indies from £75,231 to £57,435; and Australasia from £39,638 to £33,569. For railroad iron of all sorts, by far the most important market is the British East Indies, which took a value last month of £163,351, against £118,078 in February of 1885. Australasia is at present a decreasing market. In February of 1884 the value exported was £90,576; the following February the value was lowered to £44,725, and last month to £42,622.

The discussion which has taken place on German *versus* English tools, particularly in regard to cutlery, has had one good effect; it has directed attention to the importance of British manufacturers endeavouring to meet the demand for low-priced tools while still maintaining their reputation for high-class articles. A local factor tells me that for years his firm bought a cheap, common pincers, of which their sale did not exceed an average of one gross per week. It was a miserable tool, and only the very poorest of the tool hands would make it. The market, he said, was open for a tool of the kind, and the Germans were prompt to seize the opportunity. They made a cheap tool which took the fancy of the market, and the demand for it became so great that his firm are now selling at the rate of 650 dozen per three months. These goods are sold as German manufacture and they do not go into the hands of practical men, but open out new channels; in fact, my friend doubts very much if they even affect the sale of English-made pincers, for in spite of the large sale they have literally created for them, his firm are selling about as many English pincers as ever. He mentioned similar cases with regard to saws and braces. The important point is—why should these goods not be made in Sheffield? We have all the facilities for doing it; but, he says, no maker will try. It certainly seems foolish for English makers to attempt to ignore the requirements of the million who want big value for their money, and who will have it, and who decline to have their tastes cultivated to suit the fancies of the manufacturer. The demand for cheap goods is a growing one, and the Germans have shown a very great capacity in adapting themselves to the requirements of the market.

Mr. George Liddell, of Roewood, Sheffield, has patented an automatic appliance for working and turning heavy forgings during the process of forging. This appliance comes in fitly at a time when the hydraulic forging process is being largely introduced into Sheffield for the production of huge military works to meet all the possible requirements of the Government Department. The appliance can be worked by steam or hydraulic power, and by means of it guns and other forgings can be manipulated up to hundreds of tons if required.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

Little progress seems to have been so far made as regards the proposal to restrict the output of pig iron, nor is there any present prospect of a successful combination for that object between the Scotch and Cleveland makers. At the market held at Middlesbrough on Tuesday last but few sales were made. The general feeling was one of depression, and prices fell to the level at which they were a fortnight ago, when as yet the idea of restriction had not been mooted. For prompt delivery No. 3 G.M.B. is now offered at 30s. per ton, but there are more sellers than buyers, and only small lots are changing hands. Forge iron is quoted at 29s. 9d. per ton. There are no inquiries for forward delivery.

The stock of pig iron in Messrs. Connal and Co.'s Middlesbrough store continues to increase rapidly, no less than 12,607 tons having been added during the week ending with Monday last. The stock on that day amounted to 192,750 tons. At Glasgow they hold the enormous quantity of 696,332 tons, which represents an increase of 4124 tons for the week.

There are very few inquiries for warrants, and the price has again declined to 30s. per ton.

There is no better news as regards the finished iron trade. The mills which are still kept open are in great need of fresh orders and specifications. Deliveries to the shipyards have been insignificant since the termination of the strike, owing to the hindrance to all outdoor work occasioned by inclement weather. Prices remain the same as quoted last week.

The returns issued by the Cleveland Ironmasters' Association for the month of February show that ninety-nine blast furnaces are now at work, and that the total make of pig-iron of all kinds was 198,640 tons. The stock of pig-iron in the district on the 28th amounted to 612,325 tons, being an increase of 38,495 tons over the returns for January. The increase in stocks which has taken place during the four winter months amounts to 168,000 tons.

Six steamers belonging to Messrs. R. Harrowing and Co., of Whitby, which have been for some time lying idle in the Tyne, are now being prepared for sea.

At all the seaport towns on the North-east coast an intense feeling of dissatisfaction has for some time prevailed on account of the frequent employment by shipowners of foreign, in preference to British, seamen. It would appear that this has often taken place at equal wages and on equal terms and conditions. Some shipowners justify the practice, contending that the foreigner is more docile and better behaved, whilst quite as efficient as the English sailor. The foreigner does not strike, he does not desert his ship when he has the opportunity, and it suits his purpose to do so, and he does nôt arrive on board in a drunken and penniless condition. Other shipowners say they prefer English sailors if they can get entire crews of them, but that they would rather have all foreigners than mixed crews. Now that hundreds of English sailors are lounging about the streets and corners of our seaport towns—the supply being far in excess of the demand—they have time and opportunity to meet and discuss what they conceive to be the indefeasible rights of their class. They are unanimous in thinking that they ought to be employed before Danes or Dutchmen, and recently they have frequently endeavoured, in their own rough way, to enforce their supposed rights by the application of physical force to their unfortunate foreign competitors. Until the hard times took possession of commerce, as of late they have done, these men, full of the natural self-sufficiency of the true-born Briton, would not believe that any foreigners could be preferred to them on equal terms; nor could they ever be brought seriously to contemplate such a to them absurd proposition. Now, however, they have been brought face to face with the unwelcome fact. Foreigners are preferred, on equal terms, and that so frequently and so unmistakeably, that there must be a reason for it. It is no use for Jack to swear and bluster, and mob his harmless foreign competitor. He must bring himself to think and study why he has ceased to be in demand. Trade and commerce will evidently no longer stand improvident habits, waste, debauchery, and so forth on the part of those engaged in it, and those who indulge in such vices, or in the scarcely less fatal one of continual proneness to turbulence and stupidity, must expect to be superseded by steadier and more manageable, even though less capable men.

NOTES FROM SCOTLAND.

(*From our own Correspondent.*)

The Scotch iron market has been very depressed in the past week, and prices have sunk to a lower level than at any time during the present depression. Shipments of pigs are smaller than they would have been but for the snowstorm, which greatly interfered with traffic. They amounted to 6575 tons, as compared with 7699 tons in the preceding week, and 8135 tons in the corresponding week of 1885. The output is not in the least diminished, there being ninety-four furnaces in blast, as against ninety-three at this date last year. Large additions continue to be made to stock, those in Messrs. Connal and Co.'s Glasgow stores having been increased by 4000 tons in the course of the week.

Business was done in the warrant market on Friday at 38s. 6d. cash. On Monday transactions occurred at 38s. 4½d. to 38s. 1½d. cash, while Tuesday's market was very depressed, the price falling to 37s. 11½d. cash. Business was done on Wednesday at 38s. to 38s. 3d. cash. To-day—Thursday—the market was depressed to 37s. 11½d., closing with sellers at 38s. cash.

The current values of makers' iron are:—Gartsherrie, f.o.b. at Glasgow, per ton, No. 1, 43s.; No. 3, 41s.; Coltness, 47s. and 43s.; Langloan, 44s. 6d. and 42s.; Summerlee, 47s. 6d. and 42s.; Calder, 47s. and 41s.; Carnbroe, 43s. and 40s. 6d.; Clyde, 43s. 6d. and 40s. 6d.; Monkland, 39s. and 36s.; Quarter, 38s. 6d. and 35s. 6d.; Govan, at Broomielaw, 39s. and 36s. 6d.; Shotts, at Leith, 45s. and 44s. 6d.; Carron, at Grangemouth, 48s. 6d. and 45s. 6d.; Kinneil, at Bo'ness, 43s. and 42s. 6d.; Glengarnock, at Ardrossan, 43s. 6d. and 40s. 6d.; Eglinton, 39s. and 36s.; Dalmellington, 41s. 6d. and 38s. 6d.

The effort to bring about a restriction of the output of Scotch pig iron has signally failed, and there is therefore at present little or no hope of the production being restricted elsewhere. Several Scotch firms were greatly in favour of putting out a proportion of the furnaces, but difficulties were encountered as regards others whose output had already been so much reduced that they found it necessary to put several furnaces in blast to meet the exigencies of their business. They, therefore, intimated that it would be impossible for them to put out furnaces, and the difficulty at once arose which led to the breaking up of the conference.

