THE 80-TON CRANE AT WOOLWICH ARSENAL.

No. III.

IN our present paper we propose dealing with the 80-ton crane itself, which is now in course of construction at the works of Sir William Armstrong and Co., Elswick, Newcastle-upon-Tyne, that firm having contracted for its manufacture. It will be erected under the supervision of the Superintendent of Machinery at the Royal Arsenal, Mr. Hay, who has perfected a series of important hydraulic machinery throughout the various departments. The "accumulator," which produces the water power for the enormous number of cranes employed, is capable of extending its influence to a great many of them at the same time, three steam engines being attached to it, all of which can be simultaneously applied if necessary.

The crane is adapted to lift a load of 85 tons throughout a height or space of 60ft.; it has a rake of 47ft. 6in. from the centre of the pivot to a perpendicular let drop from the centre of the swivel block, and a clear height of 30ft. 3in. from the deck of the pier to the swivel eye when fully raised. The stipulated speed of lifting the extreme load of 85 tons is fixed at 4ft. per minute, a second speed being provided of about 7ft. per minute for loads up to but not exceeding 40 tons, and a third speed of about 40ft. per minute for raising the unloaded swivel block for any necessary purpose. An auxiliary chain is to be provided, having 3ft. less rake than the main block, this being intended for the purpose of lifting loads up to 8 tons at the rate of about 25ft. per minute. The details of arrangement are shown in the engraving. The speed of turning the crane on its axis is provided to be at the rate of five minutes for the accomplishment of a single complete revolution. These of course, it is needless to say, are only estimates of the actual working capabilities of the crane now under consideration.

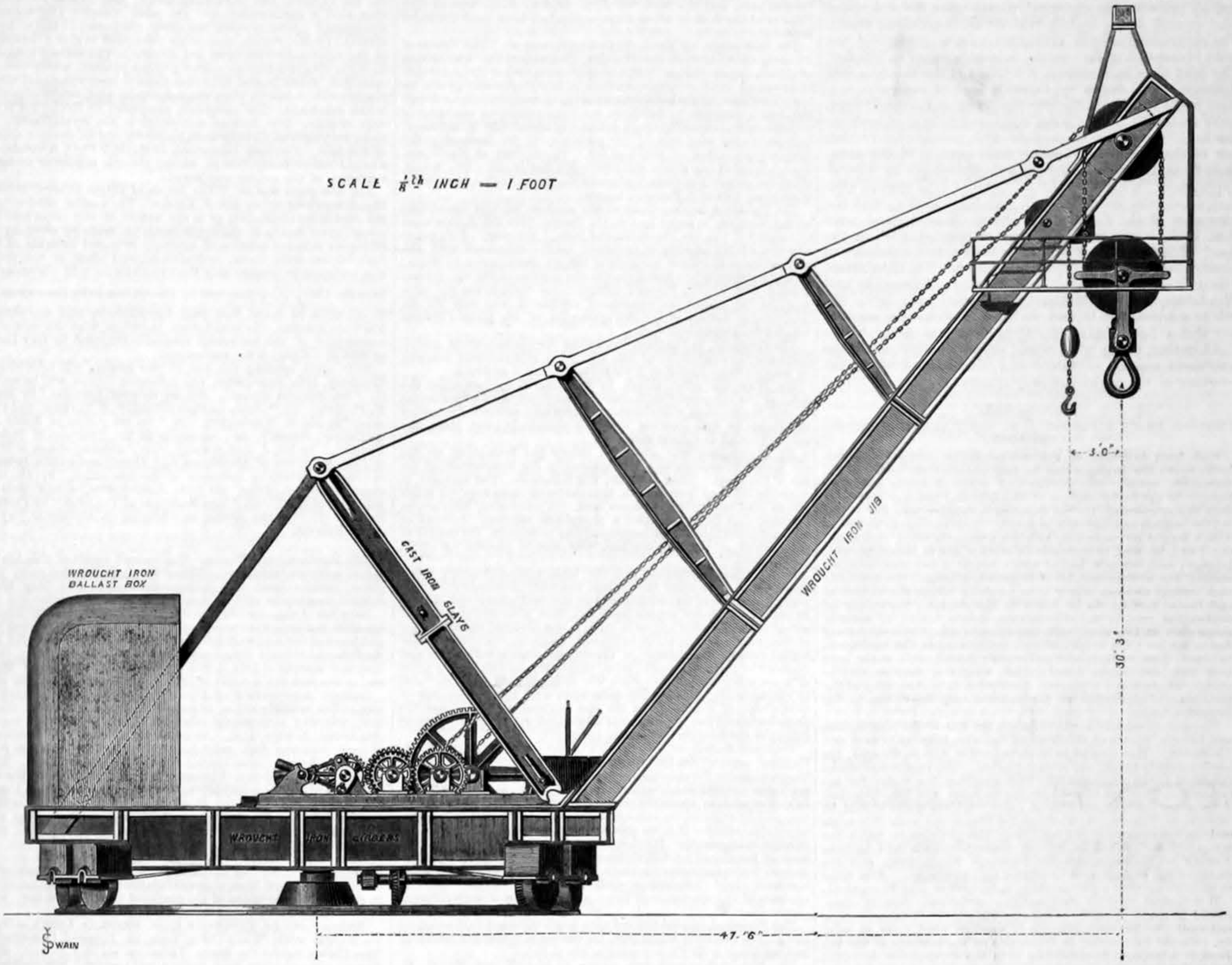
The jib is of wrought iron 55ft. long, and is attached at the bottom to a platform composed of wrought iron girders mounted upon four pairs of cast iron rollers, which run along the sweep plate or "roller path," described in our last article on this subject. Two of the pairs have a cogged wheel inside, worked by the hydraulic gear, for revolving the crane within the circle of the roller path; the other rollers are plain. Each pair of rollers is carried in a cast iron roller box, provided with gun-metal bearings for the axles to work in. The roller path is of cast iron, and the central pivot or bed, for the crane to work on, of the same material. The latter will be bushed with a gun-metal socket for the central pin of the crane, and it will be connected with the cast iron summit length of the 7ft. screw pile by four wrought iron bolts each 3in. in diameter. The central pin is of wrought iron, and about 13¾in. in diameter. It connects the crane to the centre pivot or bed. The platform girders are to be floored on the top with timber, to which, and direct to the girders themselves, the bed-plate of the hydraulic engine for winding the chains and revolving the crane will be bolted. The stays for the jib are of wrought iron, and are supported from the jib by other cross stays, as shown in the engraving. The main cross stays are of cast iron, and trussed together by diagonal stays of the ordinary character. A wrought iron platform, lightly constructed, is to be suspended at the extremity of the jib, for facilitating the means of access to jib-end sheaves. A wrought iron ballast box, capable of holding about 100 tons of gravel or slag ballast, is to be attached to the platform girders at the back of the crane, for the purpose of counterweighting the full weight of the load. This counterweight, together with the natural stiffness of the crane, will, it is anticipated, be sufficient to overcome the resistance of a far heavier load than 85 tons, the greatest test to which it is intended ever to submit it.

The hydraulic engine, for lifting and revolving, will have three cast iron oscillating cylinders, with cast iron plungers, and will be provided with valves, working gear, and reversing apparatus of the ordinary description. All the shafts for the spur and bevel gearing, for communicating the power of the hydraulic engine to the lifting drums and to the front rollers for turning the crane, will be provided throughout of wrought iron, and will have gun-metal bearings to work in. Wrought iron cupped drums of large and small sizes are provided for the large and small lifting chains respectively, and a separate brake and pawl wheel is connected to each several drum. All parts of the machinery exposed to the accumulator pressure are to be tested to an hydraulic force of 2500 lb. to the square inch before being fixed in their places.

The multiplying power of the main lifting block is to be four to one, and the lifting chain for this block to be 1½in. in diameter, or 4½in. chain. The auxiliary power is to be direct without any multiplying power, and the lifting chain for its block is to be 1in. in diameter, or 3in. chain. Both the main and the auxiliary lifting chains are to be tested to an endurance of 10 per cent. over and above the ordinary Admiralty proof at a public chain-testing establishment before being fixed to the crane after its erection.

Before concluding our notice of this monster machine and its appurtenances, we will digress for a moment to describe briefly the construction of the continuous wrought iron girders, two of which run upon the summits of the 5ft. columns forming the causeway between the "T" end of the pier and the shore. From centre to centre of each column is 48ft. The height of the web of the girders is 3ft. 9½in. The flanges are 18in. wide. Each flange consists of four layers of ½in. plates, the topmost layer being about 23ft. long and lying over the centre of the span, the second being slightly longer, and so on, the fourth, or lowermost, being 48ft. long. Wherever a joint exists there are, of course, "cover plates" put over it. A cover plate connects the contiguous portions of the girder over the centres of each column. The web of the girder is of ½in. plate. The girders are stiffened at short intervals by cross-framing of cast iron between them.

Whilst wishing every success to the working of the 80-ton crane, we cannot avoid expressing a fear that the principle which has been followed in the design of the foundations may possibly prove not to have been a sound one. We are of opinion that such foundations should be independent of and distinct from the pier with which they co-operate, so that, should any subsidence take place beneath the crane, it may not affect the latter. A crane constructed upon this—the independent—principle was erected some time ago by the Superintendent of Machinery at Devonport, and has been found to act admirably. At the same time it is quite clear that Colonel Scratchley, R.E., the Inspector of Works at the Arsenal, has laid the foundations of the new "T" pier and 80-ton crane with such extreme care and so solidly that it seems almost impossible that any subsequent disturbance of the piles and framework can take place.



THE BRAKE COMPETITION.

THE Railway Accidents Commission commenced their experimental inquiry into the comparative merits of various systems of continuous brakes on Wednesday morning. We have already indicated very fully the reasons which have caused these experiments to be carried out, and the system of inquiry to be adopted. It is therefore unnecessary to deal further with this portion of the subject here, and we may confine our attention to the actual progress of the inquiry, and the results obtained. As regards the first point, it became evident on Wednesday that the two days originally stated as presumably affording sufficient time to carry out the inquiry, would by no means suffice; and it is more than probable that, instead of two, seven or eight days may be occupied. It will be seen from the appended revised programme that no fewer than sixteen distinct experiments have to be made, and as no fewer than ten different systems of brake are represented, the result would be that if all were to be tried in the same way we should have 160 distinct experiments. In many cases, however, it is evident that far fewer than sixteen experiments can be made with certain systems, but we shall be under the mark probably if we assume that 100 separate trials will have to be made before the inquiry can be considered fairly complete. The experiments begin each day about half-past ten a.m., and they are prolonged to a late hour in the evening. On Wednesday night, however, it was found that only the "*a*" series of experiments as laid down on the programme had been completed with the London and North-Western, the Caledonian, the Brighton, the Great Northern, and the Midland. The Lancashire and Yorkshire and one of the Westinghouse trains took no

part in this trial, as all the brakes are more or less "continuous" on those trains, while of the "*b*" series only the London and North-Western, the Caledonian, the London and Brighton, the Lancashire and Yorkshire, and the Great Northern trains were disposed of. It will be seen that as the whole set of experiments hangs together, and must be taken as a whole in order to arrive at any just conclusion concerning the merits and demerits of the different competing systems, it would be unfair to the competitors to give any particulars of the results obtained at present, and the statement that a given train stopped in a given distance after running a given number of yards possesses, indeed, when taken by itself, no possible scientific interest. We shall consequently reserve the publication of figures until the trials are complete.

The large number of leading railway men present from every quarter of the kingdom affords ample evidence of the great importance attached to these trials, which constitute in themselves one of the most remarkable episodes in the history of railways. The mode of making the experiments is extremely simple. A train is started, and having run 3½ miles to get up speed, comes upon the staked-out trial ground at the highest velocity the engine can attain. The experiment is then made, the results noted, and the train is emptied of its occupants, some seventy in number. The next train in succession has followed the first at a safe distance. This draws up, takes its load of observers, and then backs steadily to the starting-point, and makes its run, to be succeeded in the same manner by the next train on the list. The trains, when done with, are sent on further out of the way. On Tuesday, those present at the trials were favoured with a sight practically unique in railway experience. When all the "*a*" series of experiments were completed, the trains were all coupled together, with the exception of the London and North-Western, and were sent back as one train, the engines running each at the head of its section of the whole train: this consisted of ninety carriages and six splendid engines. The Caledonian, Great Northern, London and Brighton, Lancashire and Yorkshire, and two Midland trains went to make up the whole composite train, and we think it is not too much to say that a finer display of rolling stock was never before got together, or one which could supply a better idea of the enormous amount of talent and wealth involved in the working of the modern railway system.

PROGRAMME.

Proposed Brake Experiments by the Railways Accidents Commission.

Each train to consist of thirteen passenger carriages and two brake vans; the carriages may be four wheel or six wheel, at the companies' option; the engines and trains complete should be brought to the Derby station of the Midland Railway not later than Friday morning, the 4th June, so as to allow time for weighing the engines and carriages in detail. Each carriage to be loaded with a weight corresponding with the number of seats, reckoning, say, ¾ cwt. per seat, to represent an average load of passengers with luggage; each van to be loaded with a weight of two tons, as representing the average weight of luggage it conveys; the weight of each carriage and van empty to be carefully taken; the weight of each loaded carriage to be taken in like manner: the weight of each engine used in the experiments, noting height of water in gauge glass at the time, and approximate quantity—weight—of fuel in fire-box; the weight of each tender used in like manner to be noted; first, without coke and water; second, with water, only tank full, and height noted; third, weight of coke or coal in tender, at starting; a general description to be furnished of the particulars of application of the brakes of each description to the respective trains.

The ground selected for the trials is the line of the Nottingham and Lincoln Branch of the Midland Railway, between Newark and Thurgaton. This ground to be staked out as may be directed, the levels carefully taken, and section plotted. The particulars will be furnished to the companies who have provided the trains for experiment. The days selected for the trials are the 9th, 10th, and if necessary the 11th and 12th of June. All the trains should be brought to Newark, in readiness for proceeding with the trials early in the morning of the 9th June. The direction in which the trains will be worked in making the experiments will be from Newark or Rolleston Junction towards Nottingham, and the carriages and engines must be coupled up accordingly. Each train to be provided with a slip coupling, to be used as may be required.

It is desired that all comparative experiments, class by class, should be made, as nearly as the case will permit, at the same time and under the like circumstances of weather, wind, state of rails, &c. Should the weather be favourable on the morning of the 9th June, it is proposed to commence with the experiments in entire trains, fitted-up with continuous brakes, taken in order as may be most convenient to the railway companies.

It has been arranged, and the commissioners have consented to make experiments on the following trains, viz.:—London and North-Western Railway Company, Clarke and Webb's brake; Great Northern Railway Company, Smith's vacuum brake; Midland Railway Company, Westinghouse brake; Midland Railway Company, Clarke's hydraulic brake; Midland Railway Company, Barker's hydraulic brake; Midland Railway Company, Kitson's steam brake, applied to engine and tender; Lancashire and Yorkshire Railway, Fay's brake; Caledonian Railway, Steele's air brake; North-Eastern Railway, vacuum brake, applied to engine and tender wheels; London, Brighton, and South Coast Railway, Westinghouse vacuum brake.

The following experiments to be tried, at the two speeds of forty and sixty miles per hour respectively:—On no account is either the steam to be shut off the engine, or are the brakes to be applied before the signal is given; nor will the guards or driver be allowed to touch the brake handles or levers after starting the trains, until the signal is given; the order to stop will be given either from the engine—by flag waved on engine—when both driver and guards will put on brakes, or by cord signal to guard; no sand to be used except in the experiments directed; in making the experiments having for their object the stopping in the shortest possible space, the amount of shock sustained in the act of stopping to be observed and measured as far as practicable.

First Series, with Complete Trains—Stop by application of (*a*) Tender brake and van brakes worked by hand; (*b*) Tender brake, van brake, and continuous brake applied by guards on flag or cord signal; (*c*) Tender brake and continuous brake, applied by guards on flag or cord signal, and engine brake, if any; (*d*) Tender brake and continuous brake, applied by driver and guards, and also engine brake, if any, using, in fact, all available means to stop excepting sand tubes; (*e*) As the last-named (*d*), but using sand boxes of engines and vans; (*f*) Rear guard to signal driver by cord, to apply his section of continuous brake, or the whole; (*g*) As the last (*f*), but without guard signalling to driver; (*h*) Driver to shut off steam, and apply continuous brakes; (*i*) Driver to shut off steam, and apply tender and engine brakes.

Second Series—Stop Engine and Tender only:—(*a*) By shutting off steam only; (*b*) By tender brake only—steam shut off; (*c*) Engine brake only—steam shut off; (*d*) Tender brake and engine brake; (*e*) Tender brake and reversing brake.

Third Series—Ascertain the Friction of the Trains of Carriages: (*a*) By running them down incline from a state of rest, or (*b*) By observing retardation of motion over a given space, the train of carriages being detached from engine by slip coupling. N.B.—Such supplementary experiments to be made, as the circumstances at the time may render desirable, and as the commissioners may think fit. The number of people on the engine of each experimental train during the time of the trials is not to exceed engine-driver, fireman, pilot-driver, non-commissioned officer R.E. for signalling, Mr. Woods, Colonel Inglis, Lieut. Scott, R.E., and locomotive superintendent (or representative) of owning company, and brake patentee (or representative).

THE CHEMICAL SOCIETY.

Thursday, 3rd June, 1875.

Professor Abel, F.R.S., President, in the Chair.

After the minutes of the previous meeting had been read and confirmed, and the donations announced, Messrs. P. Melmore, R. E. H. Goffin, C. G. Cresswell, and A. Senier, were formally admitted Fellows of the Society. The names read for the first time were those of Messrs. A. W. Genard, J. Brett Guyer, E. Gee, and A. N. Gow. Messrs. Falkland Mackinnon, Charles Thomas Blanshard, B.A., George Crampton, John Cope Butterfield, Joseph Wilson Swan, Alexander Wynter Blyth, Robert Stetton, Thomas Purdie, jun., and the Rev. W. J. J. Welch, M.A., were elected Fellows of the Society after their names had been read the third time.

The first paper, by Mr. J. T. Coleman, was on "The Effects of Pressure and Cold upon the Gaseous Products of the Distillation of Carbonaceous Shales." The author finds that if the gas which is produced in such large quantities in the preparation of oils by the distillation of shales is submitted to a temperature of 0 deg. Fah. at a pressure of 140 lb. to the square inch, a quantity of volatile hydrocarbons having a density of about ·680 is obtained, suitable to be used for air gas purposes, or for increasing the illuminating power of poor coal gas. The amount of liquid condensed is about one gallon per 1000 cubic feet of gas. The latter, after the removal of these hydrocarbons, burns with a blue flame resembling that of a Bunsen's burner.

The President having thanked the author for this interesting communication, a paper by Dr. C. Brown, "On the Agricultural Chemistry of the Tea Plantations of India," was read. This paper contains a large number of analytical results connected with the cultivation of the three varieties of the tea plant grown in India. In one instance it was found that in the portion of the tea garden treated with Dr. C. Brown's fertiliser, the yield of tea per acre was 494 lb., and in the unmanured portion it was only 397 lb. Analysis of the ash of the two specimens of tea yielded results which were almost identical.

The President, in thanking Dr. Brown for his important contribution to the agriculture of the tea plant, said it would scarcely be possible to do justice to it without studying it in detail.

Mr. Way was much struck by the interesting fact which the table of the ash constituents showed, that there was a large amount of soda uncombined with chlorine. In his own somewhat extended experience he had observed that the sodium, in most cases, was chiefly present as sodium chloride.

Mr. Warrington was afraid Dr. Brown had been going on the old system of constructing the manure on the composition of the ash of the plant. This, however, was fallacious. For instance, it would be inferred from the ash, that the turnip crop required much potash and but little phosphoric acid. It was found, however, in practice, that turnips require a phosphatic manure. Instead of taking the old method of composing the manure on the results of the analysis of the ash, the best way was to proceed on direct experiments.

Dr. Thudicum remarked that the table suggested a very interesting point. We knew that potash was very necessary for plant growth, and it was remarkable that as the leaf grows old it loses its potash. It would appear from this, that after the potash had served to build up the leaf, as it were, it was absorbed again into the system, its place being taken by lime and magnesia. In certain pathological diseases, the potash in the cell structure is withdrawn and replaced by lime. It would seem, therefore, and this was a point of great importance, that potash was essential both to animal and to vegetable life. He did not quite agree with the last speaker as to the effect of manures. In the case referred to it was not the phosphoric acid but the sulphuric acid which was accidently present that gave the manure its peculiar action.

Professor Maskelyne then gave a short account of Mr. J. A. Phillips' paper "On the Structure and Composition of certain Pseudomorphic Crystals having the Form of Orthoclase." These remarkable crystals which occur at Huel Coates, in Cornwall, are felspar crystals in which the potash has been removed, and its place occupied by oxide of tin and other minerals. The author has procured thin sections of these crystals and submitted them to microscopical examination. He describes their appearance as that of a mass of interlaced mica-like plates of a silvery white colour interspersed with quartz crystals and crystals of tin oxide, and in some instances blue tourmaline (indicolite). The paper contains analyses of two specimens of these pseudomorphs of very different composition.

The President said the fellows were much indebted to the author, and also to Professor Maskelyne, for the lucid comments which he had combined with the summary of the paper.

Dr. Wright then read two papers by himself and Mr. G. H. Beckett, the first of which was entitled "Notes on the Sulphates of Narceine and other Narceine Derivatives."

After referring to the pertinacity with which narceine hydrochloride retains traces of hydrochloric acid, and the readiness with which the former is decomposed by water, the authors say that in no case could they get any definite narceine sulphate more basic than the "bisulphate," which is prepared by crystallising narceine from dilute sulphuric acid two or three times. It has the composition $C_{23}\,H_{29}\,NO_9$, $H_2\,SO_4$, $10H_2O$, but breaks up in presence of water into more basic salts of indefinite composition. Unlike the hydrochloride, narceine sulphate is *completely* decomposed by sodium carbonate, affording a means of obtaining pure narceine. The action of nascent hydrogen on narceine removes the oxygen and gives rise to an uncrystallisable base. When narceine is heated with acetic anhydride it is partly dehydrated, and with excess of ethyl iodide it yields a varnish-like non-crystalline compound $C_{23}\,H_{29}\,NO_9$, C_2H_5I.

In the second paper "On the Action of Organic Acids and their Anhydrides on the Natural Alkaloids, Part V.," the authors treat of the action of succinic acid, camphoric acid, and oxalic acid on codeine, and on morphine, and of tartaric acid on codeine. With succinic acid the action is not similar to that which takes place with the monobasic acids, but a new class of compounds is formed analagous to the ethylene-succinic acid of Lourenço. The action of oxalic acid on the alkaloids converts them into a mixture of polymerides, from which, in one case, dicodeine and tricodeine were isolated, and in the other diamorphine, trimorphine, and tetramorphine.

Professor Abel having thanked the author, a paper on the "Action of Chlorine on Pyrogallol," by Dr. J. Stenhouse and Mr. Charles E. Groves, was read by the latter. In this paper the authors describe two compounds they have succeeded in preparing from pyrogallol by the action of chlorine on it in an acetic acid solution. The first, *mairogallol*, $C_{18}\,H_7\,Cl_{11}\,O_{10}$, is obtained by saturating the solution in the cold, and then heating it to 70 deg. Cent. in the current of chlorine. On cooling the new compound is deposited in hard lustrous crystals, insoluble in water, but very soluble in ether. The other compound, *leukogallol*, $C_{18}\,H_9\,Cl_{12}\,O_{12} + 2OH_2$, is prepared by saturating the acetic solution in the cold, and then adding about one-fourth of its bulk of concentrated hydrochloric acid. The mixture then solidifies to a mass of minute crystals, which are purified by pressure, and crystallisation from a mixture of ether and benzene. Leukogallol is moderately soluble in ether, and readily soluble in water. It melts at 104 deg. Cent., and is at the same time decomposed, giving rise to new crystalline products.

Mr. Lewis then gave an account of three forms in which mairogallol crystallises.

The President having thanked the authors for their interesting communication, Mr. W. H. Perkin read a paper "On Nitroalizarin." He finds that the action of nitric acid on diacetylalizarin produces nitroalizarin $C_{14}\,H_7\,(NO_2)\,O_4$, a very definite and stable body, crystallising in orange yellow needles, and dissolving in caustic alkali with a beautiful blue colour. Reducing agents convert this into amidoalizarin $C_{14}\,H_7\,(H_2\,N)\,O_4$, which crystallises from alcohol in dark chocolate-coloured needles with a greenish metallic lustre. The solutions of this substance are crimson red, and its alkaline derivatives are of a similar colour.

Nitroalizarin produces, with alumina, mordants of an orange red colour similar to "aurin," and with iron mordants a reddish purple, whilst amidoalizarin gives a purple with alumina mordants, and a bluish violet or steel colour with iron. Both these derivatives dye unmordanted silk, nitroalizarin a clear golden colour, and amidoalizarin a purple red. The author also gave an account of monacetylalizarin $C_{14}\,H_7\,(C_2\,H_3\,O)\,O_4$. It crystallises in golden scales, and, like the diacetyl derivative, is readily decomposed by alkalis.

The President thanked the author, in the name of the fellows, for his valuable and interesting paper, and Mr. R. Williamson then read a communication "On some Metallic Derivatives of Coumarin." After noticing the silver compound $C_9\,H_6\,O_2$, Ag_2, O, obtained by Mr. Perkin, the author proceeded to give a description of the various derivatives he had obtained. The sodium compound $C_9\,H_5\,O_2$, 2Na HO forms a yellow gummy product, which does not crystallise. When heated to 150 deg. Cent. it loses water, and then no longer yields coumarin when treated with an acid, but an amorphous brown substance. The potassium compound $C_9\,H_5\,O_2$, 2 K H O is very similar. The barium compound is not crystallisable. All these are prepared directly from coumarin and an aqueous solution of the base. The lead compound, $C_9\,H_5\,O_2$, 2 Pb O, is obtained as a bright yellow precipitate on adding plumbic nitrate or acetate to a solution of the sodium compound.

The last paper was on "The Action of Dilute Mineral Acids on Bleaching Powder," by Mr. F. Kopfer. The author, after noticing the conflicting statements as to the nature of this important compound, gives details of the experiments he made by carefully distilling an aqueous solution of carefully prepared chloride of lime with various acids, acetic, hydrochloric, and nitric, in the proportion sufficient to liberate only the hypochlorous acid, assuming the formula $Ca \begin{cases} Cl \\ O\,Cl \end{cases}$ proposed by Dr. Odling to be the correct one. In all cases he found that pure hypochlorous acid was obtained free from chlorine. It would seem, therefore, that the view of the constitution of this compound originally proposed by Gay Lussac, or that of Odling, is the correct one.

The next meeting, the last of the session, will take place on Thursday, 17th June, when the following papers will be read:—(1) "On Nitrosyl Bromide and on Sulphur Bromide," by Mr. M. M. P. Muir. (2) "Notes on the Chemistry of Tartaric and Citric Acid," by Mr. R. Warrington. (3) "On the Action of Nitric Acid on Copper, Mercury, &c., especially in the Presence of Metallic Nitrates," by Mr. J. J. Ackworth. (4) "Decomposition of Water by the joint Action of Aluminium acid Aluminium Iodide, Bromide, or Chloride, including Instances of Reverse-action," by Dr. Gladstone and Mr. A. Tribe. (5) "On Achromatite, a new Molybdo-Arseniate of Lead." (6) "New Reactions of Tungsten," by Professor Mallet. (7) "On the Action of Chlorine on Acetamide," by Mr. J. W. Prevost.

The Belgian Iron Trade.—The current aspect of this trade is one of extreme quietness. There are inquiries for rails, tires, plates, puddle bars, but Belgian firms state that they find it difficult to compete with England in regard to such *matériel*.

English Coal in Belgium.—Official advices from Brussels establish the somewhat remarkable fact that we are sending more and more of our coal to Belgium. In the first four months of 1873, English coal entered Belgium to the extent of 40,000 tons; in the first four months of 1874 it was imported to the extent of 60,000, and in the first five months of 1875, to the extent of 150,000 tons.

London Association of Foremen Engineers and Draughtsmen.—The monthly sitting of members held on Saturday, the 5th inst., was very numerously attended. It was presided over by Mr. Joseph Newton, C.E. As usual, the election and nomination of new members took precedence of the other business of the evening. Among those elected were Mr. Alfred W. G. Weeks (horticultural engineer, Chelsea), Mr. G. Trench (of the Gun Cotton Works, Faversham), Mr. Holehouse, and Mr. W. J. Connor. Mr. Ainslie and Mr. John Hogg were nominated for ordinary membership, and Mr. Aubrey was appointed auditor. The chairman next introduced Sir David Salomons, who, with the aid of models, beautifully constructed by Mr. Bateman, and which comprised a line of railway forty feet in length, with two locomotives traversing it, explained his automatic (electrical) system of signalling. Mr. Lloyd Wise afterwards introduced a resolution adverse to some of the provisions of the proposed new patent law, which was carried. The meeting terminated at a late hour.

Opening out of Extensive Coal Mines in China.—During the present week, Wang-Ching-Yong, an Imperial Commissioner from China, visited the South Yorkshire colliery district, with a view of examining the most modern and powerful machinery used in drawing coal and carrying on the work in connection with large collieries. It appears that the Imperial Commissioner visited the district at the instance of the Chinese Government, who are about to open out some large coal-mines in that country. He was accompanied by John Bourne, Esq., C.E. of London, Consulting Engineer to the Chinese Government and Mr. Learman of London. On entering Barnsley, he was received by Mr. W. H. Peacock, jun., manager of the Hoyland Silkstone Collieries. After luncheon at the King's Head Hotel, Barnsley, the party visited the collieries belonging to the Dodworth and Silkstone Coal and Iron Company, where the Imperial Commissioner inspected the surface plant, and afterwards descended the shafts and viewed the workings, with which he seemed greatly surprised. He next paid a visit to the Monk Bretton Colliery, near Barnsley, where there are probably a couple of the largest horizontal winding engines in England. After viewing the plant and appliances, the Imperial Commissioner expressed his desire to see a colliery where a large quantity of water has to be pumped. It may be stated that one of his chief objects in visiting England was to inspect arrangements and machinery for clearing mines with water. Up to the present time one of the greatest difficulties which has been met with in connection with mining operations in China has been the large influx of water which has been met with, and which has stopped mining operations, or interfered with them to a serious extent. The commissioner was next driven to the Wath Main Colliery at Wath-upon-Deanie, where something like 120,000 gallons of water per hour has to be pumped, the water, it is believed, being drained from some of the heavy collieries in the immediate locality. The party next visited the Melton Ironworks, belonging to Messrs. W. H. and G. Dawes, where he inspected the blast furnaces and the other appliances used for producing finished iron. The next place visited was the Hoyland Silkstone Collieries, where he made a very minute inspection of the large and substantial surface plant which is being put down for working the Silkstone seam. During the week he has also visited the works of Sir John Brown and those of Messrs. Cammell and Company at Sheffield. It may be stated that the Imperial Commissioner is an accomplished Chinese scholar, and has already spent some time in various parts of Europe. He can speak German and French fluently, as well as a fair amount of English. It is believed before leaving England he will give orders for a large quantity of mining machinery to take out to his native country for developing mining operations there.

RAILWAY MATTERS.

THERE are now completed and in operation 325 miles of the Texas and Pacific Railroad, and it is expected that during the present year 125 miles more will be completed and put in operation.

MOST of the members of the French Council of State are, says the *Continental Herald* favourable to the submarine tunnel scheme. They have commissioned M. Collignon, the engineer, to draw up a report concerning the undertaking.

THE report of the directors of the great Indian Peninsular Company states that the railways worked by the company during the half-year were 1278½ miles; the State lines (single track) were 151½ miles, worked for an average of three months, making the total length 1430 miles. The Nizam's State Railway, which was opened for traffic on the 9th of October, 1874, was connected with this company's south-east line at Wadi, 257 miles beyond Poonah, and 66 miles short of Raichoor, the junction with the Madras railway system. The number of train miles run upon this company's lines was 1,644,380, being an increase of 81,359 run in the corresponding half-year of 1873.

WE understand, says the *Railway News*, that Captain Tyler, R.E., with two eminent railway engineers, have been requested to act on the part of the Ottoman Government in the arbitration which has been decided upon to settle all pending differences between the Turkish Government and Baron Hirsch in connection with the Roumelian railways. The two arbitrators appointed by the Porte are Server Pasha, formerly Minister of Foreign Affairs, and afterwards Ambassador at Paris, now a member of the Council of State; and Odian Effendi, also a Councillor of State, and a member of the Budget Commission now sitting. The arbitrators on the part of Baron de Hirsch, who have been designated, but are not yet definitely appointed, are Count de Prokesch-Osten, son of the well-known diplomatist of the same name, who was for many years Austro-Hungarian Ambassador in the Turkish capital; this nominee holds a high appointment in the Austrian Railway administration; M. de Kremer, Austrian Councillor of State, is his probable colleague. Captain Tyler and the English engineers will act as technical advisers to its nominees.

THE *Levant Herald* says:—"The working company of the Ottoman railways has, we learn, stopped the works which were in progress on the Shumla line, and which, after several years' delay, had at length been begun in October last. If we are rightly informed, the principal cause of this stoppage is the non-payment of the bi-monthly certificates presented by the company to the Government. These certificates having remained unliquidated for more than six months past, the company has, it appears, found it impossible to go on making advances to the Government for the execution of the works, and is now compelled to dismiss its workmen. Under any circumstances this step is very greatly to be regretted—the more so since it is always much less easy to take up again works which have been suspended than to carry them out interruptedly. The Shumla line, which, according to the existing contract, ought to have been completed at this very time—that is to say, by the 18th of May, 1875—is of peculiar interest to our public, inasmuch as it would have put Constantinople in railway communication with the rest of Europe, through its junction at one end with the Yamboli line, which is already being worked, and at the other with the railway from Varna to Roustchouk. In a strategical point of view, moreover, it would have been desirable that the stronghold of Shumla should have been connected as soon as possible by rail with the interior of the empire."

THE report of the directors of the Madras Railway Company states that, considering the great amount of injury which was done to various parts of the railway by the extraordinary severity of the floods in October last, it was, in the opinion of the directors, a proof of the energy and skill of the company's officers that the permanent way should have been speedily restored to working order, and that the traffic receipts of the line should not have been more injuriously affected. At the Goriattum-bridge, on the south-west line, five arches were swept away. At the Cheyer-bridge five piers and two abutments, and at the Paupugneer-bridge four permanent and two temporary piers were washed away. At the Chittravutty-bridge nine piers were destroyed, and two sets of 140ft. girders carried away, besides two more much damaged. At the Pennair-bridge two piers were destroyed. Besides the foregoing, innumerable other casualties of a minor description were experienced on several parts of the lines. By the most strenuous exertions temporary repairs of the ruined structures were effected, and through traffic was resumed on the south-west line by the 4th of November, within ten days of the disaster; and on the north-west line through communication was fully established on the 19th of January last; but it had been previously restored in part, subject to transhipment of light goods and passengers and ferrying across three of the rivers, on the 17th of November, after an interruption of twenty-three days. The acting chief engineer, in a letter dated the 5th of March, remarked that "designs for the reconstruction of the damaged portions of the bridges had received the sanction of the Government." They were being executed with the greatest possible energy. The works at the Cheyair, Paupugnee, and Chittravutty bridges were so forward that the engineer believed they would be ready for traffic by the 15th of April. If no heavy freshes came down before the end of May he expected that the bridge over the Pennair river would be restored by that time. Precautions would be taken to prevent, if possible, the recurrence of such disasters in future.

AN experimental trial trip from London to Cambridge and back has been made on the Great Northern Railway in order to test the performance of one of Mann's boudoir sleeping cars, described by the proprietors as a new design of a carriage of luxury for the public. We have already mentioned the fact of these cars being used on the Paris-Vienna line. The car, which fully justifies by the perfection of its fittings, the term a "carriage of luxury," is 30ft. long, and differs from the Pullman sleeping cars in two chief characteristics—first, that instead of having one large room, it is divided into four small compartments or boudoirs; secondly, that its beds are placed transversely to the line of railway. Two of the compartments make up four beds each, and the remaining two make up two beds each; and they are perfectly enclosed and secluded on all sides. During the day-time the same compartments will afford seats for eighteen passengers. The cars are fitted up with lavatories for ladies and gentlemen, and an attendant travels with each, and can be summoned by a bell from each bed. In the beauty and finish of its appointments the car is quite equal to those of the Pullman Company, and it possesses one special convenience which is worthy of note. This is a set of small steps in each compartment, so arranged that they form the support of a table which can be unshipped and laid aside, and then they assist passengers to mount into the upper sleeping berths. When they were first introduced, although the comfort of their sleeping berths was much appreciated, we heard complaints of the oscillation due to a rigid wheel base for so long a carriage. In the car tried lately this oscillation was overcome by giving some lateral play to the wheels, and the travelling was admirable in its steadiness. The journey of 59 miles to Cambridge was made in 1 hour 27 minutes, and the maximum speed attained was at the rate of 60 miles an hour. The car is not of the newest pattern, and its weight—14 tons—exceeds by 3½ tons that of some which are now running on the Continent, and which afford equal accommodation for the same number of passengers. The compartments are lighted with the new railway lamps of the Silber Light Company, which will afford to the occupants light enough for reading or pursuing other occupations, and which can be screened when the time comes for retiring to rest. In thus following the good example set by the Midland, the Great Northern Company deserves the thanks of all who make long journeys by it; and as soon as the car comes into general use on the line, it will be possible to go to bed between King's-cross and Peterborough, and to wake refreshed at Edinburgh or at Perth. The change from the former system will not fail to be appreciated when the time comes at which tourists and sportsmen turn their faces to the north.

NOTES AND MEMORANDA.

ACCORDING to the *American Chemist*, effervescent baths are now recommended by some French physicians. A certain amount of acid carbonate of sodium is dissolved in the water, and sufficient hydrochloric acid nearly to neutralise the sodium salt is added. Salts of iron and other salts may also be added if required.

ACCORDING to the *Zeitschrift des Vereins Deutscher Ingenieurs*, Dr. Redner calculates that for every cubic metre of gas recorded as having passed through a wet gas meter, twenty-three litres of aqueous vapour, or 2·3 per cent. by volume of the gas unrecorded is aqueous vapour, taken up by the passage of the gas through the water.

SWEDISH newspapers report the discovery of a large deposit of hematite iron ore in the district of Nordland, Norway, some 15 or 20 miles from Bodo, and only about 10 or 12 miles from a Norwegian port which is completely free from ice. The analysis of the ore shows that it contains between 54 and 67 per cent. of iron and only a very small percentage of phosphates.

THE *Bassiret* states that new silver and iron mines have been discovered in the neighbourhood of Batoum, on the Asiatic coast of the Black Sea, but that sufficient is not yet known of them to enable an opinion to be formed of their value. The same paper adds that the working of the copper mines of Kure, near Castamouni, which has been abandoned by the Government, is about to be resumed.

THE hydrographic office at Paris has begun a process of engraving on copper which promises by its rapidity and the moderation of its price to be very widely useful. It consists in substance, first, in covering a plate of copper with a thin shell of adhering silver, upon which is spread a thin layer of coloured varnish; second, in drawing thereon, with a dry point, the lines of topography, and lettering, precisely as one engraves with a diamond upon stone; third, in corroding the traced parts by means of the perchloride of iron.

"ONE or two of our exchanges" says the *American Manufacturer*, "seem half inclined to doubt the correctness of our statement that iron had been recently rolled in this city—Pittsburgh—so thin that it would require 10,000 sheets of it to make an inch in thickness. We have the word of the proprietors of the mill, men who stand high among their fellow-manufacturers and the community generally. We have also seen a sheet of it ourself. It is so light that an ordinary expiration of the breath will blow it away, and seems to be about as thin and soft as gold leaf. We have no doubt that it is thin as claimed."

A PAPER on the smelting of iron ore with lignite, by R. Von Reichenbach, will be found in the *Berg-und Huettenmanische Zeitung*, No. 24, 1874. The author, after reviewing the projects of Gerstoff, Wagner, Mietsch, Khern, Siemens, and others, for solving this problem, goes on to propose the following plan:—(1) For the older lignites, a blast furnace of moderate height, with a very hot blast, to prevent a sintering of the coal. (2) With the more recent lignites, to dry them so as to expel all hygroscopic and chemically-combined water, and to use these also in low furnaces. (3) To carry on further experiments as to the coking of the lignites. (4) Where there are large quantities of fine coal, to use this in one shaft for the reduction of the ore, which is then to be smelted in another shaft with the coarser coal. (5) In case the preceding methods are not successful, to try a partial or total treatment of the ores with gas produced from the lignites in generators.

PROFESSOR GLADSTONE, F.R.S., concluded his lectures on Chemical Force at the Royal Institution, by describing a series of experiments, which have recently been made by himself and Mr. Tribe by means of what is called copper zinc couple. When thin sheets of zinc are immersed in a solution of cupric sulphate, copper is deposited upon it in a minute state of division, and thus the two metals touch at myriads of points. When this couple is immersed in a binary liquid, the liquid at each point of junction is exposed to the full chemical or electro-motive force of the metals. It was shown that this obviates the great difficulty there often is in decomposing a liquid on account of the "resistance" which it offers, and the lecturer exhibited the breaking up in this way of pure water, iodide of ethyl, chloroform, and many other substances with the production of pure hydrogen, zinc ethyl, hydrides, &c., and several bodies previously unknown, some of which are spontaneously inflammable in the air; in fact, one substance which had never been made before was prepared expressly for the lecture, and was named zinc ethylochloride. The copper zinc couple has been practically applied to the production of certain organic compounds, and to the determination of nitrates in potable waters.

A VERY curious fact with regard to what may be termed nitroglycerine compounds proper, such as dynamite, lithofracteur, and others in which the nitroglycerine is not used combined with another explosive, was brought out by Mr. Nobel, in the paper recently read by him before the Society of Arts. The power of the nitroglycerine compound is almost exactly in proportion to the percentage of nitroglycerine which it contains. Taking the power of pure nitroglycerine at 100, he showed that dynamite No. 1, which contains 75 per cent. of nitroglycerine, possessed 74 per cent. of the power; whilst lithofracteur, with 55 per cent. of nitroglycerine, possessed 53 per cent. of the power of pure nitroglycerine. The presence, therefore, of the charcoal, sulphur, and barium nitrate, in addition to the kieselguhr in the lithofracteur, adds nothing to its strength. Compressed gun-cotton is of the same power as dynamite No. 1; the patent cotton gunpowder (which contains no nitroglycerine) is but 12 per cent. weaker. Equal proportions of nitroglycerine and compressed gun-cotton has a power midway between pure nitroglycerine and dynamite No. 1; and a mixture of 20 parts nitroglycerine, 6½ parts charcoal, and 80 parts ammonium nitrate occupies the same position. A mixture of 4 parts mealed gunpowder and 1 part nitroglycerine has but one-half the power of pure nitroglycerine: which, in its turn, has 4½ times the power of Curtis and Harvey's extra strong blasting-powder exploded with a detonator.