The past week's shipments of iron and steel manufactured goods from the Clyde embraced locomotives valued at £20,600 for Kurrachee and Calcutta, £1800 worth of machinery, £5735 sewing machines, £4700 steel goods, and £21,600 general iron manufactures, of which £11,430 were wagons, angles, bars, sheets, and pipes for Bombay.

In the steel trade there is very considerable activity. With regard to the progress of the basic steel manufacture, which was started in Scotland for the first time only last autumn, Messrs. Merry and Cunningham intimate that they are so fully supplied with orders of a higher class and price, such as boiler steel and extra mild steel for welding, flanging, and stamping, that they have not found it necessary to enter the ship-plate trade. They also state that the reception that their Glengarnock basic steel has had alike at home and abroad is in every way satisfactory, and they are working full time night and day. In view of the opinion of Lloyd's that basic ship-plates have not as yet given very good results, this intimation is important, as showing that there is a very good miscellaneous demand for this quality of steel.

As was to be expected, the very stormy weather of last week greatly impeded the coal traffic on the Scotch railways, and the shipments at the different ports are therefore reduced in quantity. The week's shipments were at Glasgow, 21,384 tons; Greenock, 789 tons; Irvine, 1938 tons; Leith, 1126 tons; Grangemouth, 2527 tons; Ayr, 7307 tons; Troon, 6533 tons; and Bo'ness, 3486 tons. For all qualities the prices continue low.

Messrs. Beardmore, of Parkhead, have received a contract for a bridge for the Indian railways, which will require 3000 tons of steel.

WALES AND ADJOINING COUNTIES.

(*From our own Correspondent.*)

The ironmasters have agreed to further reduce the quotations in steel bars and blooms. Steel for tin bars is now quoted at £4 15s. to £5 5s.; blooms, £4 2s. 6d. to £4 10s. This shows a reduction respectively of 10s. and 7s. 6d., and still more impoverishes makers. The idea, possibly, is that by giving a better margin to tin-plate makers a better demand may arise; but another view taken is, that tin-plate makers will have still less temptation to go into the make of best, as some are proposing to do. I should say, looking at the superior make attained by high-class machinery and easy railway rates, tin-plate makers would be wise to confine themselves to their legitimate business.

The condition of the rail trade continues unimproved. Cyfarthfa continues brisk, but this is exceptional. In most places the lot of the ironworker is more frequently to lounge about the town than to be employed. Best steel rails are quoted at £4 15s. This leaves the ironmaster but one duty to do in respect of foreign ore, and that is to get it as cheap as possible. I have heard of prices so low that the wonder is, deducting freight, how anything is left to the exporter from Bilbao. The low prices ruling may account for the rather large consignments had of late by Dowlais Company and other works.

In the matter of exports, a sorry cargo of 540 tons rails to Rio de Janeiro, and a small cargo of bar iron for Trieste, comprise the principal business of the week.

Turning to coal, the outlook is worse. I have heard that large collieries, such as the Ocean, get but a couple of days' work per week at the best, some only one, and on the eve of despatch, too late to get confirmation, am told that this enterprising company—Ocean—have determined to stay proceedings at their new collieries at Ynysybwl for twelve months, simply "keeping the water down." If this be so, it is a ruinous condition, as a good deal of capital has been expended in cottages for men, shops, and hotels.

One of the principal coalowners told me last week that in his experience—a very long one—he never knew things so bad, or the prospects in the future so hopeless. The Cardiff foreign coal exports last week fell off to the extent of 30,000 tons, and all over the district the depression is acute. Newport fares a little better than Cardiff, and Swansea, too, with its varied industries. In addition to best steam, which is very depressed, though low prices are quoted, house coal, too, is sluggish, and many house collieries in Monmouthshire are at half work. Small steam is correspondingly dull, and pitwood is fully 3s. 6d. per ton lower now than it was last year.

The line of rail suggested in these columns for conveyance of material to the Cardiff Waterworks in the Taff Vaun Valley, and which, it was pointed out, would facilitate the work and lessen the cost, is to be adopted.

Considerable weeding out of men from the collieries will take place next month, principally, I expect, day men. Dowlais collieries are tolerably busy. Cyfarthfa management is rewinning coal from various old levels. The "rude forefathers of the hamlet," it appears, left much more coal in than they got out, and so it pays well to reopen. It was the same with iron. I have seen iron slag showing that a larger percentage was left in than was extracted.

Tin-plate shows an upward sign, and a slight advance has been obtained by makers particularly of best brands. This does not exceed 3d. per box, but it is hopeful. Stocks, however, are a little more than they were, the sales of last week having been eclipsed by the make. The total stock held at Swansea last week amounted to 172,486 boxes. Coke-plate quotations are 13s. 9d. to 14s.; the same for Bessemer. Siemens commands 6d. to 9d. more. Charcoals range from 16s. 6d. to 18s., according to quality. Over 29,000 boxes of tin-plate were despatched last week to America and France from Swansea. The Newport district report respecting tin-plate is better. Some fears are entertained that the requirements for France will soon gradually lessen, as the make there is increasing.

A serious steam tug boiler explosion occurred at the Bute Docks, Cardiff, on Monday, killing five men and injuring several others. Bodies, parts of the boiler, &c., were hurled to immense distances.

NEW COMPANIES.

THE following companies have just been registered:—

English-Dutch Light Railways Company, Limited.

This company was registered on the 27th ult. with a capital of £500,000, in £5 shares, to construct, acquire, work, and use light or other railways and tramways in Holland and Belgium, or elsewhere. The subscribers are:—

	Shares.
Thomas Francis Wells, 34, Lancaster-gate	1
Percival Fowler, Thornwood Lodge, Campden-hill, engineer	1
Thomas Underwood, Slough, Bucks	1
J. F. S. Cridland, 17, Bedford-row	1
F. H. Atkins, 33, Bouverie-street, engineer	1
R. G. Fairlie, Palace-chambers, Westminster, engineer	1
C. F. Rideal, 27, Margaret-street, Cavendish-square	1

The number of directors is not to be less than five nor more than seven; qualification, 50 shares or equivalent stock; the subscribers are to appoint the first, and act *ad interim*; remuneration, £2000 per annum. Mr. J. S. Cridland is appointed solicitor to the company; Mr. C. F. Rideal, secretary; Mr. H. F. Schomerus, of the Hague, manager; and Mr. George Buchanan, C.E., of 6B, Victoria-street, engineer.

Farrars, Limited.

This company proposes to acquire leasehold lands, beds of stone, and other property, situate at Pond Farm, Stead Hall, Granny Hall, and Smithy Carr-lane, Brighouse, in the parish of Halifax, York, lately in the occupation of John Farrar and Sons, of Southowram, stone merchants. It was registered on the 2nd inst. with a capital of £20,000, in £10 shares, to carry on business as quarrymen and stone merchants. The subscribers are:—

	Shares.
*Andrew Cockcroft, Halifax	50
*J. T. Riley, Halifax	52
*W. Crowther, Lightcliffe, stone merchant	100
*J. R. Atkinson, Sowerby Bridge, manufacturer	100
S. A. Farrar, Halifax, dyer	5
J. D. Taylor, Halifax, chartered accountant	10
J. Duff, Halifax, chartered accountant	5
J. R. Farrar, Halifax, solicitor	50

The number of directors is not to be less than three nor more than seven; qualification, 100 shares. The first are the subscribers denoted by an asterisk.

Lancashire Collieries' Association, Limited.

This association proposes to acquire and work lands, mines, collieries, &c. It was registered on the 1st inst. with a capital of £10,000, in £50 shares. The subscribers are:—

	Shares.
Robert Holt Edmundson, Wilmslow, Cheshire, merchant	1
*J. Byrne, 19, Castle-street, Liverpool, coal salesman	1
*F. Smith, 23, Falkner-square, Liverpool, solicitor	1
*J. Spencer, Sutton, St. Helens, colliery agent	1
J. Grace, 9, Harrington-street, Liverpool, solicitor	1
J. Hodgson, Hindley, colliery agent	1
J. Smethurst, Aston, colliery agent	1

The subscribers denoted by an asterisk are the first directors; the company in general meeting will determine remuneration.