THE report of Mr. T. Vanstavern, executive engineer, D.P.W., upon the exploration of Col. Applegath's supposed coal-field in the Kistna district, leaves little doubt, says the *Mining Journal*, that there is an entire absence of coal over the whole area which was believed to contain that mineral. The bore-holes have all been put down until the metamorphic rocks were reached, and no coal nor any combustible substance was met within any of them. In addition to this Mr. Vanstavern closely examined the ground over an area of 58 square miles, and searched carefully for fossils without success. He remarks that no "coal-bearing rocks nor outcrops of coal or any combustible matter was met with," and expresses his opinion that "by the nature of rocks there certainly cannot be any coal," and in this view all geologists will probably agree with him. Col. G. W. Walker, R.E., secretary to Government, expresses his regret that he has to concur with Mr. Vanstavern's views, but the explorations have been so complete that he feels sure that if coal existed at all in the place some signs of it must have been discovered. The borings have been made as close as possible to the pits dug by Col. Applegath, and in every instance have been sunk below the bottom of the pits; in addition to this Mr. Vanstavern, at Col. Walker's request, cleared out the horizontal shaft in which it was understood Col. Applegath found something resembling coal, which he was able to burn, but nothing was met with except shale. It appears that Colonel Applegath was misled by a black clay shale with graphite and dark-brown clay, which might be supposed to have been taken from the immediate neighbourhood of coal. It seems that this view was at first entertained by Col. Walker and Mr. Vanstavern, but systematic exploration has entirely dispelled the illusion, and left no hope of finding coal in the Kistna district. Col. Applegath may congratulate himself that the entire subject has been thoroughly investigated and settled, and that although it has been proved that no coal exists, the similarity of the shales met with to those found near coal relieves him from any reproach for having anticipated the existence of coal.

MISCELLANEA.

SLATE shelving has been adopted in the library of the Greenwich Observatory for bound manuscripts.

THE new Sassoon wet dock at Bombay was successfully opened on Tuesday, the steamer Caradoc being the first vessel to enter it. At the *déjeûner* which followed Mr. Donald Graham proposed a toast to the success of the dock. Mr. Gubbay responded.

ELECTRIC science occupies a place of no mean importance in the new opera house in Paris. A special room is set apart as a battery room, in which 360 Bunsen's cells, arranged in sets of 60 on rough plate glass tables, are manipulated to pass a current to any part of the stage, so as to direct the electric light upon any point of the scenery.

THE new cable about to be laid between Australia and New Zealand, in connection with the Eastern Extension Telegraph Company's system, will receive special guarantees as to rates from the New Zealand Government. The contract for the new cable will be undertaken by the Telegraph Construction and Maintenance Company.

THE New British Iron Company distributed, on Tuesday night, to miners who some time ago displayed not a little bravery in restoring the workings of the Wynnstay pit, belonging to the company, which had taken fire and was for a time closed up, gifts of money and silver medals; and to each of the various colliery managers a piece of plate was presented.

AN American establishment, the Portsmouth Foundry and Machine works, is making a pair of shears for the Aurora Iron works which will weigh 40 tons and will clip 1½in. plate, the knives clearing 10ft. every revolution. Mr. A. M. Boal, an old Pittsburgher, is superintendent of the works. The foundry is said to be the finest building of the kind in the State.

THOSE who feel anxious regarding the safety from fire of the Greenwich Observatory, will be reassured by the last report of the Astronomer Royal, from which it appears that there are on the observatory grounds three fire-plugs, always charged with water at a pressure of about 100ft., and that the observatory is provided with 220ft. of large fire-hose. The assistants are periodically exercised in the use of the hose.

THE Agricultural Society of France has organised a competitive trial of reaping machines, to take place at Versailles, in July. The prizes offered for those of French manufacture are, first, 500f. and a gold medal; second, 200f. and a silver medal; and various honourable mentions; and next, for those of foreign countries similar rewards; lastly, 500f. offered by the council-general of the Oise for a trial between the two principal winning machines, French and foreign.

A CORRESPONDENT of a German paper, writing from Yokohama, says:—"The consumption of petroleum in Japan is very large, and shiploads are received from America. Japan, however, possesses naphtha springs in her own territory, and some time since Ischisaka Schujo was sent to Pennsylvania to obtain information relating to the process of production and preparation. His son is still in the States purchasing the necessary machines and perfecting his studies of the subject."

AT Liverpool the George's Landing-stage has had another narrow escape from destruction by fire. The stage is now in the graving-dock at the Canada Works, Birkenhead, and on Monday afternoon there was a fire on these premises. The fire broke out in the mortarmill yard, and a quantity of timber became ignited; but the flames were soon extinguished by a hose from a Pacific steamer. The stage, which is being repaired, was moved from the position in which it was moored, otherwise it would most likely have been set on fire.

A THOROUGHLY determined attempt is being made near Uttoxeter to ascertain whether the neighbourhood is underlaid by coal-measures, previous attempts of the kind having been abandoned through fear of too large a consumption of capital in carrying out the experiments. The site of the present operations is near Mill-lane, about two and a-half miles south-west of the town. The spot has long been regarded by the public, and more recently by scientific men, as one likely to yield coal. It is intended to sink a ventilating shaft to the depth of 100 yards in prosecution of the design, and to brick it downwards as the operations progress. In this way some eighteen yards have already been sunk. Several gentlemen are uniting their capital in the undertaking.

THE work of repair to the Brazilian ironclad turret ship Independencia, now lying in the Royal dockyard at Woolwich at the cost of her builders, Messrs. Dudgeon and Sons, of Cubitt Town, has, after a rather long delay, been resumed. She has been thoroughly examined by the Admiralty surveyors, and it is understood that, in accordance with their recommendations, a section of the ship is to be cut away amidships, where the damage lies, and that portion rebuilt, by which course it is expected that the ship will be set up as strong as she was before her unfortunate mishap on the launching way. A great number of workmen have been set to work upon her, and the repairs will probably occupy twelve months. Most of the 9in. armour plates around her side have been removed in order to facilitate the work; but the keel of the vessel, which is uninjured, will not be touched.

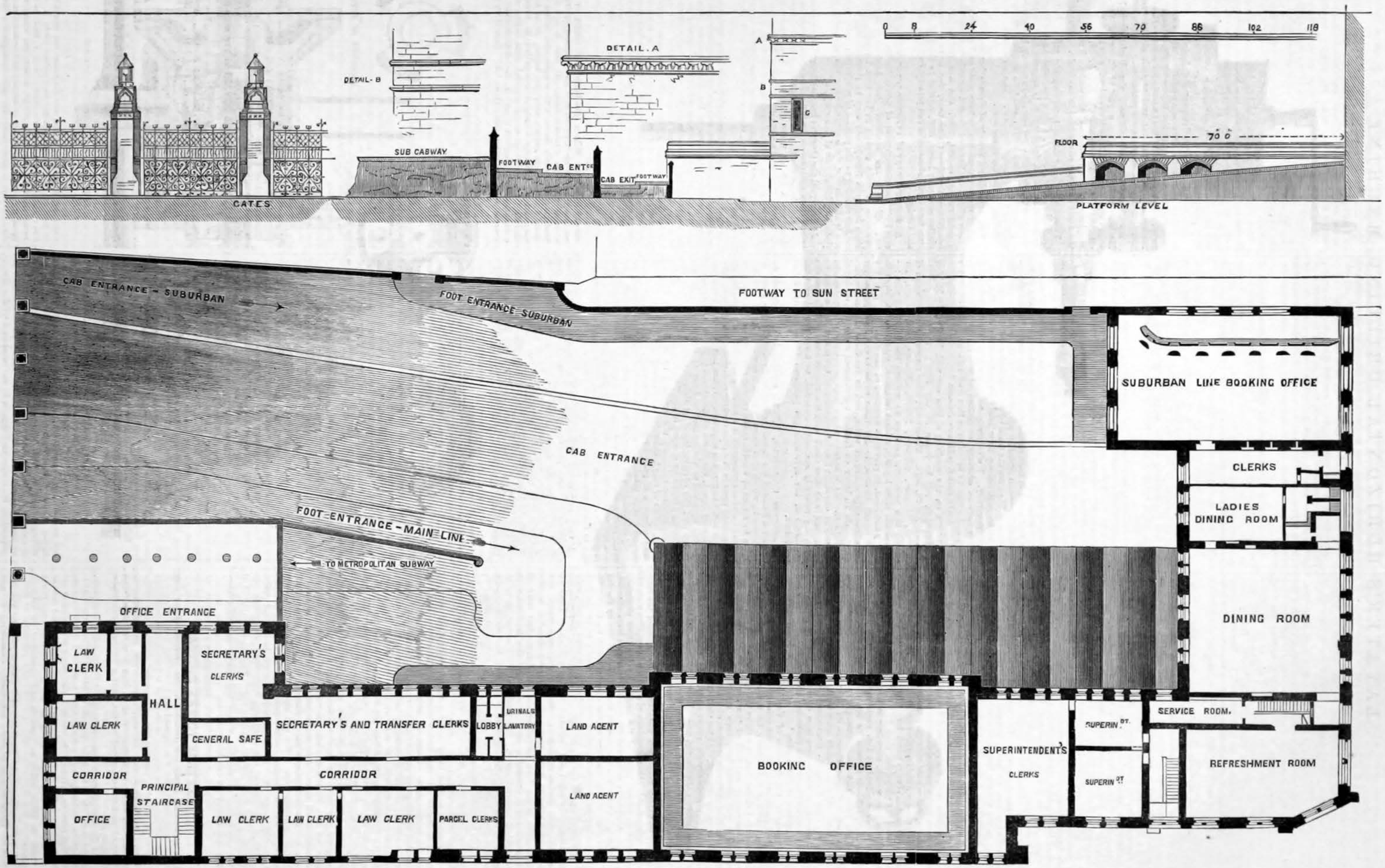
THE City solicitor, Mr. T. J. Nelson, announced on Monday evening to the Hampton Wick Local Board, over which he presided, that a letter had been received from Lieut. Colonel Ponsonby Cox, R.E., an inspector of the Local Government Board, stating, in reference to the subject of a combination of sanitary authorities in the Thames Valley for the purpose of carrying out a joint scheme of sewerage, that it was proposed to hold a conference in London during the last week in June, and asking that two or three members of the board might be named as delegates. Messrs. Frere and Co., of Lincoln's-inn-fields, had also written, stating that they were instructed to take proceedings against the Local Board of Hampton-Wick for a disregard of the notice to discontinue the flow of sewage into the river Thames. Mr. Nelson thought this letter from Messrs. Frere could not have come at a more inopportune moment, and suggested they should be informed that a commission was issued by the Government, and that under the circumstances the Conservators had better abstain from any proceedings which the board were prepared to meet. This was agreed to, and delegates were appointed to attend the conference.

THE Board of Trade returns for the month of May, which has just been issued, show that the quantity of coal exported during that period was 1,231,125 tons, value £832,6 54, as against 1,108,632 tons worth £998,153 in the same month of last year. Of the former total, the quantities taken by various countries are as follows:—Russia, 88,312; Sweden and Norway, 144,260; Denmark, 71,097; Germany, 226,004; Holland, 35,609; France, 212,363; Spain and Canaries, 53,739; Italy, 80,332; Turkey, 23,607; Egypt, 36,748; Brazil, 17,660; Malta, 10,414; British India, 16,674, and to "other countries," 214,306 tons. These figures show a falling off to Russia, Spain, Turkey, Egypt, and British India, but a considerable increase to Sweden and Norway, Denmark, Germany, France, Italy, and the States, included in the miscellaneous heading. The value of the hardwares and cutlery exported during the month fell off by £16,000, there being a diminution with Russia, France, Spain and Canaries, the Spanish West India Islands, British North America, India, and Australia, but on the other hand a slight increase is apparent with Germany, the United States, Brazil, and the Argentine Republic. In iron and steel the value of the month's exports is £800,000 lower than that of the corresponding period of last year, not less than £740,000 being due to the diminution of the demand for rails from all parts of the world, with the sole exceptions of Canada and Australia, whence a slight, but very slight, additional inquiry has set in. Pig iron has been exported in augmented quantities, as also have bars and angles, wire, sheets and plates, tinplates, and unwrought steel.

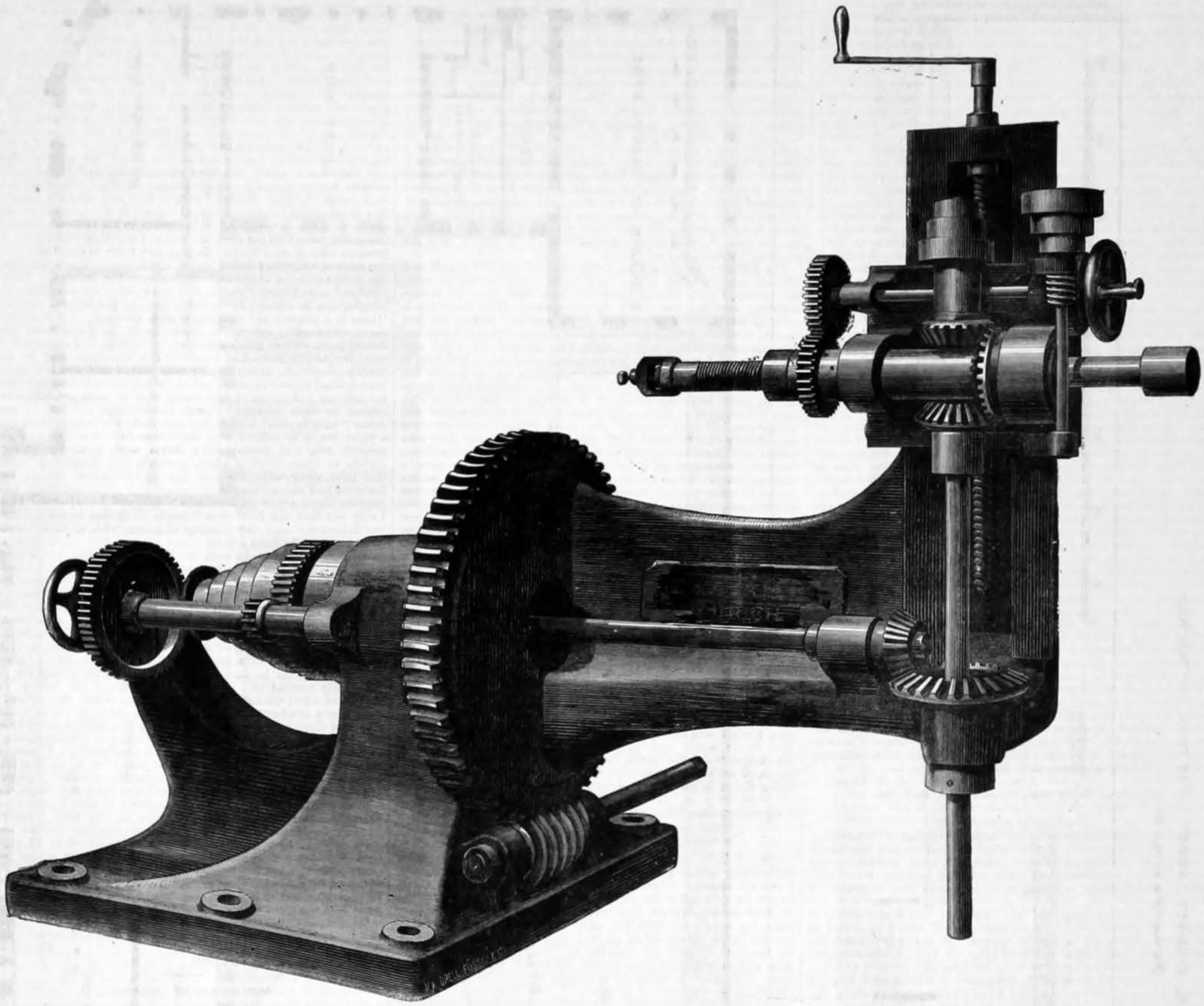
GREAT EASTERN RAILWAY COMPANY'S NEW STATION AT LIVERPOOL-STREET.

MR. E. WILSON, C.E., ENGINEER; MESSRS. LUCAS BROS., CONTRACTORS.

(*For description see page 403.*)

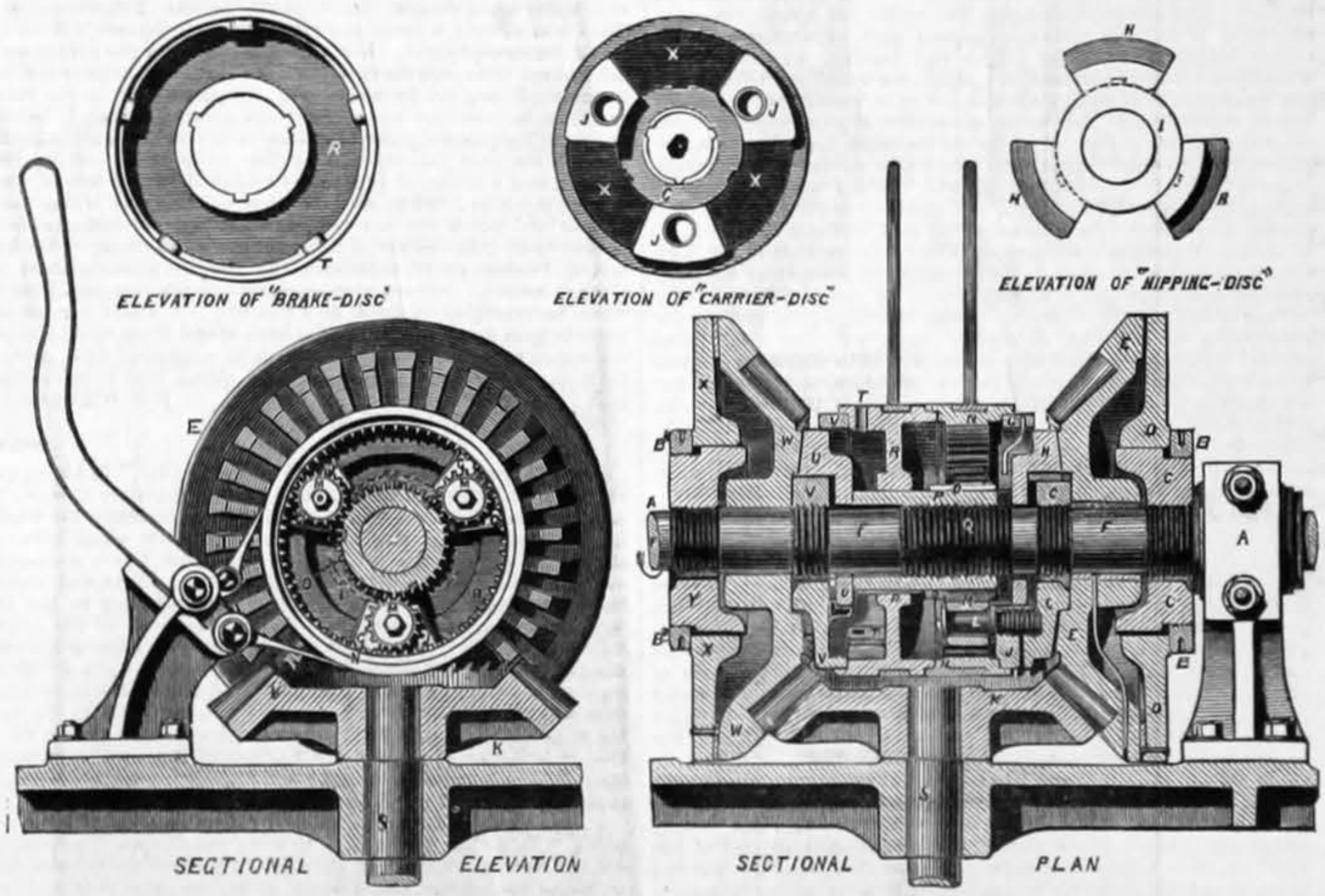


LAVATER'S HORIZONTAL DRILLING MACHINE.



WE represent in the above engraving a horizontal radial drilling machine constructed and executed by D. Lavater, of Fluntern, near Zurich. Radial drilling machines are very successfully used for boring holes in large pieces of machinery which it is often difficult to move. To this effect the radial arm supporting the drill is movable around a vertical axis, and the drill itself can be radially moved on the movable arm. The height of the movable arm above the foundation plate limits the dimensions of the articles which can be worked under such a machine, and it often becomes necessary to make large excavations in the floor to gain the necessary height for large pieces of machinery. This limitation in space caused horizontal drilling machines to be constructed, as with them a piece of any dimensions can be as easily worked as the smallest articles. These horizontal drilling machines are simply common radial drilling machines, which instead of being put up vertically are placed horizontally against the wall. The radial swinging arm remained, and in consequence some difficulty is met with in keeping it in position. Mr. D. Lavater has therefore constructed a horizontal drilling machine which obviates the above-named difficulties. The entire weight of the machine is materially reduced, whereby the price has been lessened. The machine as represented in the accompanying woodcut consists of a fixed mandril stock with double gear for the drilling motion. A radial arm is movable in the mandril stock through the entire periphery by means of a worm-wheel. The drill spindle has a diameter of 2½in., and is worked by an automatic gear. The machine can bore holes to a depth of 16in., and the distance of the drill from the axis can be altered from 6in. up to 3ft. While the weight of the horizontal drilling machines as constructed until now was 120 cwt. to 130 cwt., Lavater's machine only weighs 63 cwt. The construction of the machine is very substantial, and all the disturbing oscillations of the drill have been hereby avoided.