Railway Electric Lighting Company, Limited.

This is the reconstruction of a company called the Railway Electrical Contractors, Limited, whose patents, property, and assets are taken over. The new company was registered on the 27th ult. with a capital of £130,000, in £5 shares. The purchase consideration is £30,000, payable £12,000 in cash, £6000 in fully-paid shares, and £12,000 by the allotment and issue to the members of the old company of 4800 shares credited with £2 10s. as paid upon each. The old company was registered on the 12th of March, 1884, with a capital of £25,000, in £5 shares, and the last return, made up to the 7th of April, 1885, shows that 4250 shares were allotted, and of these 3750 were considered as fully-paid up, and that £5 per share had been paid upon the remaining 500 shares. The subscribers are:—

	Shares.
*Sir Daniel Cooper, Bart., 6, De Vere-gardens	1
*Frederick Green, 13, Fenchurch-avenue, ship-broker	1
*Malcolm A. Laing, 5, Cambridge-gate, N.W.	1
*Ernest Villiers, 5, Brechin-place, Gloucester-road	1
Frank Ernest Hersee, 50, Leyland-road, Lee, secretary of a company	1
W. J. Crozier, Springfield, New Malden, Surrey	1
E. G. Farish, 24, Coleman-street, solicitor	1

The number of directors is not to be less than four nor more than eight; qualification, 100 shares; remuneration, £700 per annum. Major Charles Henry Strutt and the first four subscribers are appointed directors.

Safety Automatic Railway Couplings Company, Limited.

Upon terms of an unregistered agreement dated 20th ult. between Joseph Henry Betteley and William Bromfield Brough, this company proposes to acquire and work the letters patent No. 7460, dated 18th June, 1885, for improvements in the construction of couplings and the methods of connecting and disconnecting railway carriages and other vehicles. It was incorporated on the 26th ult. with a capital of £100,000, in £1 shares, with the following as first subscribers:—

	Shares.
*W. Bromfield Brough, Harrow-on-the-hill	1
F. J. Henderson, 5, Kenmare-road, Hackney, engineer	1
J. H. Collins, 23, Lime-street, solicitor	1
J. Macpherson, 61, Cambridge-road, Kilburn	1
R. Field, 6, Graces-road, Camberwell, clerk	1
H. H. Sporton, 10, Benyon-road, W., engineer	1
S. Nott, 39, Lime-street, merchant	1

The number of directors is not to be less than three nor more than seven; the first are Messrs. L. H. Isaacs, M.P., of 3, Verulam-buildings, Gray's-inn, chairman; Wm. Bromfield Brough; William Martineau, of 6, Great Winchester-street; and Douglas A. Onslow, Selby Lodge, Carlton-hill, N.W., who are appointed for four years; qualification for subsequent directors, 50 shares. Until 10 per cent. dividend is declared the remuneration of the chairman will be £50 per annum and £3 3s. per board meeting, and each of the other directors will be entitled to £50 per annum and £2 2s. per board meeting. In any year in which at least 10 per cent. dividend is paid, the remuneration of the directors will be doubled. Mr. R. J. Collins is appointed secretary at a salary of not less than £300 per annum to commence with.

Byng Telephone Company, Limited.

This company proposes to acquire and work the patented invention called the Byng Acoustic Telephone and Lee Guide, with power to acquire any other mechanical telephone or licence to use the same. It was registered on the 25th ult. with a capital of £5000, in £10 shares, with the following as first subscribers:—

	Shares.
W. J. Harrison, Ryder, Newcastle-on-Tyne, engineer	1
C. Stewart Lindsay, M.E., Newcastle-on-Tyne	1
A. F. Ball, Newcastle-on-Tyne, engineer	1
J. P. Spencer, C.E., Newcastle-on-Tyne	1
J. Tennant, Gateshead, chemical manufacturer	1
J. Owen Vernon, M.E., Newcastle	1
J. H. Armstrong, Newcastle, chartered accountant	1

Table A of the Companies' Act, 1862, will apply to the company.

Alturas Gold, Limited.

Upon terms of an agreement of the 23rd ult., this company proposes to purchase from E. C. Thompson, of Meadville, Pennsylvania, U.S.A. (at present residing at the Charing-cross Hotel), certain mining properties known as the Alturas, situate at Atlanta, Alturas County, Idaho Territory, U.S.A. It was registered on the 25th ult. with a capital of £300,000, in £5 shares. The purchase consideration is £250,000 in fully-paid shares, 6000 of which are to be transferred to Mr. Joseph Brotherton Purnell, or his nominees, in consideration of outlay and services rendered in the negotiation and realisation of the property, and in the formation and launching of the company. The subscribers are:—

	Shares.
W. J. Twentyman, 264, Amherst-road, N., accountant	1
F. Cutluf, Witham, Essex, secretary to a company	1
Gordon Saies, 9, Lee-street, Poplar, accountant	1
A. Parmenter, 35, Enfield-road North, N., cashier	1
T. G. Shardlow, 12, Grove Villas, Chestnut-road, Balham, clerk	1
W. F. Parnell, 248, Clapham-road, correspondent	1
T. W. Lover, Shirley Lodge, Lancaster-road, West Norwood, advertisement agent	1

The number of directors is not to be less than three nor more than seven; the subscribers are to appoint the first and act *ad interim*; qualification, 100 shares; remuneration, £200 per annum each.

Anglo-Canadian Phosphate Company, Limited.

This company proposes to purchase from Robert Chamblet Adams, of Montreal, certain mineral lands in the province of Ontario and Quebec, Canada, containing apatite, or phosphate of lime. It was registered on the 26th ult. with a capital of £65,000, in £10 shares, 4500 of which are preference shares. The purchase consideration is £50,000, whereof £20,000 is payable in fully-paid deferred shares. The subscribers are:—

	Shares.
*Sir John Morris, Wolverhampton, chemical manure manufacturer	1
*J. Thompson, Wilmslow, Cheshire	1
*W. Crosfield, 6, Stanley-terrace, Liverpool, sugar refiner	1
*P. Moir Crane, Bank-street, Manchester, manufacturer	1
B. F. Babcock, 17, Water-street, Liverpool, merchant	1
*R. C. Adams, 41, St. Francois Xavier-street, Montreal	1
B. Radcliffe, 3, Chapel-street, Liverpool	1

The number of directors is not to be less than three nor more than seven; qualification, fifty shares; the first are the subscribers denoted by an asterisk and Mr. W. T. Costigan. Sir John Morris is appointed chairman, and will be entitled to a minimum remuneration of £100 per annum. Each ordinary director will be entitled to at least £50 per annum in every year in which the dividend does not exceed 7 per cent., and to at least £100 per annum in each year in which the dividend shall exceed such percentage. The vendor is appointed managing director at a salary of £500 per annum, and in addition thereto, will be entitled to receive out of the profits remaining after payment of 7 per cent. per annum dividend, a commission of 1½ per cent. on the aggregate amount of all sales during that year, and in the event of the profits being insufficient to pay such commission, the vendor will be entitled to receive the balance of profits remaining after payment of the said 7 per cent. dividend.

North Honnali (Mysore) Gold Mining Company, Limited.

Upon terms of an agreement of the 24th ult., this company proposes to purchase from Theodore Oelrichs, of South Norwood-hill, certain mining properties situate in the Shimoga district of Mysore, acquired by the vendor, under an agreement of the 23rd ult., made with the East Indian Company for Exploration and Mining, Limited. The new company was registered on the 25th ult. with a capital of £120,000, in £1 shares. The purchase consideration is £35,000 in cash and £25,000 in fully-paid shares. The price agreed to be paid by the vendor to the East India Company for Exploration and Mining is £11,000, and £25,000 in fully-paid shares. The subscribers are:—

	Shares.
T. H. Tate Rogers, 3 and 4, Great Winchester-street, solicitor	1
R. St. John Hall, Stapleton, near Bristol	1
J. P. T. Cleave, St. Ann's-hill, Wandsworth, solicitor	1
V. M. Elkington, 54, Windsor-road, Holloway, clerk	1
A. R. Hanson, 111, Sebert-road, Forest-gate, clerk	1
Lieut.-General W. V. Anderson, E.I.U.S. Club, 14, St. James's-square	1
T. Hakes, 64, Lansdowne-road	1

The number of directors is not to be less than three nor more than seven. The first are Robert Andrew Cole, James A. Croft, Louis Forbes, James Inch, and Colonel G. B. Malleson. Remuneration, £1400 per annum.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Applications for Letters Patent.