The driving shaft F revolves in the direction of the arrows, shown on the sectional plan, and is supported in bearings A on either side of the clutch. The bevel wheels E and W run loose on this shaft and gear with the bevel wheel K keyed to the shaft S. By clamping either the wheel E or the wheel W to the shaft F the desired motion is given to the shaft S. G and V are two gun-metal, C and Y two cast iron carrier discs, these four discs being screwed and keyed fast to the shaft F so as to be immovable thereon and consequently continually revolve with it. I and U



are two wrought iron clamping or nipping discs, riding on and keyed to the carrier discs G and V so as to permit of an easy sliding motion laterally, but enforced to continually revolve with the shaft F. The nipping disc I and carrier disc G are shown separately in elevation, and it will be readily perceived that the projections H on the disc I drop into the recesses X of the disc G, or in other words, the discs I and E and also the discs U and V thread together. P is a gun-metal nut riding on the screwed portion Q of the shaft F and it is also a pinion, seeing it has teeth O cast round its circumference. D and X are two cast iron friction discs partly faced with copper and riding on the carrier discs C and Y to which they are keyed, so as to allow of an easy lateral movement whilst compelled to revolve with the shaft F. B and B¹ are two gun-metal nuts riding on the screwed portions of the carriers C and Y, and determining the positions thereon of the friction discs D and X. Now if by means of the nut P we force the nipping disc U against the wheel W, which will, in its turn, be pressed against the friction plate X, we shall grasp the wheel between the two discs U and X, and, as these discs are revolving with the shaft, and must carry the wheel with them, the revolving of the wheel is attained; at the same time the nipping disc I is free to move laterally, and consequently the wheel E free to be driven by the wheel K in the contrary direction to the shaft

LETTERS TO THE EDITOR

(*We do not hold ourselves responsible for the opinions of our correspondents.*)

FRICTION CLUTCHES.

SIR,—In looking over last week's ENGINEER, my attention was particularly attracted to the "friction clutch steam hoist" there depicted, and manufactured by the Risdon Ironworks Company, California.

At the first glance it appeared to me the principle there involved might cause me to be again accused of having utilised the ideas of others in the designing, some months past, of a "self-contained friction reversing clutch," in which I also called into requisition a brake and a series of pinions carried by studs fixed on the face of a wheel or disc, my object being to get a reversing arrangement within as little width as possible and producing no retarding power.

I inclose a drawing of the clutch as I designed it, and you may possibly think it wou.d prove sufficiently interesting to many of the readers of THE ENGINEER to warrant its publication.

F. Again, by setting the nut P against the nipping disc I, the wheel E is in like manner brought into play, and the wheel W released; or, by placing the nut P midway between the two nipping discs I and U, both wheels are released and remain at rest. The pressure here brought into play, for producing the necessary friction for clutching the wheels, is not thrown on to the bearings A as in the ordinary friction cone, but is absorbed in the nut shaft and carrier disc C or Y, and, as these are revolving with the shaft, there is no retarding power brought into play during the time the clutch is in action, other than that necessary to overcome the wheel K. R is a cast iron brake-disc riding on the nut P and secured to it by keys, so as to admit of a lateral movement of the nut at the same time as it is compelled to revolve with the brake disc. L is one of a series of three steel studs screwed and fixed into the projecting bosses J cast on the carrier disc G. These studs carry steel pinions M gearing into the teeth on the nut P. N is a gun-metal brake ring with internal teeth, these teeth gearing into the pinions M. The brake disc R and brake ring N are braked by friction straps and levers as seen in the sectional elevation, consequently there are two levers, as seen in the sectional plan for working the clutch, one for throwing it into gear, the other for throwing it out of gear. As shown in the drawing, the nut P is pressing against the nipping disc U, and the wheel W is in gear, the wheel E running loose, and as both brake levers rest on their brackets the brake disc R and brake ring N are free from their respective friction straps, the whole clutch apparatus revolving with the shaft F. When necessary to throw the wheel W out of gear, the right-hand brake lever is lifted, causing its friction strap to arrest the progress of the brake disc R, this in its turn preventing the nut P from revolving with the shaft F, consequently the shaft in revolving inside the stationary nut carries the nut to the left, thus releasing the nipping disc U and wheel W. As soon as the wheel is released the lever is dropped, and the friction strap freed from the brake disc. The nut being now midway between the two nipping discs, the whole apparatus revolves freely with the shaft, whilst the two wheels remain stationary. To throw the wheel E into gear the same process is gone through, the nut being carried still more to the left until its pressure against the nipping disc I causes the revolving of the wheel E, whereupon the lever is dropped and the whole revolves freely, carrying the wheel E with it. Now in order to release the wheel E, the nut P must be carried to the right, and to effect this it must be caused to revolve quicker than and in the same direction as the shaft. Therefore to throw the wheel E out of gear, the left-hand brake lever is lifted, thus causing its brake strap to grip and arrest the progress of the brake ring N. At the same time, the carrier disc G is still running on and carrying with it the pinions M, and, as the internal teeth of the carrier ring N are stationary, these pinions must revolve in the direction of the arrow, thus forcing the nut P round in the same direction, but at a quicker speed than the shaft; hence, the nut is carried to the right, and the wheel E being released, the brake lever is dropped, and the whole revolves freely. To throw the wheel W into gear, the left-hand brake lever is lifted for running the nut still more to the right, and dropped as soon as the necessary pressure is attained for running the wheel round. Thus it is seen the right-hand lever throws the wheel E into and the wheel W out of gear, whilst the left-hand lever throws the wheel W into and the wheel E out of gear. The brake disc R is provided with holes T around its periphery, by which it can be pinched round in either direction, should it be necessary to move the nut when the shape F is at rest. The wear of the friction discs D and X is occasionally followed up by the nuts B and B^2, so that the wheels may be kept properly in gear at their pitch circles.

J. G. Berry.

Horten Cottage, Ripon-road, Shooter's-hill, May 28th.

FIREPROOF STRUCTURES.

Sir,—In your description of our automatic system of fireproofing, given in The Engineer of 21st May, we find certain important elements of our arrangements omitted, and as all matters having reference to a construction of really fireproof buildings are of such universal importance, we venture to ask your kind insertion of these also.

We would first speak of the fact that under the mode of use of our patent which we recommend, all water expended in arresting a fire is put to double purpose. It not only renders the floor above unheatable beyond 212 deg. of Fah., but the evolved steam passes down into the burning chamber and stifles the flame. Again, in cases where water is procurable in free amount, a single watchman is enabled under the same arrangement to place any portion—even the whole floor of a warehouse—under a continuous quenching downpour. We would next point to the importance of our fireproof galleries. Where situated externally, these carry all flame away from the walls, and render every vertical division of the building equally accessible as the ground floor during a conflagration for the pouring of water or removal of goods. Externally again, as say when in use for the box tiers of a theatre, they do away with all risk of life. Again, we would submit as a very important speciality, our power, in midst of the hottest fire, of perfect protection of all closing apparatus of openings, whether in walls and floor, and however working, equally with that of all columns of support. The circumstance again that under our system no extra thickness of walls is necessary beyond that of ordinary unprotected buildings of similar height and loading, we hold to be of material economic advantage. Again, we would point further to our arrangement of resting our systems upon continuous corbels in lieu of any insertions into walls, as a matter of great import where alterations of temperature are to be provided for. The circumstance that the subdivisional character of our floors form separately manufactured tanks and box girders, enables us to construct thoroughly water-tight systems, and renders the alteration of any portion easy without disturbance of the rest, will also be seen to be a matter of practical importance. We may remark again that even mere appearance may be fully studied in connection with our systems, and floors ceiled and decorated as completely as in any ordinarily built house. Even the power of utilising our systems for ventilation, or warming, or drying goods, will also often prove useful. We may add that the composition with which we propose to coat every portion and crevice of our ironwork, and saturate our felt, both preserves the elasticity of the latter, is unacted upon by acid or alkaline waters, and unalterable by time. We would lastly state that but slight calculation will show to practical men the economy of our patents in respect of strength, space, and lightness, space for space. Messrs. Taylor and Murray.

22, St. John-square, Clerkenwell.

ORGAN BLOWING ENGINES.

Sir,—Referring to the description of the American organ engine in your issue of the 16th, and also to Mr. Joy's letter in your last issue, my experience, when residing in London, in the practical and daily working of Mr. Joy's engine, did not strengthen the rather weak faith I have always had in the direct system of attaching the bellows feeder lever to the piston-rod of a water engine, although to my knowledge this system works well under certain circumstances. In the particular case mentioned the engine had a 7in. cylinder, and was made in 1868, including, no doubt, Mr. Joy's latest improvements, but I am sorry to say both the organist and myself had a good deal of trouble. Many times have I had to leave my place in the choir to run down and "see to the engine," which had a trick of stopping dead at the end of the down stroke. This usually happened when the organist was not actually playing, although I have known it to occur in the middle of a psalm. I remedied the defect by bringing the supply of water for working the valve pistons by a small pipe from the main beyond the engine cock; this pipe has also a cock to shut off the water from the valve pistons when the organ is not in use. Then we were troubled with a "groaning noise," which Mr. Joy may remember I wrote to him to explain, and his remedy was to have a wide groove turned in the piston and to pack it with whipcord, which was done, but in a few weeks the congregation complained of the "groaning" again. I then had a guide length fitted on the piston-rod working through a brass bushed casting fixed to the wall. The noise has, I believe, not been heard since; but there always has been another source of trouble, which is no doubt caused by the variation in the water pressure, viz., 20 lb. to 70 lb. per square inch, when the full organ is used and the engine put on its mettle, it runs rather fast, is very apt to bump, and therefore requires a very nice adjustment of the valve cock tappets to prevent the cylinder covers being knocked off, and yet get sufficient length of stroke. A foreman organ builder informed me that a small engine he fitted up always bumped when working hard, and they could not prevent it. This, I think, is not the fault altogether of the engine, but of the organ builder in not providing sufficient feeder power, and thereby requiring the engine to work too fast; but independently of these few defects, which are all easily overcome when foreseen, I am strongly in favour of a rotative engine working single feeders from a three-throw crank shank. Cuckoo and French feeders are not so suitable for reasons stated hereafter. Looking at the matter both from the organist's and organ builder's point of view, there is a calmness, steadiness, and uniformity of wind pressure from crank worked feeders which is not to be obtained with the direct system, particularly in times like the present, when high pressure wind is so largely used for pneumatic actions and reed stops.

The difficulty has always been the want of a really simple and efficient rotative water engine, and when asked for advice upon the matter, I have always hesitated from this want in recommending anything but Joy's direct system. The American is nothing but a bad imitation of Joy's engine. Within the last month, however, a three-cylinder steam engine without valves has come under my notice, which, when proportioned for water and fitted up with due regard to the requirements of organ building, is everything that can be desired; the crank shaft for the feeders can be fixed on the end of the engine shaft. The engine has only seven moving parts, including the shaft, is entirely enclosed in its own case, the pressure on the moving parts is all in one direction and continuous. If the feeders are single-acting and arranged immediately over or under their crank shaft, falling by their own weight and raised by the cranks, there cannot possibly be knocking, bumping, vibration, or noise. A three-cylinder engine gives a uniform motion which either a single or double-cylinder engine cannot be made to give; it cannot stop, stick on centres, or refuse to start, and continues to work with the most perfect smoothness and regularity, however slow its motion may be. The importance of the feeders commencing and terminating their stroke without jerk and with such a movement, which can only be obtained by the crank or cam, cannot be over-estimated. H. A. O. Mackenzie,

Dickleburgh Scole, Norfolk, May 10th. Assoc. Inst. C.E.

STEERING LONG SHIPS.

Sir,—With reference to the Bessemer steamer fouling the Calais pier, and Professor Osborne Reynolds' paper thereon, I trust I shall not be considered presumptuous in stating in support of his views, that some years ago while passing through the Suez Canal, as a passenger in a long ship, upon several occasions when speed was slackened to turn a corner, or for any other cause, she ran aground, notwithstanding all the efforts of the helmsman. The pilot stated that all long ships did so at times. I at that time pointed out to those on board that a ship passing through a canal drew a great rush of water after her, and that, if suddenly eased, that water would rush past her from the rear, and so act upon her rudder, that port would have to be given for starboard, and starboard for port to make the ship steer, until such time as the water ceased to pass her from the rear.

M. Tweedie, Major Royal Artillery.

Guernsey, June 7th.

GREASE IN FEED-WATER.

Sir,—I have been much interested in the feed-water heater controversy which has been going on in your columns lately. I will not attempt to criticise any theory that has been advanced either for or against the exhaust steam feed-water heater by any of your correspondents, but, with your permission, will simply state my experience with the above-named heater. I have at present under my charge six egg-end plain cylinder boilers, which are fed from a heater 4ft. diameter by 21ft. high, with an overflow pipe which keeps the water in the heater 6in. below the exhaust pipe. The water is heated by exhausted steam from a horizontal engine, 48in. diameter of cylinder. I may state here that this engine uses very little tallow. The feed-water is drawn principally from the magnesian limestone 130ft. below the surface; the quantity of lime held in suspension in this water is very great, so much so that the heater has to be cleaned out once every week. There is always a large quantity of coarser particles of lime lying at the bottom of the heater. The finer particles are found in a spongy state adhering to the sides, the thickness deposited on the sides averaging nearly an inch each week, which is easily scraped off with a shovel. The feed-pump, which is a double Cameron donkey, has its valves cleaned twice or thrice a-week before commencing to use the heater; the boilers were fed with cold water, each boiler being sludged once in twelve hours. Yet, with all this, there was always a large quantity of limy deposit left in the boiler when unplugged. The effect of this was the boilers could not be kept from leaking over the fires, the rivet holes were continually splitting out to the edges of the plates. Since the heater has been in use this has entirely disappeared, owing, I have no doubt, to the large quantity of lime that is thrown down in the heater. There is less hard incrustation on the boiler plate, and less loose deposit, and a saving of fuel to the extent of twenty-five per cent. I must say that I fail to see how such combination of carbonate of lime and tallow can be found, as some of your correspondents profess to find, in boilers. I have never seen anything of the kind during twenty years' experience, neither in plain cylinder nor Cornish boilers. Nevertheless, such may be the case, and I for one would be very glad to know how and why. I would suggest that some of your correspondents who have found those spongy combinations in their boilers should have them examined by a practical chemist. Probably a correct analysis would lead to some important discovery. Wm. Henderson.

Bishop Middleham Colliery, June 8th.

Sir,—In your issue of June 4 "Boiler Minder," in his reply to my letter published May 21, says he has no pecuniary interest in a heater. For one whose only interest is to disseminate knowledge, he has most pertinaciously tried to evade facts which have been already so fully demonstrated. In my letter, I gave undisguised and reliable authority, which he was unable to refute, and hence he has endeavoured to cover his defeat by only referring to the least important parts of my letter. I am not surprised at his quoting "Boiler Doctor's" letter, owing to the fact that some of his statements have so little to sustain them in practice, that like a "drowning man he gladly grasps at a straw." If I required other evidence than what I can prove from my personal connection with the working of steam boilers, I think your readers would agree with me that such testimony as given by Mr. Robert Wilson in your issue of May 25 is of a more substantial and convincing nature than anything yet adduced by "Boiler Doctor."

I have some cause to be interested in the class of heaters to which "Boiler Minder" refers, as some years since I patented in several countries one which only partially mixed the exhaust steam with the feed-water, and I know it has no equal in Birkenhead, where I am acquainted with the various modes of heating water. But upon investigating the subject of grease more fully, I had ample proof that the system is entirely wrong, and one I could not conscientiously recommend. I therefore abandoned it without having made a heater. In further proof that any system of heating feed-water that admits grease into steam boilers is injurious, I will mention some facts that have come under my own observation. One was a case of three drop flue boilers in which the grease and deposits amalgamated to an extent that compelled them to clean the boilers once in three weeks, and even use sledges to drive back the man-hole plates, and compress the deposits into space that would permit of getting them out; these boilers had surface blows that were used, but this did not keep the bottom blow cocks from being made useless by choking up, in spite of their efforts to keep them open, without great waste of fuel, by constant blowing. In this case there had not been any trouble in blowing prior to their adopting a patent feed-water heater, which mixed the grease with the deposits. They soon replaced it with a tubular heater that heats their water to 212 deg., and is also so constructed that this temperature is maintained while the blowing is now done from the heater and not the boilers, which are now only examined once in three months, and this only done to fulfil their system, as no deposits are found of any note, and their coal bill is considerably reduced. When recently in Newcastle-on-Tyne, I visited a well-known works where I saw a heater that mixed the exhaust steam and feed-water which had been disconnected and replaced by a tubular heater of modern construction. While I can name many such cases, "Boiler Minder" cannot cite one where a heater of this construction has been changed for one that mixes the exhaust steam with the feed-water. In reference to his remarks about the increasing sales being a proof of merit, I question whether he can produce a list of sales within the past two years to equal one-fourth the sales of a certain tubular heater which has among its purchasers the names of some of the best engineers in the country. "Boiler Minder" says I have "betrayed a weak point by admitting that burning can be avoided by regularly cleaning the boilers," and says, "here is a remedy of 'Amateur's' own showing. I cannot understand why feeding with water heated by mixing the exhaust steam should meet with so much objection." Perhaps if I substitute the word frequently instead of regularly the objections may be more readily perceived. It has already been proved that new boilers have been burned in two months, and as examining and cleansing boilers necessitates a stoppage of the works, this in most establishments cannot be done except at a great disadvantage and loss. I know many "sane parties" who do not stop their works more than twice a year, hence it follows that the "remedy" would be a very expensive one, and consequently steam users naturally prefer a system of water heating which prevents the dangers of burning and does away with the loss and inconvenience arising from frequent and unnecessary boiler cleaning. With reference to his remarks about grease forming into "balls and honeycomb" pieces, I may add that this formation depends altogether on the quality of the feed-water and the quantity of grease with which it becomes impregnated. In some boilers whose construction allows good circulation such balls are formed, but this requires time, and so long as a new supply of grease is being constantly admitted into the boiler, it will in any event cause a waste of fuel to generate steam from such water. When bad water is used, I know it has caused results as already explained in my reply to "Boiler Doctor" in your last issue. I have had to cut a piece out of the crown plate of a locomotive type of boiler owned by one of my friends; it was burned by mixing grease with the feed-water. During a late visit in Yorkshire, the principal of a firm of well-known locomotive builders informed me that he had heard of some portable engines that they lately sent to the Continent, and two of the boilers were burned by using the exhaust steam so as to admit the grease. I have seen a number of pieces cut from the crown plates of various classes of stationary boilers, and although I am partial to any theory that can be proved a true one, I have not taken up "Boiler Minder's" statements altogether on "theory" or unadvisedly; I therefore think it is he that has shown a "weak point," as in his first letter he stated that he got "pure water" from his so-called "properly constructed heater;" upon inquiry we learn that the words were "inadvertently" used, and he now informs us that "pure water" means something less than pure. Again, he says that "water at 212 deg. floats the grease;" to this I have to apply his own term, "chimerical," and which he immediately contradicts by saying that "whatever quantity of grease remains in the heater with other deposit, must inevitably leave the water more pure before entering the boilers," thus acknowledging the correctness of my statements, for if it is better for the boilers when only a small portion of the grease is prevented from entering them, is it not a sufficient proof that the system of heating feed-water by exhaust steam, which entirely avoids grease, is the best and safest one to adopt? Amateur.

Helensburgh, N.B., June 8th.

THE BRINDLEY MEMORIAL.

Sir,—Last January I requested you kindly to insert a letter from me about the Brindley memorial, which you kindly did. May I ask you to again say a few words upon this subject? On the 18th inst. we are going to lay the foundation stone of this Brindley memorial, which is a fountain in the midst of the village. The freemasons of Buxton are going to lay the stone. We have still much need of help, for we have only funds to raise the fountain, and require at least £80 more to put a proper and becoming stone fence round it, and to place trees and shrubs to ornament the surroundings. May I venture to hope your powerful aid will be enlisted to help this memorial forward? Any donations will be most truly acceptable. My great anxiety is to make the memorial such that the Civil Engineers will, when they visit Buxton, be pleased with the work. Augustus A. Bagshawe.

Wormhill Vicarage, Buxton, Derbyshire.

ROCK DRILLS.