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

2nd March, 1885.

2934. COTTON HARVESTERS, H. J. Allison.—(*C. T. Mason, jun., United States.*)
2935. HAT VENTILATORS, F. C. Bowen, London.
2936. INFANTRY BAYONETS, W. Wilkes and T. Nicholls, Bloxwich.
2937. TRICYCLES, J. A. McKay, Stockport.
2938. SPHERICAL OIL, &c., BURNER, W. H. Peters, Birmingham.
2939. SHUTTLE-GUARDS in LOOMS for WEAVING, T. Livesey, Halifax.
2940. AUTOMATIC VALVE MOTIONS, H. and R. H. Lanceley, Chester.
2941. PICKER PRESERVERS in LOOMS, W. T. Bleasdale, Halifax.
2942. COUPLINGS of RAILWAY, &c., CARRIAGES, S. Chadwick, Halifax.
2943. INDIA-RUBBER BELTS, &c, J. Hebblewaite and E. Holt, Manchester.
2944. COMBINED BASKET and BAG, T. N. Hunter, Manchester.
2945. MAKING SPADES and SHOVELS, J. Hutchinson, Dunmurry.
2946. SECURING the CORNERS of FRAMES, J. Blakey, Halifax.
2947. LAMP, J. F. Bolshaw, Liverpool.
2948. MACHINERY INDICATOR, &c., G. B. Thompson, Dublin.
2949. HINGES, J. Sowden and W. Cowan, Bradford.
2950. ENRICHING ILLUMINATING GAS, J. Parkes, Birmingham.
2951. REGISTERING APPARATUS, J. and F. Lott, Liverpool.
2952. CYCLES, J. F. Russell, London.
2953. TRICYCLES, F. White, Paris.
2954. APPARATUS employed in MULES, P. Crook and G. Firth, London.
2955. VALVE MOTION for PUMPS, &c., E. Lund, jun., London.
2956. ELECTRO MOTORS and DYNAMO-MOTORS, M. Immisch, London.
2957. ATTACHING HANDLES to LOCKS, J. Cundall, Leamington.
2958. SIGNAL INDICATORS, T. B. Sloper, London.
2959. ELECTRICAL BRUSHES, W. T. Whiteman.—(*W. H. Miles, jun., and J. C. Aiken, United States.*)
2960. FITTINGS of ROLLER BLINDS, &c., J. Campbell, Enfield.
2961. FANLIGHT FASTENERS, J. U. Davis, London.
2962. MEASURING CURRENTS of WATER, J. A. Muller, London.
2963. LAMP BOWLS, G. R. Loudan, London.
2964. HEATING ARRANGEMENTS of OVENS, W. Johnson, London.
2965. ATTACHMENT for VELOCIPEDES, C. Marchutz, London.
2966. SECURING CORKS in BOTTLES, &c., W. Robertson, London.
2967. LEVELS, J. J. Hicks and C. Tight, London.
2968. RAIL JOISTS, H. F. Dale, London.
2969. AUTOMATIC VALVES, F. Hochuli.—(*P. Fischer, France.*)
2970. SPINNING MACHINERY, &c., G. Bernhardt, Manchester.
2971. SEWING MACHINES, W. R. Lake.—(*A. Eppler, jun., and E. Adams, United States.*)
2972. TWISTING WOOD, W. R. Lake.—(*E. A. Alden and D. O. Pease, United States.*)
2973. CENTRIFUGAL PUMPS, W. R. Lake.—(*W. O. Webber, United States.*)
2974. ATTACHING FUSES to CARTRIDGES, F. W. Macan and W. J. Sharp, London.
2975. DYNAMO-ELECTRIC MACHINES, N. Tesla, London.
2976. DRIVING APPARATUS for SEWING MACHINES, D. Noble, London.
2977. LADY'S FANS, C. C. Cole, London.
2978. SHAFTS, POLES, and ARMS for CHAFF CUTTERS, W. H. Sleep, London.
2979. BOTTLES and STOPPERS, W. Heatley, London.
2980. VULCANISED RUBBER DIES, A. J. Boult.—(*G. J. B. Rodwell, Canada.*)
2981. TRUCKS for CENTRE-RAIL ELEVATED RAILWAYS, A. J. Boult.—(*F. A. Bartholomew, United States.*)
2982. LOCKING DEVICES, A. J. Boult.—(*A. P. Merrill, United States.*)
2983. VENTILATORS, A. J. Boult.—(*C. Cluthe, Canada.*)
2984. BOOTS and SHOES, F. Haslam, London.
2985. TENSION PULLEY for REGULATING BLIND CORDS, C. A. Grossetete, London.

3rd March, 1886.