Sir,—In reference to the assertions published in the correspondence columns of your valuable journal of the 21st of May last, will you kindly allow us to place things in their proper light, so that your readers may be guarded against forming erroneous impressions about the relative merits of the Ferroux and the McKean rock drills, working at the St. Gothard tunnel? Information reaching us from a reliable source makes us aware that it is not the intention of the contractor for the carrying out of the tunneling operations at the St. Gothard works to pledge himself to use Messrs. McKean's machines exclusively. Moreover, in the comparative trials where Messrs. McKean's machine should have signally triumphed, it must be stated that, although it was well able to reciprocate under a pressure below one and a half atmospheres, yet it could not, with this low pressure, either effectively strike the tool to its work, or turn it, although the machine had the advantage over the Ferroux machine competing with it in the work at the time, in that it was perfectly new and in the best order, while the Ferroux was one of the first, and hastily made, machines of its kind, and had been, moreover, at least a year in constant service at the tunnel. Lastly, if any person seeks exact information upon the relative merits of each system of borer employed at the St. Gothard tunnel without prejudice, he can search the quarterly report of the Swiss Federal Council on the progress of the working at the St. Gothard tunnel, and read at page nine the following statements:—"Besides the machines employed at the borings of the headings gallery, a few only were employed for the excavation. On the north side of the tunnel, six Dubois-François machines worked together in the emuette of the strope. On the south side either Sommellier's or McKean's machines were employed, as well for the enlarging as for the deepening of the tunnel ground. From the 4th of December on (*sic*), Messrs. McKean's machines, mounted on a frame, were working at the lengthening of the emuette of the strope. Though the use of mechanical borers for the widening of the tunnel's section was mostly a single trial, yet it permitted a comparative trial to be made of the respective results obtained by the different systems employed. The time used by each machine for boring a hole one metre in depth may be taken as a standard of comparison, and in that lapse of time is also comprised all the delays occasioned by the change of the boring tools, &c., which are inevitable in a work of long duration. In the heading works of Goeschenen, it was proved by observations made on a length of 6352 metres of holes bored, that a Ferroux

machine, used for making a hole of one metre in depth, occupied in doing so one hour and nine minutes. It has also been observed in the emuette of the strope at Goeschenen, that on 4226 metres of holes, a Dubois-François machine took a time of one hour thirty-one minutes to bore a hole one metre in depth. At Airolo, observations made in the heading gallery on a length of 2617 metres of holes pierced, gave a mean result for the same machines of one hour twenty-four minutes for one metre of hole sunk. For the widening of the heading gallery at Airolo, Sommellier's machines have been used, but from some unfavourable circumstances the work performed by these machines was minimum; the mean time occupied by any of these machines was two hours twenty-four minutes sinking one metre of hole; this observation was made on a length of 623 metres of holes bored. We must still mention the McKean's machines, which have been employed in the emuette of the strope at Airolo only since the middle of December, and, after observations made on a length of 205 metres of holes bored, used a mean time of two hours and one minute per metre of hole pierced. These data prove sufficiently that Sommellier's and McKean's machines, in their present state, cannot compete with those of Ferroux or Dubois-François. The Ferroux machine is the best of all rock drills tried till now on tenacious rock. For less hard rock the Dubois-François machines can also be used with success, especially where a great quantity of compressed air cannot be disposed of. Moreover, the question of the expenses occasioned by the frequent repairing of the machines formed also an element of comparison between Ferroux's and Dubois-François machines. It was acknowledged during this trial (semestre) that the cost of repairing amounted in Goeschenen to 2·43, francs per running metre of bored holes for Ferroux machines and to 4·27 francs for Dubois-François machines; these costs are consequently in the proportion of four to seven. The Ferroux machine is then also preferable to Dubois-François in what concerns the cost of repairing."

B. ROY AND CO.

Vevey, June 2nd.

FOOT-POUNDS AND INCH-POUNDS.

SIR,—Your correspondent "A Seeker after Truth" seems to be confounding dynamics and thermo-dynamics and the work done by steam at a pressure of 12 lb. per square inch upon a piston whose area is 1 square inch acting through a range of 1ft., as compared with what may be done with 12 cubic inches of steam cut off from any source of supply.

If steam at a pressure of 12 lb. per square inch act on a piston of 1 square inch area through a range of 1ft., it can clearly overcome a resistance and do work equal to 12 foot-pounds. If the steam only act through 1in. it will do work equal 12 lb. through 1in. equal 1 foot-pound. But somehow, your correspondent finds this result opposed to the teachings of thermo-dynamics, and illustrates his objection to such a result by saying that if "only 1in. of steam be used of 12 lb. pressure, only one-twelfth of the power will be expended, for 1in. can only weigh one-twelfth, and hold one-twelfth the units of heat of 12in.," and this rightly; but your correspondent goes on to say, that the expenditure of 1in. of steam will only perform $\frac{1}{144}$ of the work which would be done by 12in., as he adds, therefore it—1in. of steam at a pressure of 12 lb.—will only raise 1 lb. through 1in., instead of 12 lb.

How "A Seeker for Truth" arrives at this result he does not show, although he goes on to explain that a jet of water acting through 1ft. at a certain velocity, will do twelve times the work that a similar jet of the same area and velocity will do, if only acting through 1in., and also to explain that $\frac{1}{12}$ of a bar of iron weighing 12 lb., if let fall through 1ft. will only develope 1 foot-pound. Certainly these examples do not show why 1in. of steam should only do $\frac{1}{144}$ the work which can be done by 12in., nor why the laws of thermo-dynamics conflict with those of dynamics.

Your correspondent reminds his readers that "heat must not be confounded with mere temperature," but it would seem necessary, judging by the irrelevancy of his use of the mechanical equivalent of heat, that he should be reminded that temperature and heat are, nevertheless, not separable, and, without any mention of temperature, your readers will be unable to see why the 2·3 cubic inches of your correspondent should "hold sufficient," or why not more than a "sufficient quantity of heat" to be equivalent to 772 foot-pounds. It is not difficult, however, to see where your correspondent's sophism lies; he has failed to remember that whether he has 1in. or 12in. of steam, it exerts the same pressure of 12 lb. against his piston of 1in. area, and therefore 1in. of steam will raise 12lb. 1in., and 12in. of steam will raise the same weight through 12in., so that the quantity of steam used is as the work done.

Very little information is given as to the nature of the experiments which gave results apparently supporting your correspondent's theory, but if they were made with bottled-off steam, which was at 12 lb. pressure when bottled, and no means were adopted for keeping its temperature at that due to a pressure of 12 lb. per square inch, much cannot be said for either theory or experiments. It is one thing to make experiments, but another to understand Nature's answer to the question thought to be put to her.

Westminster, June 9th. W. W. BEAUMONT, A.I.C.E.

TUBE WELLS.—With reference to our report of the Bath and West of England Show in our last number, we are requested by Mr. George Hawksley, of Crutched Friars, to state that he is also the owner of patent rights in respect of the "Abyssinian Tube well." Mr. Hawksley is the owner of the rights for India, Ceylon, Burmah, and Singapore, and also for seven English counties.

SOCIETY OF ENGINEERS.—At a meeting of the Society of Engineers held on Monday evening in the Society's Hall, Westminster-chambers, Victoria-street, the president, Mr. J. H. Adams, in the chair, a paper on "Continuous Brakes" was read by Mr. St. John V. Day, C.E. The author, in the first place, pointed out eighteen conditions essential to a perfect brake, and then proceeded to consider the several systems of brakes which had been practically tested. Clark's chain brake, and his more recent hydraulic brake operated by the admission of steam below a piston in a cylinder, forcing up the piston and thereby communicating pressure to the several brake cylinders throughout the train, were noticed, together with the most recent results obtained with Clark's chain brake. The Heberlein brake was then described with the results obtained in trials with it in Bavaria, after which continuous brakes operated both by vacuum as well as a plenum of compressed air were dealt with, the former on the system of Du Trembley and Martin, as well as the Smith, Westinghouse, and Sanders vacuum brakes, the latter according to the reaction systems of Westinghouse and that of Messrs. Steel and McInnes, as running on the Caledonian Railway between Glasgow and Edinburgh. The author stated the results of experiments with the different brakes mentioned, from which he concluded that neither the chain nor vacuum brakes were capable of fulfilling the conditions essential to a perfect brake, that excepting the Sanders vacuum brake, the other brakes operated by a vacuum could act as train-stoppers merely, unless the recent proposal to apply an exhauster in the guard's van was found to answer, in which case there were possible circumstances wherein a vacuum brake might stop both parts of a train in the event of a portion breaking away. The general conclusion at which the author arrived was that a perfect brake was only to be found up to the present time in the reaction systems of Westinghouse and Messrs. Steel and McInnes, but that on account of the limited number of reliably ascertained experimental results at present at disposal, it was impossible to estimate the relative efficiency of the several brakes which had been tried. It was to be hoped that the deficiency of our knowledge in that respect would soon be removed by the experiments now being conducted by the Accidents Commission. The paper was profusely illustrated by diagrams and models and a spirited discussion followed its reading.

GREAT EASTERN RAILWAY COMPANY'S NEW STATION AT LIVERPOOL STREET.

THE rapid development of the railway system, in immediate connection with the metropolis, has caused many alterations to be made in various termini; in some cases, has compelled a complete rebuilding, and in the room of small, inconvenient, and crowded platforms and approaches, have arisen buildings and accommodation almost palatial in their character.

The terminus of the Great Eastern Railway Company at Liverpool-street, if not partaking altogether of the palatial, will be unmistakeably a great improvement upon many of the London termini, and will be one of the largest; the area comprised within the retaining walls—this being a low-level station—is more than ten acres in extent, and is some 2000ft. in its entire length. The general character of the design is Gothic, broadly treated in the several elevations.

The west and south elevations are well seen from the junction of New Broad-street with Liverpool-street, and along the approaches leading from Liverpool-street to the booking-offices. Being, as we have said, a low-level station, the approach to the main line booking-office is on a descending gradient of 1 in 25. At the same time, great care has been taken to secure speedy attention to passengers and their luggage arriving in carriages. A large level space on the level of the platforms has been preserved in front of the booking-offices for carriages, and it is so arranged that, as soon as they are freed of their occupants, they go out by an independent road from the station into Liverpool-street, thus avoiding all confusion.

The west elevation is about 320ft. in length, and has an agreeably diversified skyline. The main line booking-office, being a central feature, rising to a height of 90ft., the remainder of the elevation being 67ft. in height, with the exception of the block at the south end facing Liverpool-street, which is uniform in height with the centre. The windows of the second floor are the most striking in the extent and character of their treatment. They are lofty pointed two-light windows, united under one arch, with plate tracery in the head.

There is also a wing at the northern extremity of the west point, running westwards, which is about 146ft. long and 67ft. high, with an ornamental clock-tower adjoining the suburban high-level booking-office tower, which is utilised by being made available to support a reservoir in case of fire; fire mains are laid from the reservoir, so that any part of the vast building could be deluged with water in a few minutes.

The materials used are stock bricks with Bath stone in cornices, arches, and dressings generally. The main line booking office, as becomes its use, is one of the finest apartments within the station buildings, being 90ft. long, 50ft. wide, and 49ft. high, the ceiling being on a level with those of the second floor. At the level of the second floor a gallery is carried round the booking-office, as a means of communication between the various offices. The ceiling is panelled into deep coffers, and finished with white and gray plaster. On either side of this booking-office there are respectively first and second-class waiting-rooms, with ladies' waiting-rooms attached, adjoining which is the refreshment-room, 40ft. by 28ft., and 29ft. in height. Attached to which, and reached from the exchange galleries running across the station on the suburban booking-office level, are large general and ladies' dining-rooms. In various portions of the building are lifts worked by hydraulic power. The corridors are warmed by means of hot water coil cases.

The business of the company will be transacted in the offices in the building. These are approached at the Liverpool-street level, along a corridor 10ft. wide, leading to the principal staircase 20ft. square, from which access is obtained to all the offices by corridors 8ft. wide. The offices for the principal officers of the company are on the second floor, and comprise chairman's, deputy-chairman's, general manager's, secretary's, superintendent's, engineer's, together with the board, committee and luncheon rooms. The board room is situate in the south wing, and is a handsome room 37ft. by 20ft., with oak-panelled dado and ceiling. There are no less than 150 rooms throughout the building.

The area occupied by the various lines of platform is covered in by a roof in four spans, the two central ones being 109ft. each, and the side spans 46ft. and 44ft. The whole width covered in is 314ft.

The roof trusses are principally comprised of wrought iron with ornamental details of cast iron, and the effect is extremely pleasing. The columns are double in the centre, and have also to act as downpipes for the conveyance of water from the roof. The covering is chiefly glass, with a small proportion of boarding and slates. The length of the roof over the main line on the east side is 730ft., and that over the local platforms 450ft. long and 76ft. above platform level. The platforms are arranged so that the advantages of the end-on system as at Charing Cross, as well as those of the "sidelong" as at King's Cross, are retained. The main line platforms are 1000ft. long and 32ft. in width, while the local platforms are 550ft. in length, and vary in width from 10ft. to 21ft. Lamprooms are provided below the platform, connected with each by a subway and hydraulic lift.

The arrangements for traversing carriages across and along the main line, and the whole of the turntables, eleven in number, are worked by hydraulic power.

Communication is also obtained with the Metropolitan system by a junction with the railways, besides subways from the platforms under Liverpool-street for passengers. The whole of the signalling and multifarious working of the points is connected at Primrose-street, into one box, which contains more than 100 levers for the purpose of interlocking and other arrangements.

The whole of the works have been designed by Mr. Edward Wilson, C.E., the company's engineer, and executed by the well-known firm of Messrs. Lucas Brothers.

PERKINS' BOILERS.

WE stated recently that one of Mr. Perkins' high-pressure engines and boilers was about to be fitted to one of her Majesty's ships. The following is a copy of the report of the Committee on Boilers appointed by the Admiralty, dated the 19th day of September, 1874, on the propriety of constructing egines and boilers on Mr. Perkins' plan for marine purposes, which has resulted in the order above referred to being given. The Committee on Boilers state, for the information of the Lords Commissioners of the Admiralty, that they have carefully and fully considered the propriety, or otherwise, of constructing engines and boilers on Mr. Perkins' plan for marine purposes. From the official papers which have been placed before the committee, it is found that in March, 1873, the Yorkshire Engine Company were called upon to forward tenders for engines on Perkins' system for vessels of the Daring and Mosquito classes of 720 and 360 indicated horse-power, respectively. In May, 1873, tenders were forwarded accordingly, and after a careful examination of the designs as submitted by the Yorkshire Engine Company, the engineer-in-chief of the navy considered the disadvantages connected with the engines on this plan were much greater first cost, greater weight, greater complexity of engines, greater cost of maintenance, and the necessity of having pure water in boilers. The matter then remained in abeyance for some months, but in May last attention was again called to this subject, and it appeared from the Yorkshire Engine Company's letter, that they had in their former tender for engines misunderstood the power to be given; and consequently had prepared and forwarded a design for engines of a greater maximum power than was required. The company shortly afterwards forwarded a revised tender and drawings for engines of 720 indicated horse-power for a vessel of the Fantome class, in which the space, weight, and price were reduced. It was then decided that when it became necessary to obtain engines of the power referred to, they should be invited to tender for them. Thus the matter stood until July last, when a letter from Mr. Bailey, containing printed documents, was laid before this committee; and it was then decided that, when convenient, the matter should be fully considered in all its bearings, and that as much evidence as possible, for and against, should be obtained. The committee stated in paragraph twelve of their letter of the 7th August last as follows:—

"The committee have also had under their careful consideration the plan of engines and boilers on the system proposed by Mr. Perkins, and have inspected the engines on this plan, which are on board the Emily, a small yacht, while under weigh; and the Filga, a tug, as well as the engines which are now at work in his factory. The committee have examined Mr. Perkins, and have applied to him for more specific information relating thereto; and on receiving Mr. Perkins' reply a further communication will be made on the subject."

Since that date the committee, with a view to a more searching investigation of the condition of the boiler and cylinders of the land engine at Mr. Perkins' works, induced him to open out the boiler, and cut open three of the tubes from different levels; and also to open out the cylinders, and have the pistons drawn. This was done in the presence of the committee, and a strict examination was made of all the working surfaces and the state of the tubes; and samples of the tubes, &c., were obtained. The tubes in this boiler had been in use, it was alleged, nearly thirteen years; and they were found to be in a remarkable state of preservation; and the piston, packing, and valve rings of the engine, which were of Perkins' patent metal, composed of five parts of tin and sixteen parts of copper, and which were stated to have been in place, and at work without lubrication eighteen months since last examined, were found to be in a similar condition. Bearing in mind that the main feature involved in Mr. Perkins' system is the use of soft fresh water, or rain water, over and over again, the waste being supplied by water obtained from a double distilling apparatus, the committee have directed their attention to some other engines using fresh water, with a view to obtaining as much information as possible on the point referred to. They have accordingly obtained evidence in regard to the following engines and boilers with which fresh water is used, observing that it is the general practice to have fresh water in land boilers, viz.:—(1) A land engine at Messrs. Gwynne's works, Essex-street, Strand; (2) a land engine at the works of Messrs. J. Stewart and Co., Isle of Dogs, Blackwall; (3) a land engine at Messrs. Merryweather's, Lambeth; (4) the fire engine boilers at Messrs. Merryweather's and at Messrs. Shand, Mason, and Co.'s; (5) the boilers used for producing steam for warming the Houses of Parliament; (6) and also cases in which attempts have been made to use fresh water at sea in marine boilers. The committee visited these different establishments, and, so far as they could, have examined the boilers and obtained on the spot as much information as possible. Although it does not appear that any of the systems at present in use are worked exactly on the same principle as Mr. Perkins adopts, yet the committee are of opinion that there is an advantage in using soft fresh water in boilers generally; and the favourable opinion which they have formed with regard to the Perkins system has thus been so far confirmed. The committee, then, are of opinion that evidence sufficiently satisfactory has been obtained of the working of Perkins' system to enable them to propose to their lordships that experiments should be made on such a scale as to test its value, with as little loss of time as possible; and they therefore recommend, with the view to thoroughly testing the system in a practical manner, the under-mentioned engines, &c., should be obtained, viz.:—(1) A land engine and boiler for use in one of her Majesty's dockyards; (2) a pair of marine engines and boilers for use in one of the harbour vessels, such as one of the home port tugs; (3) a set of engines and boilers for a small sea-going man-of-war, as proposed by Mr. Wright, engineer-in-chief of the navy; (4) also that some vessel at present fitted with compound engines, and about to receive new boilers of ordinary type, should be fitted with a surface condenser on Perkins' principle, in order to test its applicability to that description of boiler. In all these trials the system, as pursued by Mr. Perkins in his land engine, which the committee have examined, should be most closely adhered to; and his metal applied wherever requisite to avoid the necessity of internal lubrication, which it is alleged is not required when that metal is used. In consideration of the circumstances in which Mr. Perkins is placed with regard to the Yorkshire Engine Company (Limited); and as the committee are not aware that this company have hitherto supplied marine engines or boilers for her Majesty's service or the merchant service; and looking to the general circumstances attending the application of a new invention to engines of a larger size, and of different construction to those which have hitherto been tried under Perkins' system, the committee would suggest the propriety of constructing these engines and boilers in one of her Majesty's dockyards under the superintendence of Mr. Perkins, if their lordships should under the above-named circumstances deem it desirable so to do. In the event of their lordships arriving at this decision, the committee would suggest that the drawings for the engines, boilers, and condensers should be prepared by Mr. Perkins, and submitted to the Admiralty for approval; and that for this purpose Mr. Perkins might have the assistance of a draughtsman, but he should take the whole responsibility of the result, and superintend the construction in the ordinary manner as an engineer. It is the intention of the committee to keep the question of the use of soft fresh water in view; and they expect to obtain still further evidence during their visits to the different seaports and manufacturing towns of the country; yet they have considered it advisable that they should at this time state their views upon this question, so far as they are enabled to do so; reserving their detailed and more matured opinions on the question of the use of soft fresh water for marine boilers generally, until their final report.

THE UTILISATION OF PEAT.

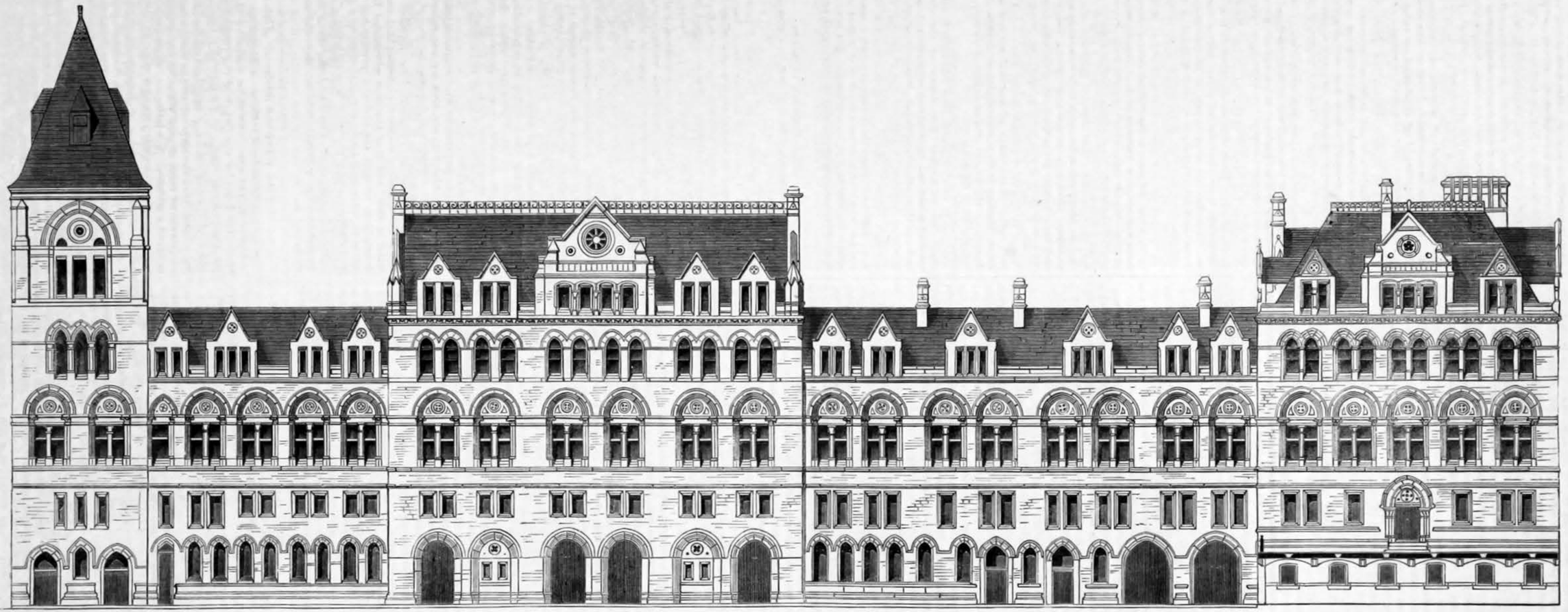
IN our impression for May 28, we concluded our report of the very able and elaborate report on the utilisation of peat, prepared by Mr. F. A. Paget, C.E., for the British Commissioners' "Reports on the Vienna Exhibition." To this paper Mr. Paget has appended two synoptical tables, showing at a glance the results which have been obtained in practice from different systems of utilising peat. These tables are sufficiently valuable to deserve reproduction, and we give one of them on page 409, while the second will appear in an early impression. The tables are so complete that they require no explanation other than that which we have just given.