2986. SELF-CLOSING NON-CONCUSSIVE WATER VALVE, C. R. Stewart and J. Scott, London.
2987. PERMANENT WAY of RAILWAY, J. Edwards, Hackney.
2988. CORNISH BOILERS, I. Morris, Bloxwich.
2989. APPARATUS for ACTUATING DABBING BRUSHES for COMBING MACHINES, P. Watson, Bradford.
2990. CARD SHEETS, G. Hudson, Bradford.
2991. HOSIERY KNITTING MACHINES, H. Clarke, J. M. Thornton, and T. Mawby, Leicester.
2992. PIPES and TAPS for FILTER PRESSES, J. Newton, Longport.
2993. MOTORS, M. Milburn and R. Hannan, Glasgow.
2994. CUT-OFF VALVE, A. Ridge and J. Blake, Manchester.
2995. STOP VALVE, A. Ridge, Manchester.
2996. KETTLES, &c., T. Fletcher, Manchester.
2997. ROLL TOBACCO-BINDER, J. M. M'Donnell, Dublin.
2998. LUBRICATORS, J. S. Barraclough and J. W. Schofield, Halifax.
2999. GAS MOTORS, D. Clerk, Glasgow.
3000. CHECKING the RECEIPT of MONEY from PERSONS RIDING in PUBLIC VEHICLES, J. M. Black, London.
3001. CLEANSING SUGAR, &c., BAGS, W. T. Crooke and A. A. Arnold, London.
3002. INTERCEPTING TRAPS for SEWERS, J. Fletcher, Birmingham.
3003. VENTILATING COVERS for SEWERS, J. Fletcher, Birmingham.
3004. DRIVING CHAIN, W. Morgan, Birmingham.
3005. PREVENTING DAMAGE to WATCHES and CLOCKS, A. J. Morcom, London.
3006. WATER TAPS, H. Watson, Halifax.
3007. OIL LAMPS for CYCLES, &c., J. Roots, Tottenham.
3008. MANGLES and WRINGERS, W. Lockwood, London.
3009. TIRES of VEHICLES, W. Lockwood, London.
3010. MOTIVE POWER ENGINES, G. F. Deacon, Liverpool.
3011. UMBRELLAS, &c., P. J. Rademacher, London.
3012. BALANCING WINDOW SASHES, W. J. Hill.—(*R. Clarke, J. G. Darling, and D. M'Farlane, Canada.*)
3013. FEEDING APPARATUS for SEWING MACHINES, H. Bernard.—(*C. Tabbert, Germany.*)
3014. AUTOMATIC LUBRICATORS for STEAM CYLINDERS, W. W. Campbell.—(*R. Campbell, Java.*)
3015. CASTORS, W. J. Panton, Birmingham.
3016. SOFAS, &c., R. Glover, London.
3017. RAILWAY CARS, E. W. Furrell, Streatham-common.
3018. AIR-TIGHT INSPECTION CHAMBER, R. P. Beattie, London.
3019. VENTILATORS for WINDOWS, G. R. Buffham, London.
3020. STEAM BOILERS, W. and J. Beesley, London.
3021. BUTTON-HOLE CUTTER, C. H. Felton, London.
3022. INSECT TRAP, D. L. Brain, Southsea.
3023. APPARATUS for INDICATING TEMPERATURE, J. Murrie, Glasgow.
3024. MACHINE for CLEANING GUN BARRELS, C. J. O. Ferguson, Inverness.
3025. MACHINERY for the PURPOSE of DEFENCE, E. Graddon, Kent.
3026. BOTTLES, &c., for STORING and HEATING LIQUIDS, G. A. Goodwin and E. O. Eaton, London.
3027. STEAM PUMPS for RAISING WATER, J. L. Berry, Glasgow.
3028. BELTING for DRIVING MACHINERY, F. T. K. Firmin, Glasgow.
3029. AUTOMATIC SLIDING ANTI-BALLOONING THREAD-BOARD in the RING SPINNING FRAME, S. M. Ratnagur, London.
3030. TREATMENT of COTTON SEED OIL RESIDUE, J. Longmore, Liverpool.
3031. APPARATUS for USE in DRAWING OFF GRAIN from SILOS, G. Henderson, Liverpool.
3032. FOUNTAIN PENS and PENHOLDERS, W. J. Sollas, Liverpool.
3033. KNITTED RIBBED FABRIC, J. H. Cooper, W. J Ford, G. Blunt, and W. M. Richards, London.
3034. EMBROIDERING and OVER-EDGING MACHINES, G. Browning, Gloucester.
3035. STEAM or WATER MOTOR, L. A. Groth.—(*A. V. Ludwig, Germany.*)
3036. APPARATUS for STARTING GAS ENGINES, S. Griffin, London.
3037. ERECTING GAS PIPES to FORM PICTURE RODS, J. Halley, London.
3038. TUBES, W. Fairweather.—(*The Babcock and Wilcox Co., United States.*)
3039. TUBES, W. Fairweather.—(*The Babcock and Wilcox Co., United States*)
3040. CRAMPS, J. Hampton, London.
3041. PROJECTILES, J. D'A. Irvine and J. Harriss London.
3042. MAKING CONVERTIBLE CARS, &c., G. Byrne, jun. London.
3043. BELT and NAVEL PROTECTOR, E. Somerford London.
3044. VENTILATORS, C. Kite, London.
3045. CARRIAGE LAMPS, H. R. Lamport, London.
3046. STEAM-ENGINES, M. P. W. Boulton & E. Perrett, London.
3047. REPEATING FIRE-ARMS, L. and S. S. Younghusband, London.
3048. REINS, E. D. Adcock, London.
3049. TRAMWAY POINTS, E. F. Grainge, London.
3050. CHANGING ADVERTISEMENTS, J. M. O'Kelly, H. J. C. Sommerville, and C. H. Russell, London.
3051. USING LATHES for MILLING, &c., W. H. Greatorex, London.
3052. FITTINGS for FEEDING BOTTLES, J. Lakeman, London.
3053. ELECTRIC ARC LAMPS, W. L. Wise.—(*G. Mariotti, Austria.*)
3054. FIRE POKERS, C. Priestland, Aston.
3055. SUBSTITUTE for a GRAVE or TOMB-STONE, J. W. Hardy, London.
3056. METAL ROLLERS for GRINDING GRAIN, F. Stallmaier and F. Fux, London.
3057. ARTIFICIAL FUEL MACHINERY, J. A. Yeadon and R. Middleton, Leeds.
3058. ARTIFICIAL FUEL MACHINERY, J. A. Yeadon and R. Middleton, Leeds.
3059. UMBRELLAS, R. Gray, Glasgow.
3060. SHUTTLE-GUARD, J. Gregson and W. T. Fox, Preston.
3061. BATH for PHOTOGRAPHIC PRINTS, B. H. Thwaite, Liverpool.
3062. BOBBINS for SPINNING and DOUBLING FRAMES, T. Wrigley and J. H. Wilson, Manchester.
3063. BISULPHITES from ALKALINE BASES, J. M. Walton, Manchester.
3064. CONSTRUCTION, &c., of BOILERS for the MANUFACTURE of PAPER PULP from WOOD, &c., J. M. Walton, Manchester.
3065. FINISHING TEXTILE FABRICS, R. W. Thom, Manchester.
3066. CAP SPINNING and TWISTING FRAMES, W. T. Garnett, Bradford.
3067. INNER SOLES of BOOTS and SHOES, S. H. Hodges, Street.
3068. BALL CASTORS for FURNITURE, J. Taylor, Birmingham.
3069. SACK HOLDER, N. Means, Upwell.
3070. SHIRT BANDS and CUFFS, and MEANS of FITTING STUDS THERETO, M. Wilson, London.
3071. METALLIC FENCES, Jesse Leigh, London.
3072. ROTARY MOVEMENT, J. C. Sellars, Liverpool.
3073. CONNECTING PIPES, E. H. Cheetham, Leeds.
3074. BURNING HYDRO-CARBONS in a FURNACE after the manner of a COAL FIRE, W. Smith, London.
3075. CAR or CARRIAGE STARTER, L. A. Groth.—(*W. Wernigh, Germany.*)
3076. UMBRELLAS, L. A. Groth.—(*Merkewitz and Hammerschlag, Germany.*)
3077. METAL BODY to facilitate the BOILING of COOKING UTENSILS, C. Southon, jun., London.
3078. REFLECTORS for RAILWAY CARRIAGE LAMPS, D. K. Simpson, Liverpool.
3079. HOLLOW SUGAR or CHOCOLATE WARE, O. Dunkel and M. Franz.—(*W. Sommer, Germany.*)
3080. PACKINGS for STEAM ENGINES, T. Fox, Liverpool.
3081. HOISTING, &c., COAL, SALT, &c., E. F. Bamber.—(*S. J. Kilby, Calcutta.*)
3082. MANUFACTURING BALL CASTORS for FURNITURE, F. Davis, Birmingham.
3083. LUBRICATING AXLES of HUTCHES, &c., D. Anderson and J. Hogg, Glasgow.
3084. BOOTS and SHOES, E. G. Brewer.—(*J. Plas, Belgium.*)
3085. ENVELOPE LETTER, I. Lindemann, London.
3086. BOILER, T. F. Veasey.—(*J. H Lancaster, United States.*)
3087. WATER TUBES, T. F. Veasey.—(*J. H. Lancaster United States.*)
3088. FEED-WATER HEATER, T. F. Veasey.—(*J. H. Lancaster, United States.*)
3089. CHURNS, J. Young, Glasgow.
3090. PLACARDS, &c., for ADVERTISING, C. Koeneman London.
3091. VELOCIPEDES, J. Harrington and J. Hopper, London.
3092. SAFETY LAMPS, W. J. Clapp, and W. Sandbrook, London.
3093. WATER-POWER, &c., ENGINE, R. Johnson, Bradford.
3094. SECURING PEDAL RUBBERS, W. Bown and J. H. Hughes, London.
3095. WATERPROOFING FABRICS, G. F. Redfern.—(*E. Chevallot, France.*)
3096. COLOURING CERAMIC PRODUCTS, G. F. Redfern.—(*A. V. Morizot, France.*)
3097. CLOTHING, E. C. A. Cottell, London.
3098. FIRE-PROOF SOLUTION, W. H. Murray and R. J. Young, London.
3099. FURNACES, R. McL. Young, London.
3100. REGENERATIVE GAS LAMPS, &c., S. Chandler, sen., S. Chandler, jun., and J. Chandler, London.
3101. STOPPERS for BOTTLES, C. A. M. Clark, London.
3102. PORTLAND CEMENT, T. Weekes, London.
3103. DISTRIBUTING FOOD, B. J. B. Mills.—(*L. Deguenant, France.*)
3104. GRINDING DRILLS, &c., G. P. Smith, Tunbridge Wells.
3105. ROW-BOATS, H. H. Lake.—(*Messrs. Wirth and Co., Germany.*)
3106. ELECTRIC, &c., BELLS, H. P. F. and J. Jensen and B. W. Webb, London.