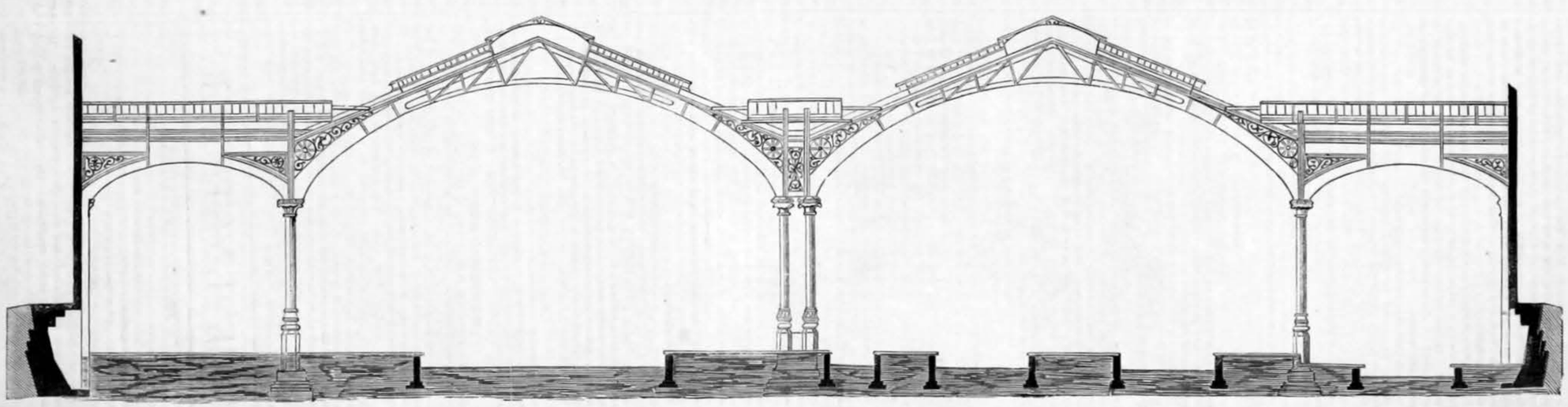
SOUTH KENSINGTON MUSEUM.—Visitors during the week ending June 5th:—On Monday, Tuesday, and Saturday, free, from 10 a.m. to 10 p.m., Museum, 9072; mercantile marine and other collections, 1294. On Wednesday, Thursday, and Friday (admission 6d.) from 10 a.m. to 6 p.m., Museum, 2394; mercantile marine and other collections, 125. Total, 12,885. Average of corresponding week in former years, 13,570. Total from the opening of the Museum, 14,292,912. Patent Office Museum, 3165. Total number since the opening of the Museum, free daily (12th May, 1858), 3,188,279.

GREAT EASTERN RAILWAY COMPANY'S NEW STATION AT LIVERPOOL-STREET.

MR. E. WILSON, C.E., ENGINEER; MESSRS. LUCAS, BROS., CONTRACTORS.

(*For description see page* 403.)





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

MEETINGS NEXT WEEK.

CHEMICAL SOCIETY.—Thursday, June 17th, at 8 p.m.: "On Nitrosyl Bromide and on Sulphur Bromide," by M. M. P. Muir. "Notes on the Chemistry of Tartaric and Citric Acid," by R. Warrington. "On the Action of Nitric Acid on Copper, Mercury, &c., especially in the Presence of Metallic Nitrates," by J. J. Ackworth. "Decomposition of Water by the Joint Action of Aluminium and Aluminium Iodide, Bromide, or Chloride, including instances of Reverse Action," by Dr. Gladstone and Mr. Tribe. "On Achrematite: a New Molybdoarseniate of Lead, and New Reactions of Tungsten," by Prof. Mallet. "On the Action of Chlorine on Acetamide," by E. W. Prevost.

THE METEOROLOGICAL SOCIETY.—Wednesday, 16th instant, at 7 p.m.: "On a White Rain or Fog Bow," by G. J. Symons, F.M.S. "On a Proposed Form of Thermograph," by Wildman Whitehouse, F.R.A.S., F.M.S. "On the Rainfall of Athens," by Prof. M. V. Raulin (translated from the *Comptes Rendus* by R. Strachan, F.M.S.) "On the Barometric Fluctuations in Squalls and Thunderstorms," by the Hon. Ralph Abercromby, F.M.S. "Note on Solar Radiation in its relation to Cloud and Vapour," by J. Park Harrison, M.A., F.M.S.

THE ENGINEER.

FRIDAY, JUNE 11, 1875.

RIVER POLLUTION.

WE are not about to return here to the general principles which, as it appears to us, govern the relations between rivers as sources of water supply for man and beast and as the great drains or channels of defecation for all the refuse educts of animal and vegetable life. In former articles we have indicated the conditions which nature has prescribed for these relations, and pointed out that when their balance is destroyed beyond a certain limit by the adventitious circumstances of what we may call civilisation, concomitant with a dense population, the channels of our streams and the waters of our rivers can be no longer our natural drains and our drinking fountains; that we must choose one or the other function to be fulfilled by the river, and that we shall find that that function must remain what nature always intends it to be—that of universal main drainage, and that we must look elsewhere for our water supplies. Further, that these supplies must in general be sought in our islands, at least by impounding water in partly natural, partly artificial reservoirs upon the upper streams and their catchments which feed our rivers, and situated sufficiently above the great sources of contamination. These and other general conditions of this certainly important national problem we have pointed out in some detail and with sufficient lucidity in former articles in this journal.* The principles contained in those articles are equally applicable to the most Arcadian state of population in which the refuse of animal and vegetable life form the refuse for drainage, or to that far more formidable condition of things in which the artificially-created refuse of countless manufactures, organic and inorganic, in solution or in suspension, are poured into our streams to be dealt with as they may by the decomposing action of air and water on their way to streams of greater volume or to the sea. We might ask here what it is that legislators propose to themselves as the chief aim and benefit to be obtained by the penal statutes now aimed against river pollution.

We can easily see that by a sufficiently cumbrous, costly, and irritating system of interference the appearance to the eye or nose of many of our streams whose banks are thickly studded with manufactories may be improved, and that some gross abuses, such as making the channels of such streams dust bins and cinder-tips, or other solid rubbish depositaries upon a great scale, may be prevented; but we apprehend that the law as it already stands affords ample provision for redressing this latter class of evils, if only the riparian inhabitants were of a mind to have them redressed. But granting that future legislation shall have done all that can reasonably be expected of it, and much more than is ever likely to come from the sort of legislation proposed, we ask, what is to be the ultimate upshot of it all? What is to be the benefit derived when all the dispollution possible upon our manufacturing streams has been effected? Does anyone seriously expect that streams such as the Irwell, the Aire, the Calder, or the Clyde in its middle course will ever become fit to drink, or in which fish can live and thrive? We may gradually make them look a little better, but main drains, more or less foul, they must continue while ever the vast industries concentrated upon their banks continue to flourish. If we are obliged to confess this, had we not better make up our minds at once to treat them as main drains and legislate upon this basis, which would vastly simplify the subject, and render needless much official interference that hereafter must prove as vexatious as will be useless.

Our present object is to point out that the results of many of our great national industries must for ever continue to pollute, more or less, the natural waters of all the streams into which the respective drainage areas lead, notwithstanding any legislation impotently intended to the contrary, and even though those most intimately interested in those great industries were the most earnest in their desire to prevent such results. Let us illustrate this by an example or two:—Upon the banks of the Clyde, the Tyne, the Wear, the Dee, and the smaller streams of Lancashire, flourish those enormous manufactories of soda and of vitriol which form the basis for all subsequent and minor chemical manufactures, and supply materials employed in countless industries not chemical, such as paper-making, &c. Around these manufactories are to be seen mountainous heaps of the refuse of the "lixiviated salt cake," consisting mainly of difficultly soluble lime and soda compounds, coaly matter, and many complex combinations of sulphur, some of the older refuse heaps being so rich in the latter that methods have been devised, and to a certain extent employed, for recovering some of the sulphur from them. These heaps cover acres of ground; they are freely exposed to the rain and dew; and on walking round them we easily see the brown, discoloured liquids ooze from them at many points. These, having a supply as perennial as the rains of heaven, find their way inevitably into the river. We shall not pause to consider to what extent these washings of the alkali refuse heaps are deleterious; it is sufficient to say that, even in minute quantity, they render water undrinkable. Again, let us cast an extended glance over any of our great coal districts, such as that nearly the oldest of them, commonly called the Black Country. Here we see the surface over scores of square miles covered with heaps of refuse, mainly from collieries and ironworks, but with many other industries interspersed. The natural drainage channels of the original surface have been hopelessly blocked or perverted. The rain which falls penetrates every porous and ill-compacted "tip," whether of coal or of iron refuse, and, after soaking through and dissolving in its progress whatever is soluble in aerated water, festers in pits and gullies amongst the heaps, and often joined by waters pumped from the shafts, slowly finds its way to the natural outfalls as they now exist. The water that has percolated these coal tips is always more or less rich in sulphate of iron, as well as other salts, and that from the furnace tips in silicates of the alkalies and earths, as well as in dissolved iron compounds, which ultimately oxidise into the rusty slime which lines the drainage channels of such places. Poured into the adjoining rivers these dissolved matters may not be highly poisonous, or at all so, but they render the water more or less unfit for drink or fish to swim in. Let us pass to some of the rivers in our great mining districts. There are streams in Cornwall, on either bank of which for miles in length the ground is covered with heaps of mine *débris*, or of the refuse of washed ores. These permeable heaps, varied in their materials, amongst which are to be found, thinly disseminated, portions of the poisonous metals, continuously discharge the oozings of the rain that falls upon them into the adjoining river. In some places these are joined by the waters pumped from mine shafts at considerable distances from the stream; these waters are occasionally rich enough in sulphate of copper in solution to be worth depriving of that metal in "precipitating pits" before being let loose into the river; the sulphate of copper, or "bluestone," a highly poisonous salt, is, indeed, thus got rid of, but only by its conversion into sulphate of iron or "green copperas," a salt not poisonous, indeed, but even in very small quantity rendering water unpotable and destructive to fish.

It is pronounced with much boldness that at least no solid material must under any circumstances be passed into any stream, and, as we have already said, so far as throwing dry rubbish of any sort into the bed of a stream, we entirely concur in this; but if this rule is also to apply to all solid matter if suspended in water, we should find that its being insisted upon would interfere with, or extinguish some of our greatest mining or mineral industries. If we visit Dalcoath, formerly a copper mine, but now, at a greater depth, the greatest tin mine in England, the oxide of tin which constitutes the ore is diffused in microscopic crystals through a relatively enormous mass of rock, which has to be crushed, stamped, buddled and washed again and again, until the heavier tin oxide is got out from the relatively enormous mass of fine mud produced from the ground-up rock. Water in great volumes is the essential instrument in those mining operations, and this refuse mud is got rid of in the only way in which it can be, by turning the main stream of already more or less muddy water, after it has done all its other work, in upon these deposits of refuse silt, and transporting them away to the nearest river course and towards the sea. So also in the preparation of the china-clays, which form so rich an element in the wealth of Cornwall, vast quantities of mud must be dealt with in the same way. To compel, by law, the owners of these industries to preserve their refuse in enormous heaps, would be only to raise the price of the respective commodities, or perhaps destroy them altogether; and, let us ask *cui bono*, the stream itself being in reality no better than it was before, still only fit for what nature intended it, a main drain. Nor do these remarks apply only to mining and metallurgic districts. What is to become of the great flax industry, and linen trade, if the water that percolates from the "flax dams" is by any means to be stopped off from finding its way into natural drainage channels? The difficulties involved in this branch of our subject are only known to those familiar with the natural and manufacturing circumstances of the north of Ireland, and we have not space to enlarge upon them here.

There is but one thing that legislation can do—prevent gross and unneighbourly abuses of the river channels, some of which we have above pointed out; so also there is but one thing that engineering skill can effect, namely, to increase and equalise the volume of the water flowing through these rivers, by impounding the rainfall of the wet seasons upon their upper forks and tributaries. Nature, however, may set a limit to this that may still prove utterly insufficient very materially to improve the condition of rivers such as the Irwell, and others here mentioned.

* Amongst these we may refer to that entitled "Rivers and Cities" (ENGINEER, Sept. 5, 1873, p. 153), and to the article entitled "Rivers and Manufactories" (ENGINEER, June 4, 1875, p. 387).

PUBLIC WORKS IN EGYPT.

IT is only within the last half century that engineering works in Egypt have been promoted and constructed in a manner which promises well for their future permanency and the real interests of the country. Long previous to the time alluded to, engineering works of enormous magnitude rivalling those constructed in India during the dynasties of the Abdallahs and the Aurengzebes, existed in Egypt, but with the exception of the Pyramids but little remains of either their former grandeur or utility. With the decadence of the cities, the pleasures and wants of whose inhabitants they were intended to minister to, they fell into disuse, and shared in the general destruction and desolation which ages ago swept over that portion of the African continent. But although the nature and extent of these great works of construction can now be but guessed at by the light of some stray excavations here and there, and their successors bear but little resemblance to them in either design or execution, yet the physical condition of the country remains unaltered. Rightly or wrongly, the origin of surveying—one of the branches of our profession—is attributed to the necessity which compelled the Egyptian landowners to define their properties by some boundaries which were not liable to be obliterated by their annual natural floods.

As of old, so at present, the ever-recurring periodical overflowing of the Nile constitutes the natural phenomenon of the country. From time immemorial the efforts of the monarchs and the people have been directed towards the one great object—viz., that of regulating and rendering uniform, and turning to the best advantage, the fertilising inundations of this mighty and mysterious river. Probably the idea and attempt also to unite the waters of the Mediterranean and the Red Sea may boast of the same degree of antiquity. The Nile being thus the most important and, in a great measure, the sole source of the prosperity and wealth of the country, it is evident that works of irrigation, and others undertaken with the object of improving the course and condition of the river, must constitute a prominent feature in Egyptian engineering. In Upper Egypt some extensive works of this character were carried out by the father of the present ruler. They comprised canals, banks, and roads, and some idea of the extent of the undertaking may be gathered from the fact that in one year the amount of the earthwork reached to nearly seventy million cubic yards. As may be expected in a country in which skilled labour is both scarce and expensive, the use of earthwork instead of masonry or brickwork will, in all cases to which it is applicable, be adopted. It forms not only the cheapest, but, when of good quality and sufficiently plentiful to render the maximum dimensions of no consequence, the best description of material for that particular class of work.

A glance at the physical contours of that portion of Egypt which lies between the mountains of Libya on the west and those of Arabia on the east, will demonstrate in what manner, and the reason why, it became affected by the inundations of the Nile. If two sections be made of this part of the country nearly at right angles with one another, it will be found that one, which may be termed

the longitudinal section, has a gradient or slope which is practically identical with that of the river itself during flood time. The other, or cross section, has a gentle fall from the river banks towards the desert, so that when that point is reached the total difference of level amounts to between 13ft. and 14ft. The nature of the soil of Egypt renders these periodical inundations indispensable to its permanent fertility. A geological section shows an upper layer of ooze resting upon sand and gravel, which in their turn repose on a bed of clay. The substratum, moreover, is impregnated with various salts, to such a degree that if the land be not overflowed for a few years it becomes so salted as to be perfectly useless for purposes of cultivation, and remains so until it is thoroughly washed by another inundation. In addition to the duty already marked out for the future irrigation works of Egypt, they have other functions to fulfil. Among these are the construction of banks or walls for the retaining and storing of water, not only to prevent the salting of the land, but also to raise the water so as to enable it to command land situated at a higher level. One of the oldest works of this kind was undertaken to preserve the city of Memphis. It was in the early part of the present century that the great work was commenced of forming throughout the whole of Upper and Middle Egypt a series of basins in which the floods might be successively and thoroughly utilised. In order to complete this project in an effectual and certain manner for the latter part of the country, it will be necessary to construct a canal of great magnitude, already proposed, and the line of which has been determined.

It has been recently proposed by a well-known authority—M. Linant Bey—to restore the ancient lake Mæris, which Herodotus states was an artificial lake formed to store the waters of the inundation, and distribute them as required during a season of drought, or when the floods were insufficient to irrigate the neighbouring country. It is not worth while investigating the cause of the destruction of this lake, but we may briefly notice the advantages which would accrue from its re-establishment. It appears that by the formation of the necessary tanks forty-two thousand acres of fertile land would be lost to cultivation; but, on the other hand, by converting this land into water, so to speak, it would be possible to irrigate or bring into cultivation during drought, or seasons of insufficient floods nearly seven hundred thousand acres. Against this increased cultivable area must be set the cost of reconstructing the necessary banks, sluices, channels, and other works. This cost is very much enhanced by the fact that the level of the present bed of the ancient lake is nearly 27ft. higher than it originally was. M. Linant Bey estimates that nearly thirty million cubic yards of earthwork would be required to construct the works. Provided the result would recoup the outlay, there would be no difficulty either in finding the necessary capital or in carrying out the undertaking.

Coming down to our own times, the public works constructed recently in Egypt are of a character which speaks well for the future prosperity of the country, whether they be regarded as intended to promote the fertility of the soil, the increase of intercommunication, or the interests of commerce. Until the Euphrates Valley Railway is made, Egypt will constitute, as it does now, the shortest route to our Indian possessions and to the East generally—a route very considerably facilitated by the opening of the Suez Canal. Twenty years ago there was no railway across the desert, either from Cairo to Suez or from Alexandria to Cairo. At present there is comparatively a good port at Suez on the Red Sea, while similar accommodation has been provided at Alexandria, and recently very much extended and improved. Both these towns have also been furnished with waterworks. Under the present ruler the railway system has been greatly extended, especially in the Soudan district. Sugar and other manufactories have been established, and no efforts seem to be spared to promote the welfare of a country which is renowned for its antiquity and former magnificence. A point worth adverting to in connection with our subject is whether it will be found advisable in future to resort to other means to irrigate the land than that of simply raising embankments of various heights. It is not improbable that when all the land situated at the lower and consequently more favourable level be brought into cultivation, the aid of machinery may be called in to raise the water to a height sufficient to command the land placed at a greater altitude.

LITERATURE.

Minutes of Proceedings of the Institution of Civil Engineers, with other Selected and Abstracted Papers. Vol. xxxix. Session 1874-75. Part I.

[SECOND NOTICE.]

IN our previous notice of the volume now before us, we reviewed so much of the contents as would have constituted the principal portion of one of the former similar publications. The present issue, however, marks the commencement ef an entirely new *régime* with respect to the publications of the Institution. For the future, instead of two volumes per annum, four will be published. The gradual extension of the "Minutes" is thus referred to in the last annual report:—"A few years ago the proceedings were contained in one annual volume of 540 pages, afterwards expanded into two volumes together of 944 pages. Now it is proposed to issue one volume of about 350 pages as early in each quarter as circumstances will permit." It is evident that in order to effect this change some new feature, some fresh additions, must be introduced. These consist, in the first place, of a certain number of selected papers, which, although not read at the meetings, are considered to possess sufficient interest and merit to entitle them to a place in the publications of the Institution. Occasionally, but rarely, communications have been published in previous volumes which had not been read at the meetings, but this departure from the ordinary rule was due nearly always to the abstruse character of the paper, which rendered it impossible for the auditor to follow it with any exact idea of its object or signification. Many communications, both professional and scientific, are not adapted for being read to an audience, but demand study and reflection to be even partially comprehended.

The first of three selected papers gives a succinct account of "Engineering in Sweden." Between three and four thousand miles of mixed heavy and light railways are either opened for traffic or in progress of construction in that country, which was somewhat slow to adopt steam locomotion in consequence no doubt of its being well provided with water communication. A curious point connected with the iron trade existing between Sweden and England is the large exchange in that commodity which takes place between the two countries. The exports and imports are about equal, and at first sight it appears very strange that Sweden should export so large a quantity of iron to England, and import so much in return, instead of supplying her own wants. The explanation of this apparent anomaly is due to the fact that the iron exported from Sweden is smelted with charcoal, and is too superior and too expensive a raw material for conversion into ordinary market bars and other sections. On the other hand, the English iron, which is smelted with coke and coal, is quite good enough for the purposes above mentioned, but not of a sufficiently pure character for the manufacture of the higher qualities of wrought iron and steel. The reason why the Swedish raw material is smelted with charcoal is simply the want of coal. The comparative value of the two descriptions of iron, deduced from the average during the last twenty years, is £7 per ton for the English and £12 10s. per ton for the Swedish. The communication on "The Consolidation of Earthworks" will be found very interesting, especially to railway engineers. It deals with most of the difficulties which arise during the construction of deep cuttings and high embankments, points out the precautions to be observed in treacherous and yielding ground, and describes the remedies to be adopted in cases of slips and failure. The author brings forward numerous practical examples of railways, both in this country and abroad, in which cuttings and embankments which showed unquestionable signs of failure, were made secure by the adoption of proper measures. These include, briefly, drainage, longitudinal and transverse strutting, both overhead and underneath, retaining walls, piling, fascines, and planting. Judging from the heavy character of the works in some of the examples of cuttings, it would have been more economical to have in the first instance constructed a tunnel.

Among the names in the "Memoirs" will be found those of the late Joseph Cubitt, Sir William Fairbairn, Sir Charles Fox, Mr. John Grantham, Mr. T. Marr Johnson, and Sir John Rennie. A perusal of the brief biographies of our professional brethren, of whom it may be truly said, "Their works live after them," brings us to the third and concluding section of our volume, comprising, "Abstracts of Papers in Foreign Transactions and Periodicals." As this is essentially a new feature, and a valuable one also, in the publications of the Institution, we have a few words to say about it. The object is to afford to the members of the Institution, in a clear and condensed form, a description of the most important engineering works carried on abroad, together with brief notices of all scientific experiments and researches which are likely to be read with interest by the profession generally. Articles descriptive of engineering works in progress or completed, of mining operations, of railways, sanitary works, telegraphs, and treatises of a theoretical character, are treated of in this new section. The more prominent portions of their contents, together with what is so important—namely, their practical results and bearings—have been abstracted with as much brevity as is consistent with clearness, so that each separate communication is at once readily comprehensible, affords definite information on the subject of which it treats, and is, so far as an abstract can be, a complete epitome of the original article. The advantage of a compilation which will place the members of the profession *en rapport* with what is doing in the whole of the engineering world, is obvious, especially to those who are carrying out works in distant and remote regions, and are unable to avail themselves of the benefit of our scientific journals. It is true that nearly all engineering works of importance either at home or abroad are described and, when necessary, fully illustrated in our own columns; but we are not of the opinion of those who imagine that our previous publication will detract from the value or utility of the "Abstracts." Recapitulation in a modified form and under certain conditions is by no means vain repetition, and besides, no single scientific jouurnal can cover the whole range of engineering science completely. We are certain that the 120 pages or so which are devoted to the present, and will be to the future sections, will constitute a most important and generally appreciated addition to the minutes of proceedings. We congratulate the Institution on the issue of so substantial a volume, so replete with instructive contents. Should its successors be up to the same standard, of which we have little doubt, the members, at the end of the fourth volume, will possess a record of the engineering of the year throughout the world which it would be impossible to find in any publication of a similar character. The volume is edited by Mr. Forrest, the able secretary of the Institution, whose ability and energy do not seem to have been the least impaired by the additional responsibility and labour which he has undertaken.

PRIVATE BILLS IN PARLIAMENT.

VERY little business has been done during the past week. The hotly-contested battle between the promoters of the Crosshill Burgh Extension and the Glasgow Municipal Extension Bills has at length been concluded in favour of the former. The Glasgow Bill has been rejected. The Prudential Assurance and the Inverness Water and Gas Bills have passed committee, as has also the South Devon Railway Bill, which was unopposed.

Before the referees a *locus standi*, subject to slight conditions, has been allowed in respect of the petitions of Mr. Postlethwaite and the London and North-Western Railway against the Whitehaven, Cleator, and Egremont Railway Bill. The petition of the Borough of Wicklow against the Dublin, Wicklow, and Wexford Railway Bill has been disallowed.

The Bridgwater Railway Bill has been withdrawn. Lord Redesdale has entered a protest to the following effect against the Sligo, Leitrim, and Northern Counties Railway Bill:—Because in this bill it is for the first time proposed to create preference capital for making a new railway by a new company. Because the capital is to be £200,000 in shares and £100,000 in borrowed money. Of the former a dividend of 5 per cent. is guaranteed by baronies and landowners on £72,800, and of the remaining £127,200, £50,000 is to be issued with a preference, leaving £77,200 ordinary share capital which will not be entitled to receive anything until the full dividends agreed on have been paid from the net income of the concern on £222,800. Because the estimate for the construction of the line being £243,000, the aforesaid sum will be insufficient to complete the same. Because the character of the undertaking being such as to render it necessary to start it by issuing part of its capital with a preference, it must be taken as admitted that the company have little expectation of finding customers for ordinary share capital, and, consequently, that when the preference capital has been exhausted they will have to apply to Parliament for new powers to make the remainder of their share capital marketable. Because this can only be done by a grant of pre-preferential share capital or by extended borrowing powers, the dividends on which must take precedence over those which the bill professes to secure to the preference shares created under it. Because, under these circumstances, the capital which persons will have been induced to take believing it to have a preference secured to it will no longer hold that position, and Parliament, by allowing the issue of such shares in a first bill, will have deluded persons into subscribing to an investment under a deceptive name. Because, as this preference capital is to have priority over that which is to be guaranteed by the baronies and landowners, any capital created by pre-preference shares or additional borrowed money must also have precedence over that so guaranteed, or it will have no preference over anything, and the baronies and landowners will thus become subject to a liability not contemplated by them when they agreed to the guarantee. Because Parliament ought not to sanction any measure for the construction of a railway which does not appear to afford the means for completing the same, and the provisions of this bill to secure subscription for the capital are inadequate.

The following Bills have been read in the Lords:—For the second time, the Midland Railway, the Longwood Gas, the Marlborough Gas, and the Middlesbrough and Stockton Tramways Bills. For the third time, the East London Railway, the Sutton Bridge Dock, the Glasgow (City) Street Improvement, the Stapenhill Bridge, the Plymouth, Devonport, and Stonehouse Cemetery; the Truro Water, the Millom Gas and Water, the Portishead District Water, the Pontefract Borough Extension, and the Bradford Water and Improvement Bills.

In the Commons the following bills have been read a third time and passed:—The Liverpool Tramways and the West Lancashire Railway, the Blackburn Water, the Glasgow and Yoker-road, the Lymington Harbour and Docks, the Whitby, Redcar, and Middlesbrough Union Railway; the London, Tilbury, and Southend Railway; the Sevenoaks, Maidstone, and Tunbridge Railway; the Lymington Harbour and Docks, and the Ryde and Newport and Cowes and Newport Railways bills; while the Cornwall Minerals Railway Bill and the Greenock Police Bill have been read a second time.

DOVER HARBOUR.

THE report of the select committee to whom the Dover Pier and Harbour bill was referred, and who were instructed to report upon the advantages which the proposed harbour, if successfully constructed, may afford to the defence of the country in the case of a European war, and for purposes of refuge and Channel communication, has just been published. It states that there is no room to doubt that, in the case of this country being obliged to engage in warlike operations, the proposed harbour would be of the greatest value and importance, both in a naval and military point of view. At the present moment it may be said that there is no place between Sheerness and Portsmouth at which vessels of her Majesty's navy can obtain a supply of coal if required. The Downs are no doubt an admirable naval station, both in point of security and convenience of position, but coaling there would have to be carried on from sea-going vessels or floating depôts which in time of war would be exposed to attack by the enemy, unless protected by works which at present do not exist. If the proposed harbour is successfully constructed, ironclads of the largest class can be moored alongside the existing Admiralty pier, or the Eastern pier, if modified with that view; coals from any part of England or Wales may be brought by railway in trucks direct to the side of vessels, and shipped with facility, safety, and despatch. In a military point of view, the advantages of the proposed harbour in time of war are not less apparent. Hitherto no proper facilities have been provided either at Woolwich, Chatham, or Sheerness for the embarkation of troops, while at Portsmouth the length of wharf in the dockyard is quite insufficient, and in time of war would probably be required by the Admiralty for naval purposes. On the other hand, Dover is in communication by two railways with the military stations of Canterbury, Maidstone, Sheerness, Chatham, Woolwich, London, Aldershot, Portsmouth, and Shorncliffe; and, as the lines of rail come down to the pier, alongside of which the transports would be lying, a very short time would suffice for the embarkation of a large force. To these considerations must be added the important fact that the proposed harbour will be under protection of great military works, which it would be necessary to provide in any other position where a harbour for naval and military purposes could be constructed. With regard to its capabilities as a harbour of refuge, the committee, while of opinion that some advantage is likely to be derived by the commercial marine in this respect, yet do not wish to lay too much stress upon this advantage, and were that the only object in view, would not feel justified in recommending its construction.

Lastly, with regard to the advantage of the proposed harbour, with regard to Channel communication, there is no doubt that the convenience of embarking and disembarking in any weather in the smooth water of a sheltered harbour is of great public importance. That this is fully appreciated by the great companies which carry the postal and passenger traffic from the port of Dover to the Continent, is sufficiently evidenced by the proposals which have in past years been made by them for the construction of a smaller harbour specially designed for that purpose.

In conclusion, the committee desire to draw the attention of the House to the evidence which has been submitted to them, and by which they have been much impressed, to the effect that a considerably increased extent of deep water space might be secured by a slight modification of the present designs, at an increased cost of moderate amount. It appears, however, to the committee that it would be beyond their functions to recommend such an increase of expenditure, and they therefore content themselves with bringing the evidence referred to specially to the notice of the House.

A FURTHER trial of the engines of the Bessemer was made on Saturday. They are reported to have done well. The cabin was not worked.

A GREAT RUSSIAN BRIDGE.—A great bridge 3600ft. in length is about to be thrown over the Volga. The work is to be commenced in August; the contract has been let to the Schlessin Company.

SOCIETY OF ENGINEERS.

May 3rd, 1875.

Mr. JOHN HENRY ADAMS, President, in the chair.

THE following paper "On the Use of Paint as an Engineering Material," by Mr. Ernest Spon, was read:—After questions of form, strength, constructive material and similar matters have been duly settled in connection with any engineering work made of wood or metal, the engineer has to consider the best method of maintaining that work in good condition. Apart from working casualties, the material of which the particular work is constructed is exposed to atmospheric and chemical influences which tend more or less to modify and corrode its surface, and an artificial surface is therefore formed by applying paint. Most of the paints used for ordinary work are composed of the colouring matter, then of a quantity of white lead, with which and a particular oil they are worked into a paste of the shade required, and are afterwards trimmed down with oil and turpentine when used. The white lead which thus forms the basis of most paints, and is by itself a colour, is the basic carbonate of lead, a heavy earthy powder, white when first made, but soon becoming of a grey tint when exposed to the air, from the action of sulphuretted hydrogen. It is insoluble in water and effervesces with hydrochloric acid, dissolving when heated, as chloride of lead, which crystallises in needles on cooling. Dilute nitric acid easily dissolves white lead, with effervescence caused by the escape of carbonic acid gas. When heated on a knife or slip of glass it becomes yellow. It is not very generally known that white lead and oil combine with such energy that if linseed oil is poured upon a very large quantity of white lead, and the mass allowed to stand for a few hours, the temperature becomes so high that the oil is carbonised and colours the whole a black. We should carefully avoid mixing with white lead substances which may impair its brightness or depreciate its other qualities, and it should be kept in closed vessels, otherwise it will acquire a brown shade. For good paint it should be pure and without foreign mixture; however, both manufacturers and painters add to it variable proportions of chalk, sulphate of lead, and the like, and it is often mixed with that sulphate of baryta which is called baryta white, and which is prepared from the native sulphate or from carbonate of baryta artificially treated with sulphuric acid. Baryta white is an adulteration which ceases to be objectionable when the manufacturer makes the composition known, as it is of a handsome white colour, entirely innocuous, fast and resisting most reagents; its great defect being that it possesses but little body or covering power. The manufacturers sell various qualities of white lead, sometimes in powder or in lumps, as genuine dry white lead, or flake white, but the greater portion in a paste, holding from 7 to 9 per cent of oil. Krems, Nottingham and Newcastle whites are pure lead differing only in the way in which they are made, Venice white is a mixture of equal parts of white lead and sulphate of baryta. Hamburg, Holland, and other whites contain from 3 to 60 per cent. of sulphate of baryta, and inferior qualities large proportions of chalk. White lead paint is solid and durable, but two disagreeable vapours given off by the lead exercise a dangerous effect upon the health of the workmen who are engaged either upon its manufacture or its use.

Many substitutes have been tried to obviate the employment of white lead; zinc white in particular has received considerable attention, it has not such a bad effect upon the health, having no smell of itself, and does not impart any to the liquids with which it may be mixed, so that any place freshly painted with it may be at once inhabited without fear of its injuring the occupants. Zinc white is the oxide of zinc; it is insoluble in water, but dissolves in hydrochloric acid, usually effervescing slightly from the escape of carbonic acid, which oxide of zinc absorbs from the air. When heated, oxide of zinc becomes yellow, but resumes its white colour on cooling. It is as brilliant, white and fine as white lead, and becomes on drying so hard that it will take a bright polish, it does not alter under the destructive action of sulphurous vapours, or of gas with equal weights; it covers a larger surface than carbonate of lead, but it is very dry under the brush, and therefore requires more labour in applying it, which to a great extent explains the disinclination to use it, spite of all the efforts made in its favour. It also takes longer in drying, and when adulterated is very liable to change colour.

Red lead, so largely used by engineers, is an oxide of lead, usually in the form of a bright red powder, which is not affected by water, but evolves the smell of chlorine when boiled with hydrochloric acid, and is slowly converted into chloride of lead. Dilute nitric acid only partly dissolves it, leaving a brown powder. On account of its durability, it is frequently used as the priming coat, often the only coat given, on ironwork. Care should be taken that no salt is present, otherwise a chemical action commences, blisters are formed, and the lead is reduced to the metallic condition. It has been proposed to substitute for red lead a red obtained from a sulphide of antimony, termed antimony vermillion, which is sold in a state of very fine powder, without taste or smell, and which is insoluble in water, alcohol, or essential oils. It is but little acted on by acids, and foreign engineers state that when ground in oil it acquires great intensity or brightness of colour, that it has a good body, is unalterable by air or light, and may be freely mixed with white lead. Black paints made from the residual products obtained in distilling coal and shale oils are largely employed for rough work. They combine readily with drying oils, and give an intense and handsome black, which is at the same time very economical. Native oxide of iron has of late years supplied us with a paint which possesses many of the good qualities of red lead without its inconveniences. Oxide of iron paints are most effective and durable paints to use on iron, as they have no tendency to change or affect the surface of the metal. An analysis of one of these paints gave—peroxide of iron, 68·95; aluminous earth (clay), 1·48; burnt clay, 29·57; total, 100·00. The purple-brown oxide is a hydrated peroxide of iron, Grant's black is made of shale containing iron, and the well-known Torbay paint is a protoxide of iron. Under equal volumes iron paints cover more than those from lead; mixed with one-third of white lead it forms an excellent mastic, similar to that made from red lead, and which becomes very hard after drying for some time. As the iron oxide paint resists a strong heat it is advantageously employed for painting parts of machines and boilers. The so-called anti-corrosive paint is made of equal parts by weight of whiting and white lead, with half the quantity of very fine sand or road dust, with colours at pleasure. The mixture being made with water can be used as a water-colour, but it is usually applied as an oil paint. The preparation of oil recommended for this purpose is twelve parts by weight of linseed oil raw, one part of boiled linseed oil, and three parts of sulphate of lime, the whole well mixed. One gallon of oil thus prepared is used to 7 lb. of the paint. Paints containing silica have been used for both wood and metal; they give a hard surface which is very durable; it is stated that when mixed with proper oils they will resist the action of salt water or acids better than iron or lead paints, that they cover well, and that in the case of wood they form a considerable protection against fire. In addition to the pigments mentioned, which are in themselves colours, various tints are produced by additions of—ochres, earths naturally coloured by iron; chromes or yellows, consisting of oxide of lead and chromic acid; blues, such as Prussian blue, from animal refuse burnt with potash and iron; smalts, from oxide of cobalt; ultramarine blue, from carbonate of soda, silica, alum, and sulphur; or greens, from oxides, carbonates, and arsenates of copper.

The oils employed in engineering painting are linseed oil, nut oil, and poppy oil, which in common with a few other vegetable oils and some resinous matters, possess the property of drying, after being placed upon the surface of a substance, into a resinous compound. Of these oils, linseed is by far the most important, and its characteristics deserve careful study, as it alone has pre-eminently the valuable qualities of great strength and flexibility. It is by far the strongest oil, and the one that dries best and firmest. It has also great body, resists the inclemencies of the weather well, and is least affected by the atmosphere. Good linseed oil is of a pale transparent amber colour, very limpid, with little smell, and comparatively sweet to the taste; it is specifically lighter than impure oil, and dries quickly and firmly. This oil is more viscous or glutinous than other oils, and can be easily recognised by its peculiar odour and taste. Linseed oil improves greatly in quality by age, and ought to be kept at least six months after it has been expressed before being used. A strong drying quality can be given to the oil by boiling it either with or without the addition of other substances. The substances thus added are very various, the principal being litharge, acetate or sugar of lead, red lead, and oxide of manganese, the last named when the body of the paint is to be zinc white. The most simple method of preparing drying oil is by boiling it for a considerable time without any addition, and drying oil can be prepared for common work by mixing 1½ lb. of red lead with one gallon of linseed oil, boiling them together, and afterwards letting the oil stand for a few days for the lead to sink to the bottom. A considerable drying quality may be given to linseed oil and the colour much improved, without its being boiled, by mixing about 1 lb. of white lead to the gallon of oil, and letting it stand a week or two until the lead and feculent parts of the oil have sunk to the bottom of the vessel in which the oil is placed. This is likewise a cheap way of purifying oil, as the lead can always be used for common purposes. Other things being equal, the most essential quality to be required in oils is their drying well, which, although it may be assisted by additions, is yet to be desired in the oil itself, as the effect of some pigments is sometimes such as to counteract the strongest driers and occasion great trouble and delay from the work remaining wet a considerable length of time. Nut oil is more uncertain in its qualities than either linseed or poppy oil, and is frequently a long time drying. When of good quality it is very limpid, of an agreeable taste, sweet smelling, and free from rancidity or sediment. Poppy oil is extracted by pressure from the seeds of the plant, and should be white or very slight yellow in colour, sweet, and without smell. Both nut and poppy oils are far inferior in strength, tenacity, and drying qualities to linseed, but have the reputation of keeping colour better, and are on this account sometimes employed in interior work, for thinning paints used for ornamental purposes, and which require to be very white or carefully executed. Driers for hastening the drying of colours are much used, in addition to the drying oils. Those most approved are sugar of lead and litharge. These when ground, and mixed in small quantities with paints, very much assist them in drying; indeed, some colours will not dry without them. Red lead is also an excellent drier, and in cases where its colour is not objectionable is much employed. Sugar of lead is, however, the best drier, though somewhat more expensive than the others. In the last or finishing coats of light colours driers are generally avoided, as they have a slight tendency to injure the colour. The spirits of turpentine for thinning the colours should be of good quality, which may be ascertained by weighing equal quantities and comparing the weights, the lightest being the best. The goodness of spirits of turpentine may likewise be ascertained by noticing the degree of inflammability it possesses; the most inflammable is to be preferred. Those who are much in the habit of using turps, as they are familiarly called, will tell by the smell their good or bad qualities, for good turpentine has a pungent smell, the bad a very disagreeable one, and not so powerful. Painting when properly executed will not present a shining, smooth, and glossy appearance, as if it formed a film or skin, but will show a fine and regular grain, as if the surface were natural, or had received a mere stain without destroying the texture. For woodwork, before the paint is applied, the surface must be free from moisture of any kind and seasoned. Dampness, moisture, or unseasoned substances in woods, stopped in or covered over with paint, will in all probability tend to their destruction. The surface is then freed from anything which may prevent the paint from becoming identified with the material. Thus in painting pine-woods of any kind, the resin contained in the knots which appear on the surface must be neutralised, or a blemish will show over every knot; this is done by killing the knots with two or more coats of red lead ground with water and mixed with size; a preparation known as patent knotting is also very much used, it is composed of shellac, naphtha, and some other drying agent. The heads of nails having been carefully punched in, all nail holes, cracks, or other defects are stopped and filled up with putty or wood. The surface of the wood is then rubbed smooth with sandpaper or pumice-stone. The number of coats usually given to new woodwork is four. The first, or priming coat, need have very little, if any, of the final colouring matter in it. After priming, all nail holes or other superficial defects are carefully stopped up before the next coat is applied. The coats are laid on as the previous coats become dry, which is generally in about forty-eight hours. The paint requires renewing after every two or three years, when but two coats are usually required. For fine work such coat is rubbed with pumice or sandpaper and well dusted before the next is added.

In repainting old work, all dirt is carefully removed with the stopping knife and duster, those places that are rough are rubbed with pumicestone, and greasy marks cleared off with turpentine. New patches and decayed parts are then brought forward with a coat of priming, all defects stopped and made good with putty, and the first coat or second colour proceeded with in turpentine. The quality of the next coat will entirely depend upon the manner in which it is to be finished. If it is to be painted twice in oil and flatted, the next coat or third colour should be mixed up chiefly in oil, and tinted like the finishing colour, to form a ground for the flatting. The greater the shine of the ground, the more dead will the finishing coat or flatting be; likewise the more dead the ground, the better will the finishing coat shine; therefore it is a general rule that for finishing in oil the undercoat should be turpentine, and for finishing flat the undercoat, or ground colour, should be oil, but it is to be observed that all turpentine undercoats have a little oil with them, and all oil undercoats, except the priming or first coat on new work, have a little turpentine with them. When ironwork has to be painted the engineer has a very different task to perform. Cast and wrought iron behave very differently under atmospheric influences, and therefore require somewhat different treatment. The decay of iron becomes very marked in certain situations, and weakens the metal in direct proportion to the depth to which it has penetrated; and although where the metal is in quantity this is not very appreciable, it really becomes so when the metal is under ⅜in. in thickness. The natural surface of cast iron is very much harder than the interior, occasioned no doubt by its becoming chilled, or by its containing a large quantity of silica, and affords an excellent protection, but should this surface be at all broken, rust immediately attacks the metal, and soon destroys it. It is very desirable that the casting be protected as soon after it leaves the mould as possible, and a priming coat of oil or paint should be applied for this purpose, the other coats thought requisite can be given at leisure.