5th March, 1886.

3107. COUPLING and UNCOUPLING RAILWAY WAGONS, &c., W. and T. Hill and F. T. Turner, Longport.
3108. BEDSTEAD FRAMES or BOTTOMS, W. P. Hoskins, Birmingham.
3109. JOINTING PIPES for STEAM, &c., J. and O. Cunningham, Egremont.
3110. ENGINE CYLINDERS, &c., E. S. Brett, F. G. and A. C. Hands, and W. Thomas, Birmingham.
3111. STRAINER PLATES, H. Watson, Newcastle-on-Tyne.
3112. RAILWAY COUPLING ARRANGEMENT, T. F. Remer, Liverpool.
3113. VENTILATION, C. J. Henderson, Edinburgh.
3114. BEARDING WHEAT, T. H. White and Co. and W Weaver, Belfast.

115. Self-locking and Burglar Proof Coal-plate, G. Kyte, Cardiff.
3116. Filtering and Decolorising Sugar, &c., M. F. Heddle, D. C. Glen, and D. Stewart, Glasgow.
3117. Birdcages, G. Baker, Birmingham.
3118. Skewers and Hangers, G. Baker, Livery-street, Birmingham.
3119. Indicating the Chords Commonly Used in Music, W. Ritchie, London.
3120. Compressing Silage, C. W. Wilson, Kirby Lonsdale.
3121. Wicks for Oil Lamps and Stoves, G. Asher and J. Buttress, Birmingham.
3122. Cleansing and Purifying Buildings, A. E. Scott, London.
3123. Locks and Latches for Doors, &c., H. Rothery, London.
3124. Fish Biscuit for Dogs, &c., W. Garthwaite, Great Grimsby.
3125. Measuring Currents of Electricity, S. Sudworth, London.
3126. Permanent Propelling Motive Power, A. Biver, London.
3127. Rein Button, C. H. Felton, London.
3128. Oil Lamps, O. Barber, Liverpool.
3129. Hoists or Lifts, W. B. and T. H. Jones, and J. Howard, Liverpool.
3130. Sieves and Screens, W. T. Crooke, London.
3131. Spring Fastener for Gloves, &c., E. Fisher, London.
3132. Adhesive Plasters, T. Casely and A. T. J. Cutmore, London.
3133. Electrical Conductors, W. R. Lake.—(*H. A. Clark, United States.*)
3134. Cooling, Warming, &c., Air, J. Howorth, Manchester.
3135. Electric Cables, W. R. Lake.—(*H. A. Clark, United States.*)
3136. Recording and Alarm Thermometers, W. Doehring, London.
3137. Hydraulic Apparatus, H. H. Lake.—(*L. Belden, United States.*)
3138. Smelting Tin Ore, &c., G. T. Lewis, London.
3139. Hinge, F. C. Hammond, London.
3140. Cricketer's Wicket, W. Salmon, London.
3141. Holder for Photographs, &c., E. Pachtmann, London.
3142. New Explosive Compound, J. N. Heidemann, London.
3143. Coating Sheet Iron, &c., with Zinc, J. A. Du Rietz, London.
3144. Cleansing, &c., the Charge Chambers of Breech-loading Fire-arms, R. Morris, London.
3145. Lamps, A. H. Hearington, London.
3146. Lamps, R. B. Evered, London.
3147. Combined Lasts and Jacks, H. Stockman, London.
3148. Tube of Infants' Feeding Bottles, J. P. Neumann, London.
3149. Incandescent Electric Lamps, A. Bernstein, London.
3150. Horn Trainers for Cattle, F. Holden, London.
3151. Machines for Dressing Grain, &c., C. E. Mumford, London.
3152. Mixing Machines, &c., G. F. Redfern.—(*B. F. Giraud, France.*)
3153. An Improved Game, G. F. Redfern.—(*N. C. et Gerson, France.*)
3154. Baking Machines, H. H. Lake.—(*M. Kauth, United States.*)

6th March, 1886.

3155. Protecting Cases for Registering Thermometers, L. H. Guinness, London.
3156. Stopper for Bottles, J. Holmes, Keighley.
3157. Cheque Books and Covers, D. L. Brain, Southsea.
3158. Hydraulic Jacks, G. Lewis, Manchester.
3159. Copying Presses, J. Holroyd, Manchester.
3160. Safety Bicycles, J. E. P. Scott, Manchester.
3161. Drain Pipes for Sanitary Purposes, W. Meakin, London.
3162. Knitted Ribbed Fabrics, H. Clarke, J. M. Thornton, and T. Mawby, Leicester.
3163. Metallic Belting, R. L. Kirlew, Manchester.
3164. Planing Cutters for Wood, &c., B. Sutcliffe, Halifax.
3165. Apparatus for Relieving the Sudden Strains upon Towing Ropes, J. Saynor, London.
3166. Lubricating Axles, T. Mirfin and J. W. King, London.
3167. Metallic Packing, R. Baird, Glasgow.
3168. Starting and Reversing Engines, G. McGhee, Glasgow.
3169. Screw Gill-boxes, G. W. Douglas and J. Shaw, Bradford.
3170. Preparing Casks, G. T. Beilby, Slateford.
3171. Treating Clays, &c., J. Prince and W. Johnson, Leeds.
3172. Measuring Distances, G. A. Vetch, Glasgow.
3173. Meat Safes and Dish Covers, G. Baker, jun., Birmingham.
3174. Slate Pencil Sharpeners, W. H. Myhill and J. Cooke, Birmingham.
3175. Springs for Bicycle, &c., Saddles, G. Salter and C. J. Holdship, Birmingham.
3176. Automatic Delivery of Goods, C. H. Russell, London.
3177. Lighting Cigarettes and Cigars, C. H. Russell, London.
3178. Rotary Engines, J. A. Wade and J. Cherry, London.
3179. Inkodyne Tablet, W. J. Payne, London.
3180. Rifle and Gun-cleaner, W. J. Payne, London.
3181. Seats, C. Groombridge and J. P. Rickman, London.
3182. Cure of Liver and Stomach Complaints through the Action of an Insulated Voltaic Electric Chain Belt, W. Laughton, London.
3183. Dynamo-electric Machines, T. A. Garrett, London.
3184. Prismatic and Magnetic Compasses, J. H. Steward, London.
3185. Metal Boxes, H. D. B. Wall, Liverpool.
3186. Ladder-tape Looms, W. Kennedy, London.
3187. Fishing-rods, A. G. Bartleet, Birmingham.
3188. Signal, &c., Rockets, J. Pain, London.
3189. Applying Photographic Emulsion to Photographic Plates, E. J. Palmer, London.
3190. Centrifugal Drying Machines, J. B. Alliott and G. P. Haughton, London.
3191. Duplex Fish-plate, J. Keywood and H. H. Perry, Croydon.
3192. Trousers Stretcher, H. Goodwin, London.
3193. Locking of Cash Tills, P. Campbell, Glasgow.
3194. Floats for Supporting Fishing Nets, W. Duncan and A. Black, Glasgow.
3195. Barrel Bolts for Doors, &c., F. A. Harrison, London.
3196. Purifying Saccharine Juices, R. Englert and F. Becker, London.
3197. Condiment Flavoured with Spearmint, C. W. Shepherd, Bradford.
3198. Manufacture of Azo Dyes, J. Y. Johnson.—(*The Actiengesellschaft Farbenfabriken vorm. Friedrich Bayer and Co., Germany.*)
3199. Telephones, J. Stuart.—(*J. Hutinet and P. Felix, France.*)
3200. Portable Ovens, J. H. Johnson.—(*La Société Geneste Herscher et Cie., France.*)
3201. Handles for Knives, &c., P. Fagan, London.
3202. Walking-sticks and Umbrellas, W. Harrop and W. Moore, London.
3203. Treating the Entrails of Animals, E. H. M. Denny, London.
3204. Duplicating Engines, W. G. Adams, United States.
3205. Mountings for Heavy Ordnance, W. J. Hoyle, London.
3206. Stoppers for Bottles, F. Foster, London.
3207. Spinning Tops, E. Heinrich, London.
3208. Siphons, H. L. J. Parenty, London.

8th March, 1886.

3209. Driving Revolving Rubbers, J. Gordon, Ballymena.
3210. Rope Grippers, S. W. Cross, London.
3211. Actuating Movable Shuttle-boxes, W. H. Tootill, J. Snape, and W. H. Crompton, Manchester.
3212. Cleansing Yarn in Winding Machines, H. Tetlow, Manchester.
3213. Affixing Postage Stamps to Letters, &c., B. Thornton, Manchester.
3214. Gas and Water Meter, A. G. Browning, South Wales.
3215. Producing Matrices for Stereotyping, J. Campbell and J. Taylor, Dundee.
3216. Playing Cards, J. McLaren, Glasgow.
3217. Treating Sewage and Making Cement, J. B. Hannay, Glasgow.
3218. Safety Lock, J. Bär and C. Köster, Germany.
3219. Washing Machines, T. C. Smith, Manchester.
3220. Distilling Ammoniacal Liquor, A. Dempster, Halifax.
3221. Velocipedes, W. E. Crowther, Manchester.
3222. Abacus, T. Rushforth, London.
3223. Governors, W. C. Lockwood and H. Carlisle, Sheffield.
3224. Chemical Envelope, P. S. Nixon, Bristol.
3225. Domestic Fireplaces, J. Pearson, Ashton-on-Ribble.
3226. Tandem Bicycle, C. W. Siddle, Huddersfield.
3227. Book Rests for Chairs, &c., D. McClure, Washington, U.S.
3228. Application of Springs to Railway Carriages, O. Underwood, London.
3229. Blade Skates, H. M. Nicol, Glasgow.
3230. Spark Arresters, J. Y. Johnson.—(*E. Werner, Germany.*)
3231. Collecting Carbonic Acid Gas, &c., J. Gale, London.
3232. Devices for Taking Up the End Pressure of Thrust of Rotating Shafts, C. A. Johansson, London.
3233. Covered Metallic Tubes, F. Madeley and A. Oldham, London.
3234. Props for Mines, &c., D. Mills, London.
3235. Absolutely Continuous Current Dynamo-electric Machines, C. J. Hall and W. Lowrie, London.
3236. Separating Dust from Chaff, T. Hoadley and J. Hoadley, London.
3237. Twisting Threads, H. Page, F. Ball, and J. Hudson, London.
3238. Obtaining Ammonia Chlorine and Hydrochloric Acid from Ammonium Chloride, L. Mond, Liverpool.
3239. Gauges, J. Nicholson, London.
3240. Electric Search Light Apparatus, C. Hall, London.
3241. Milling Machines, J. W. Rutherford and W. Balmer, Galashiels.
3242. Miners' Picks, M. Withers, London.
3243. Safety Roller Horse Protector, J. Covell, Hastings.
3244. Breech-loading Guns, R. Morris, London.
3245. Gas Lamps, J. C. Mewburn.—(*P. Sée, France.*)
3246. Loose Red Looms, J. Seed, London.
3247. Producing Oxalates of Antimony, M. B. Vogel, London.
3248. Mordanting Vegetable Fibres, &c., M. B. Vogel, London.
3249. Music Stools, &c., E. Parr and C. H. Hare, London.
3250. Oil Lamps, J. Roots, London.
3251. Infants' Feeding Bottles, A. C. Henderson.—(*E. L. P. Lelièvre, France.*)
3252. Stained Glass Windows, A. C. Henderson.—(*L. Charmantier and S. de Cazenave, France.*)
3253. Conversion of Electric Currents, H. H. Lake.—(*F. Heimel and F. Waldman, Austria.*)
3254. Knitting Machines, G. A. White, London.
3255. Automatically Delivering Goods, P. Wood and W. H. Jones, London.
3256. Cricket Stumps, J. G. Heard, London.
3257. Meters for Measuring Liquids, W. G. Kent, London.
3258. Gloves, J. H. Cooper and W. J. Ford, London.
3259. Rock Tunnelling, H. N. Penrice, London.
3260. Electric Arc Lamps, H. H. Lake.—(*F. Heimel and F. Waldmann, Austria.*)
3261. Metal Castings, W. Potthoff, London.
3262. Lawn Tennis Poles, G. C. Nott, London.
3263. Ankle Pad, J. McIntosh, London.
3264. Attaching Castors to Furniture, &c., L. Lewis, London.

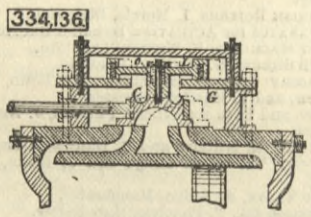
SELECTED AMERICAN PATENTS.

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

334,136. Balanced Valve, *Edwin B. Sintzenich, Rochester, N.Y.—Filed May 21st*, 1883.

Claim.—The combination, with a steam cylinder and piston, of the slide valve C, slotted plate G, and balance plate L, attached to the slide valve by a connection passing through the slot in the plate, and provided with the spring *o* to compensate for expansion, substantially as and for the purposes set forth.

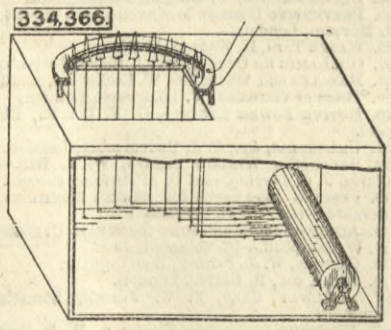
334,136



334,366. Electric Lighting Apparatus, *Arthur C. Ferguson, Saratoga, N.Y.—Filed October 12th*, 1885.

Claim.—(1) A series of light-giving electrodes arranged adjacent to each other in the form of letters or figures, in combination with automatic mechanism, substantially as specified, for closing and separating the electrodes successively, substantially as set forth.

334,366.



(2) The combination, with a revolving cylinder having pins, of levers acted on by said pins, carbons and carbon-holders in pairs, and connections between the respective levers and carbon-holders for moving one or both electrodes successively and producing ranges of flashes in straight or curved lines, substantially as set forth.

334,206. Hydraulic Jack, *John Weeks, New York, and Harrison Traver, Brooklyn.—Filed October 20th*, 1885.

Claim.—In a hydraulic jack, the combination, with the pump C and the ram B, of the packing F, the ring H, the pin L, and the packing ring or nut G, said pin passing through the packing and the ring H and entering the joint between the pump and the ram, substantially as herein shown and described, whereby

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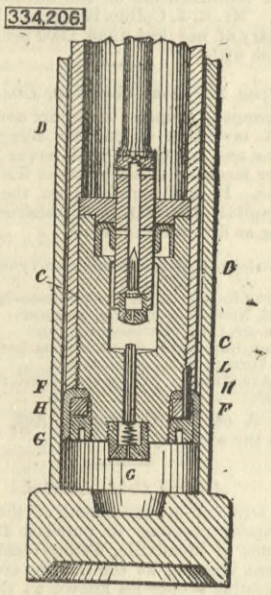
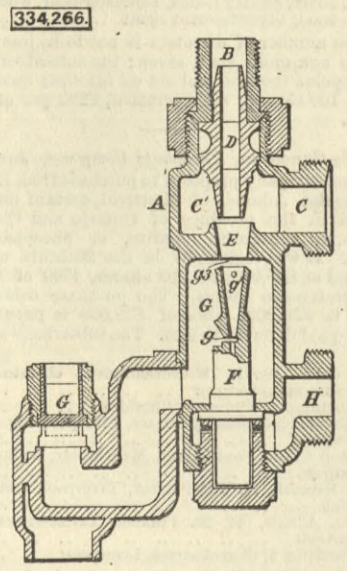


the packing can be readily applied to the pump and the ram, as set forth, and the several parts prevented from moving relative to each other.

334,266. Injector, *Horace B. Murdock, Detroit Mich. —Filed, September 21st*, 1885.

Claim.—(1) In an injector, a delivery tube constructed with its entrance end and relief orifices opening into the same overflow chamber, and in connection therewith an escape valve located below the entrance to said tube, said valve constructed to open automatically under the pressure of water in the overflow chamber when the same has risen to a level a little below the entrance end of the delivery tube, and to automatically close when the water has wasted below said level, substantially as described. (2) An automatic injector consisting of the combination, with a force tube and a combination tube, of a delivery tube having its entrance end and relief orifices opening into said overflow chamber, and a single escape valve, said valve constructed to automatically open whenever the

334,266.

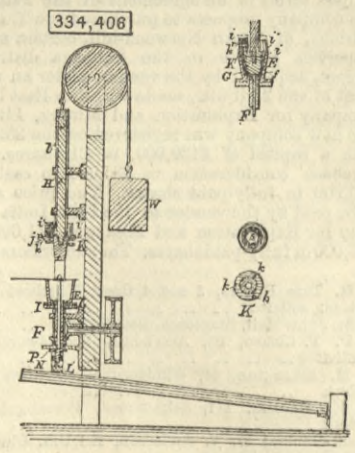


pressure within the overflow chamber equals or exceeds that exerted by a column of water at a level a little below the entrance end of the said delivery tube and to automatically close and remain closed whenever there is less pressure within said chamber, substantially as described. (3) The combination, with an injector having an overflow chamber, G, a steam inlet, B, a water inlet, C, and a vertical delivery tube F, provided with an entrance end and an opening g^1, located within the overflow chamber, of an escape valve G^1, arranged below the upper entrance end to said delivery tube and automatically operated by the column of water before the latter can rise to said upper entrance end, substantially as described. (4) In an injector, a reversible forcing tube adapted by reversing the tube to present its discharge end at a different distance from the mouth of the combining tube, substantially as and for the purposes described.

334,406. Machine for Moulding Flower-pots, *Hermann Ammenheuser, Albany, N.Y.—Filed June 23rd*, 1885.

Claim.—(1) The combination, with the revolving mould E, held from moving vertically, and reciprocating die I, held from revolving and having flange *i* at its upper end, and coacting with mould E, for forming flower-pots, of spring receptacles i^1, springs *r*, ring-form follower K, guide pins *k k*, working through plate *j*, secured to flange *i*, and having their lower

334,406

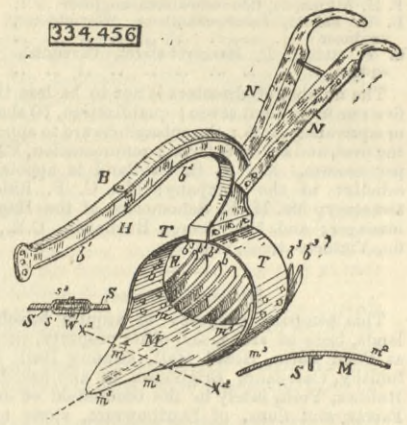


ends secured to follower K and their upper ends provided with heads, serving as seats of springs *r*, all substantially as described, for the purposes and operations set forth. (2) The combination with mould E, which is revolved on one horizontal plane, disc G, provided with projecting spur *f* and mounted on reciprocating vertical shaft F, and step P, of the die I, secured to reciprocating vertical shaft H, elastic follower K, concentric to said die and steadied and made elastic by mechanism, as above described, yokes L L^1, draw rods *l* l_1, treadle N, and weight W, having connection with yoke L, all substantially as shown and described, for the purposes and operations set forth

334,456. Potato Digging Machine, *William H. McCall, Greenwich, N.Y.—Filed July 10th*, 1885.

Claim.—(1) The combination of the digger and the screen R with the shoe S, secured to the mould board of the digger, and the wheel W, journalled in slotted bearings in the shoe and arranged to oscillate on its bearings, substantially as described, and for the purpose stated. (2) The combination of the top, made with the downwardly curved sides t^2, the mould board M, made at the rear with the upwardly curved sides m^1, to connect with said top, and in advance of the said connection having the downwardly arranged side curves m^2, and the screen R, made with blade form

334,456

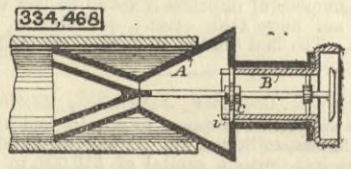


bars *b*, attached to the under side of the mould board, to be below the rear end of the latter, and made to curve upwardly at their rear ends, substantially in the manner as and for the purposes set forth. (3) The combination of the top T, the mould board M, the screen R, the shoe S, made with the offsets s^2, the wheel W, having the shaft *o*, and the slotted bearings b^2 constructed and arranged to operate substantially in the manner as and for the purposes set forth.

334,468. Boiler-tube Cleaner, *Robert A. Regester Baltimore, Md.—Filed April 7th*, 1885.

Claim.—In a boiler-tube cleaner, the combination of the body piece A, provided with the cross arm *c*, and

334,468

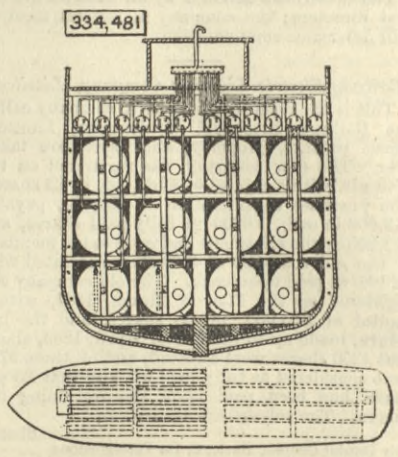


the sliding shell B, provided with the slots *i*, that engage with the cross arm *c*, whereby the shell is prevented from turning.

334,481. Vessel for Transporting Liquid Cargoes in Bulk, *Louis V. Sone, New York, N.Y.—Filed September 25th*, 1885.

Claim.—The combination, in the hull of a vessel, of a series of main storage tanks and a corresponding series of separate supplemental tanks located above said main tanks and connected thereto by independent pipes, whereby the contents of each

334,481

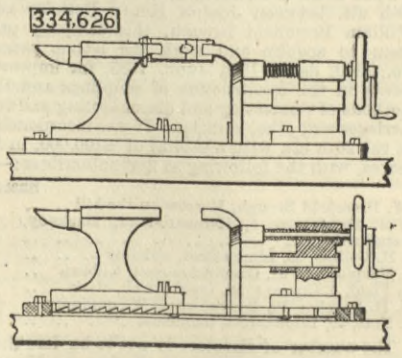


main tank are kept under continuous pressure, and diminution therein is automatically supplied from the corresponding supplemental tank, and the overflow from the main tank is received in the supplemental tank, substantially as described.

334,626. Combined Anvil, Vice, and Drill, *James Weathers, Indianapolis, Ind. — Filed September 22nd*, 1885.

Claim.—(1) The combined tool consisting of a slotted base, an anvil guided by said slot and adjustable on said base, to standard also adjustably guided on said base and carrying a feeding screw, and a movable vice jaw guided by the base and by the standard, substantially as specified. (2) The combined tool consisting of a slotted base, an anvil adjustably guided on said base, a standard, also guided by said base, a feeding screw on said standard, and a drill shaft and stock passing through said screw, substantially as specified. (3) The

334,626



combined tool consisting of a slotted base, an anvil guided therein adjustably, an adjustably guided standard carrying a feed screw and drill stock, and a movable jaw guided by said standard and base, substantially as specified. (4) The combination, with a slotted base, of an anvil adjustable thereon, an adjustable standard on said base and carrying a feed screw, a movable jaw guided by the base and standard, and supplemental serrated jaws removably secured to the anvil and movable jaw, substantially as specified.