The following is the process to which all cast iron water pipes should be submitted. It was introduced by Dr. Smith, and is equally applicable to any other kind of casting that can be manipulated:—Each casting is thoroughly dressed, and made clean and free from the earth or sand which clings to the iron in the moulds, hard brushes being used in finishing the process to remove the loose dust. Every casting must be likewise free from rust when the paint is applied. If the casting cannot be dipped presently after being cleansed, the surface must be oiled with linseed oil to preserve it until it is ready to be dipped; no casting is on any account to be dipped after rust has set in. The coal tar pitch used as a paint in this process is made from coal tar distilled until the naphtha is entirely removed and the material deodorised. In England it is distilled until the pitch is about the consistence of wax. The mixture of 5 or 6 per cent. of linseed oil is recommended by Dr. Smith. Pitch which becomes hard and brittle when cold will not answer for this use. Pitch of the proper quality having been obtained, it must be carefully heated in a suitable vessel to a temperature of 300 deg. Fah., and must be maintained at not less than this temperature during the time of dipping. The material will thicken and deteriorate after a number of pieces have been dipped; fresh pitch must, therefore, be frequently added, and occasionally the vessel must be entirely emptied of its old contents and refilled with fresh pitch. The refuse will be hard and brittle like common pitch, and consequently worthless for the purpose. Every casting must attain a temperature of 300 deg. Fah. before being removed from the vessel of hot pitch. It may then be slowly removed, and laid upon skids to drip. In the case of water pipes, all those of 20in. diameter and upwards will have to remain at least thirty minutes in the hot fluid to attain this temperature. The coating when cold should be tough and tenacious, and not brittle, nor have the slightest tendency to scale off.

In considering the painting of wrought iron it must be noticed that when iron is oxidised by heating in contact with the atmosphere two or three distinct layers of scale form on the surface, and, unlike the skin upon cast iron, can be readily detached, as by bending or by hammering the metal. The outer layer of this scale is more highly oxidised than the inner, and is slightly redder in tinge from the presence of a variable excess of ferric oxide over that contained in the inner layer. The oxide occurring in the outer scale is fusible only at a high temperature, is strongly magnetic, and slightly metallic in lustre; while the inner layers are more porous, dull, and non-metallic in lustre, less brittle, and also less powerfully magnetic. It will be seen that the iron has a tendency to rust from the moment it leaves the hammer or rolls, and that the scale above described must come away. One of the plans to preserve the iron has been to coat it with paint when still hot at the mill; and although this answers for a while, it is a very troublesome method which ironmasters cannot be persuaded to adopt, and the subsequent cutting processes to which it is submitted leave many parts of the iron bare Besides, a good deal of the scale remains, and until this has fallen off, or has been removed, any painting over it will be of little value. The only effectual way of preparing wrought iron is to effect a thorough and chemical cleansing of the surface of the metal upon which the paint is to be applied, that is, it must be immersed for three or four hours in water containing from 1 to 2 per cent. of sulphuric acid. The metal is afterwards rinsed in cold water, and if necessary scoured with sand, put again into the acid bath or pickle, and then well rinsed. If it is desired to keep iron, already cleansed, for a short time before painting, it is necessary to preserve it in a liquor rendered alkaline by caustic lime, potash, soda, or their carbonates. Treatment with caustic lime-water is, however, the cheapest and most easy method, and iron which has remained in it for some hours will not rust by a slight exposure to a damp atmosphere. Although desirable, this method of cleansing the surface is impracticable in the majority of cases, and recourse must be had to scrapers and hard brushes to remove the scale of rust. Having obtained a clean surface, the question arises what paint should be used upon iron? Bituminous paints, as well as those containing variable quantities of lead, were formerly considered as solely available, but their failure was made painfully apparent when the structures to which they were applied happened to be of magnitude, subjected to great inclemency of weather or to constant vibration. Recourse has, therefore, been had to iron oxide itself, and with very satisfactory results. Iron oxide paints are made of two qualities. The first quality is the best adapted for ironwork, and is made by purifying the oxides and placing them in retorts, when the various colours are mixed with them. They are altogether submitted to seven distinct processes in the course of manufacture. To insure large surfacing qualities, or the power of covering a large area with a small quantity of paint, the ingredients should be reduced to an impalpable powder before they are mixed with the oil, and, after mixture in first quality paint, they are ground for seven or eight hours. The second quality have their colours chemically combined by mixture, and are not so carefully prepared, although they are excellent for common work. A pound of iron oxide paint, when mixed ready for use in the proportions of two-thirds oxide to one-third linseed oil, with careful work, should cover twenty-one square yards of sheet iron, which is more than is obtained with lead compounds. Oxide of iron paint endures a very great heat without material alteration, and keeps both its colour and preservative qualities well. The author is of opinion that, when used under proper supervision, no better protection can be found for iron structures than oxide of iron paints. There is this difference to be noticed between the painting of iron and wood, that with the former, when a painter comes to spots of rust that cannot be removed, he should endeavour to incorporate them with the paint rather than paint over them. The re-painting of iron involves carefully washing down and removing all dust, dirt, and so on from the entire surface, every particle of rust being scraped and chipped off, the work receiving from two to four coats in oil, properly applied. The author would observe, in conclusion, that the real value of any paint depends upon the quality of the linseed oil, the quality and character of the pigment, and the care bestowed on the grinding and mixing, and as all this is entirely a matter of expense, cheap paints are not to be relied upon. He is convinced that the superiority of most esteemed paints is due to the above causes rather than to any unknown process or material employed in the manufacture, and their comparatively high price corroborates this opinion.

THE LATE MR. THOMAS WEBSTER, Q.C.—We regret to have to record the death, on Thursday evening last week, of Mr. Thomas Webster, Q.C. He was the eldest son of the Rev. Thomas Webster, vicar of Oakington, in the county of Cambridge. He was born on the 16th of October, 1810, and was educated at the Charterhouse. Thence he proceeded to Trinity College, Cambridge, and graduated as 14th Wrangler. He was for several years secretary to the Institution of Civil Engineers. He was called to the Bar at Lincoln's-inn in the year 1841, and joined the Northern Circuit. His scientific knowledge brought him into notice in connection with patent cases, in which he soon acquired a very large practice. In 1851, during the preparations for the Great Exhibition, Mr. Webster assisted in procuring the provisional protection to inventions exhibited, which led the way to the Patent Law Amendment Act of 1852. In 1865 Mr. Webster was appointed one of her Majesty's Counsel. He was elected a Fellow of the Royal Society in 1847.

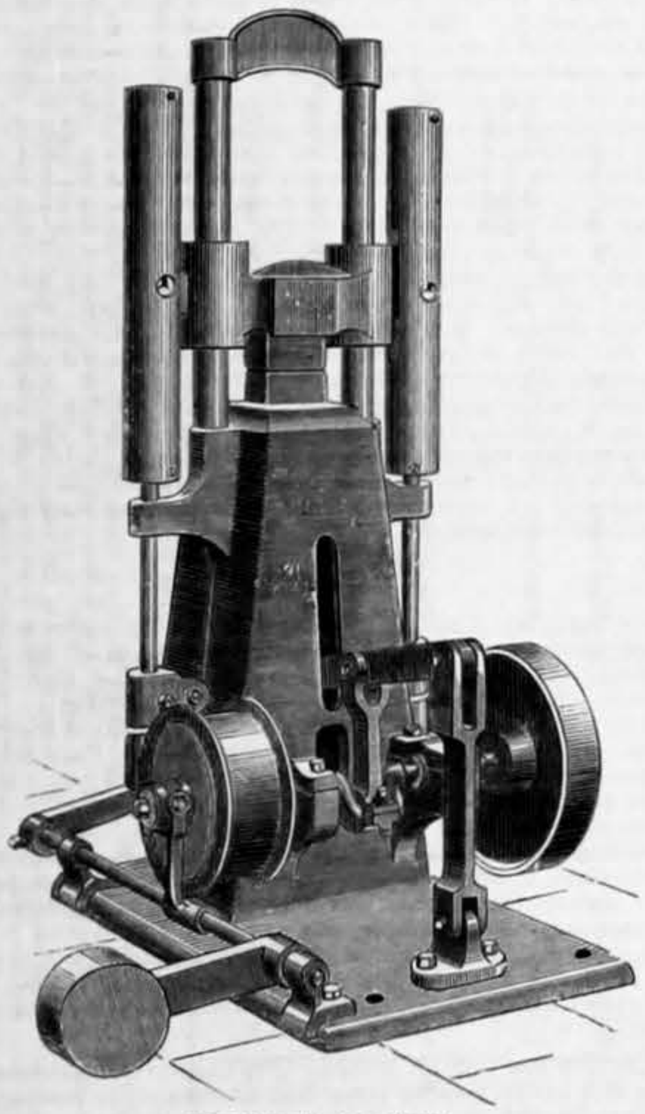
TRACTION ENGINES ON ROADS.—The Larne traction engine nuisance case has occupied a great deal of time in its hearing, and a very considerable amount of our space. We do not say that either the time or the space was wasted; but we feel sure that even our good friends in the neighbourhood of Larne must be gratified that the case has at last been concluded. The magistrates gave their decision yesterday. It was adverse to the plaintiffs, as the court held that a traction engine traversing the public road did not constitute a nuisance. Railways frequently ran close to public roads; and their engines might practically be regarded as forming a nuisance equally with traction engines, supposing these were nuisances; but railways run under Acts of Parliament, and could not be prosecuted as nuisances. The magistrates held that traction engines also had the sanction of Parliament, and did not think that in this particular instance a nuisance had been proved. In particular, it was remarked that though the engine was regularly driven through the town of Larne, none of its inhabitants had come forward to complain of it. The charge was, therefore, dismissed; and we think there is substantial justice in the decision. It is no doubt, very annoying to owners of horses to have them frightened on the public road; but the evidence on this point was not particularly strong, and without a very strong case indeed, the court would not have been justified in giving a judgment which would have had the effect of prohibiting the use of traction engines altogether.—*Northern Whig, Belfast.*

THE MANCHESTER EXHIBITION.

(*From our special Correspondent.*)

MESSRS. G. L. SCOTT AND CO. (Limited) have a good selection of wheel moulding machinery, comprising several improvements. The "Standard" machine, the invention of Mr. W. E. Hayes, has the trammel in one piece instead of two, the radius of the mould is adjusted by a screw passing over the centre of the machine, and the dividing wheel is placed below the trammel. The weight of the machine being considerably reduced, the centre of gravity being brought lower down and increased bearing surface being provided, the result is a much more stable and compact tool than those previously manufactured by this firm. The "Box" machine, also the invention of Mr. W. E. Hayes, is designed for moulding wheels, &c., in boxes. In this machine the dividing wheel is larger than the wheel to be moulded, thus insuring the greatest accuracy in the pitch of the teeth. The moulding box is stationary and forms the foundation of the machine, which revolves in it and can be readily transferred to another box. There can be no doubt that this machine will produce most accurate work, the objections to its use being that the size of the wheel produced is limited by the size of the box.

Messrs. Scott and Co. are also the exhibitors of one of Browett's power hammers. The usual standard is dispensed with, the hammer block forming the sole base, and carrying the mechanism for imparting the vertical reciprocating motion to a crosshead within the block; the ends of the crosshead project through slots in the sides of the block, and are connected by rods to two tubes closed at each end and containing loosely fitted pistons, to which are secured the ends of the crosshead carrying the tup, and which pass through slots in the tubes. Above and below the pistons there are chambers filled with air under pressure;



BROWETT'S HAMMER.

during the up stroke the tup is lifted by means of the expansion of the air in the lower chambers to a greater height than is due to the throw of the crank, and while thus ascending it receives the elastic impact of the upper chambers now on their down stroke, causing the blow of the hammer to be rapid and dead. The hammer is very compact, and free from much vibration. The tup weighs 20 lb., and the hammer is run at 250 blows per minute.

Mr. J. Nelson has a very neat little instrument for cutting off and polishing the ends of bolts, &c., which we illustrated in our number of Oct. 9, 1874. It cuts all bolt ends to precisely the same length and radius, giving them a very neat appearance, and the work is done easily and expeditiously by hand. Mr. Nelson has also a handy little drilling machine weighing only 30 lb., which will drill a hole 1½in. diameter and 6in. deep, and the handle can be fixed in any convenient position.

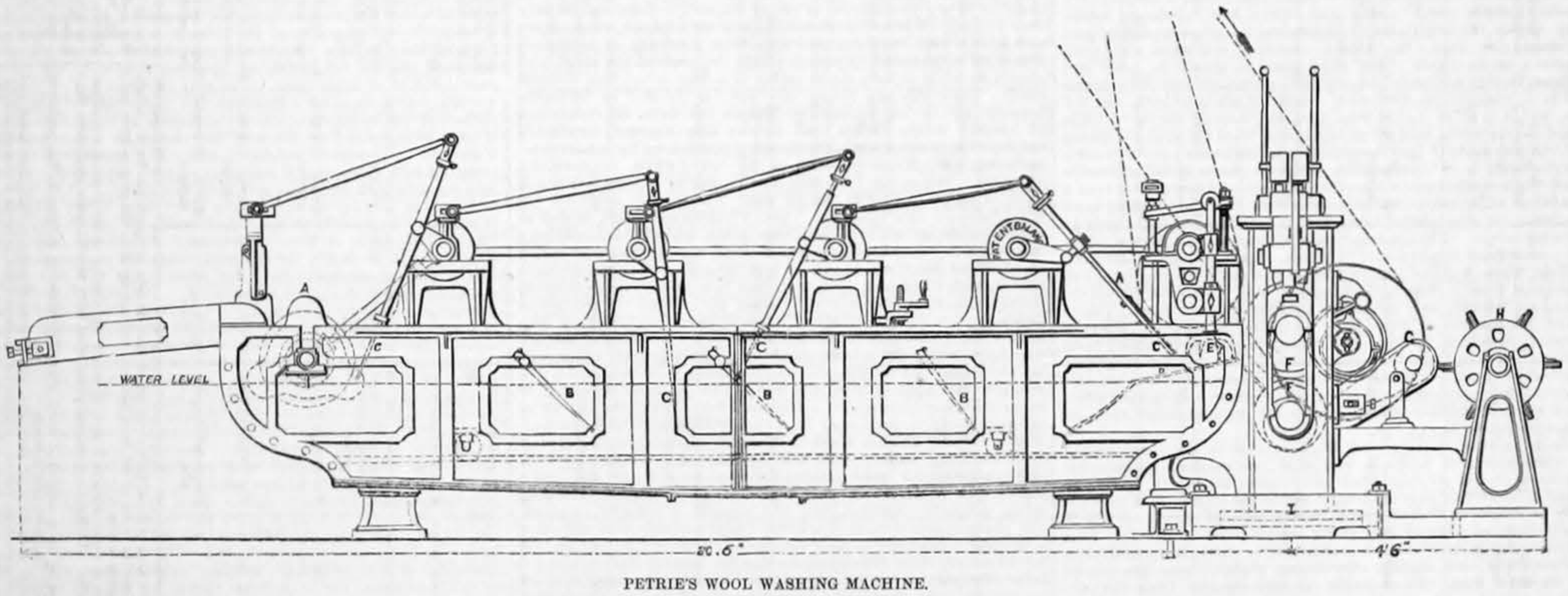
A case of turning tools and hammers for engineers, smiths, &c., and quarry and mason's tools, exhibited by Mr. Benjamin Nicholson, shows the enormous advances that have been made, from the smooth stone of the primitive savage alluded to by Dr. Anderson in his opening address, and the origin of the many varieties of hammers contained in this case. It would form an interesting study to trace out the gradual development of form in so simple an article as a hammer, and the variety and even elegance of outline now given to these tools is somewhat remarkable, but no doubt experience has proved that each form is the best for the particular purpose for which it is used.

Two of Tweddell's hydraulic riveting machines are exhibited by Messrs. Rees and Gledhill. The portable one is shown slung in a frame with a screw movement to enable the instrument to be held in any desired position. The stationary riveter is a good strong machine. One of Sholl's pneumatic power hammers is shown by the same firm.

One of the most complete stands in the exhibition is that of Messrs. Henry Pooley and Son, who exhibit fourteen varieties of their well-known weighing machines, all of which are worthy of notice from the accuracy of the registering apparatus and the strength and finish of the whole machine. The road weighbridge comprises a platform measuring 12ft. by 7ft., fitted within cast iron walls, which reduce the expense of fixing and preserve the working parts in their true relative positions. The steel knife edges are exceedingly long, and the fulcra are suspended in links and protected from any water that may find its way into the pit. The steelyard is so arranged that all loose weights are dispensed with, any weight of any load up to 12 tons can be ascertained with great ease and accuracy. A small weight placed upon a prolongation of the steelyard, and moved by means of a key, provides for the adjustment of the weighbridge. A smaller machine on the same principle will only receive one pair of cart wheels, and weighs up to four tons, but as this machine leaves greater scope for *ingenuity* in weighing and tareing, it is not so reliable as one that receives the entire weight of the cart and horse. A most useful article for collieries, blast furnaces, foundries, &c., is a weighing machine, the platform of which forms a turntable for small trucks, the weight being shown by a revolving card, graduated up to 15 cwt. The tare of the tubs or trucks having been once ascertained, a sliding weight on the steelyard can be fixed in the proper position, when the indicator will only show the net weight. The vibration of the indicator is checked by means of a loose piston suspended in water, and the action of the machine is so rapid that it is stated that twelve tubs can be weighed per minute. A machine for weighing passengers' luggage has the platform roughed so that it can be placed without inconvenience in a railway station. The principle novelty in this machine is the mode of throwing it in and out of gear, which is exceedingly neat, and the total absence of loose weights makes its indications extremely rapid. A furnace barrow weighing machine is made extremely strong to resist the rough usage to which such articles are subjected, while the jar of passing loads is taken off the knife edges by means of a spring platform. Now that Portland cement is being so extensively used on engineering works, both engineers and contractors require reliable machines for testing the quality of the cement, the variation in which is one great drawback to its use. Messrs. Pooley show a neat machine for this purpose. The steelyard is graduated up to 1300 lb., and the sliding weight is worked by an endless cord running on pulleys, a clip to grasp the brick to be tested is suspended from the short arm of the steelyard, and a corresponding clip attached to a screw underneath the frame can be adjusted to suit the length of the brick to be tested. The clips are arranged to prevent any torsional strain from coming on to the sample. The remaining articles exhibited by Messrs Pooley and Son, comprising small weighing machines of various patterns, are too well known to require description.

The Hydraulic Engineering Company appear to have made the adaptation to various purposes of Brotherhood's three-cylinder engine their speciality. One machine exhibited at Manchester consists of a three-cylinder steam engine driving a three-cylinder pump, and supplying a differential accumulator of a novel construction. In this accumulator the ram is stationary, and is of two diameters, viz., 7in. for the lower half of its length and 6in. for the upper half. The cylinder has two stuffing boxes, one at either end, and is loaded with cast rings to the desired extent. If the ram were of the same diameter throughout, the cylinder would not move, but the area of the top of the cylinder, under pressure, being greater than the area of the bottom, owing to the reduction in the diameter of the ram, the pressure causes the cylinder to ascend. This accumulator is very steady and does not require any great height. An hydraulic capstan worked by a three-cylinder engine is very compact, and all the working parts are well protected, a great advantage on board ship. The same firm also exhibited some good cranes and punching and riveting machinery.

In an out-of-the-way corner, dignified by the name of "annexe," I found a very compact and well finished machine made by Mr. John Petrie, jun., for scouring and washing wool. The raw wool is carried by a creeper or endless band under a revolving roller or dasher A, of a peculiar shape, by which it is submerged in a tank containing the hot liquor, furnished with a perforated bottom and a sludge chamber 6in. deep. In the tank are three inclined rakes B, B, B, capable of yielding, if necessary, to the passage of the wool, and resuming their original positions. Four movable balanced rakes C C C C, cause the wool to pass from one end of the tank to the other, the last rake having a longer stroke than the previous ones, and delivering the wool on to a slightly inclined table D, furnished with fixed teeth. The wool is lifted over this table by means of the fork E, and thus transferred to the squeezing rollers F, F, with the least possible delay. These rollers are weighted by means of strong spring levers, on which weights ride with jockey wheels, thus affording an easy and equal pressure when unevenly fed. From the rollers the wool is carried by an endless band G of webbing over an opening fan H, revolving at the rate of 250 revolutions per minute. The liquor squeezed out of the wool by the rollers falls into a tank I, with a perforated bottom, from which it is pumped back into the scouring tank by means of a peculiar pump, into which it is hardly possible for the wool to get, but if it did so, the clacks are specially designed to allow it to pass, and are very easy of access for cleaning, as there are no bolted clack doors to be removed to get at them. The liquor is heated by steam, and the whole machine is well designed and finished, and all the parts readily accessible.



PETRIE'S WOOL WASHING MACHINE.

Class VIII., for apparatus for the manufacture of gas and sanitary appliances, is almost entirely monopolised by Messrs. G. Waller and Co., who have a very miscellaneous collection, the most important, some small engines and gas exhausters. One combined oscillating cylinder engine and 1000ft. per hour exhauster is very compact, and suitable for small works. All these machines are exceedingly well finished, and the miscellaneous exhibits of the firm comprise many useful articles. In the same section there is a model of a sewage gas works, invented by Mr. H. Bray, and in full operation. The liquid sewage is put in at one end of the apparatus and a light is exhibited on the stand, and stated to be the result of the process, but I could not obtain any satisfactory explanation respecting the mode of working or the results obtained, but I did notice that a large proportion of heavy oil was put into the retort, therefore the gas is not produced from sewage alone.

IRON AND STEEL TESTS IN AMERICA.—We have received the following from Mr. Thurston, of the Stevens Institute of Technology, who is actively promoting the success of the above tests. He will be glad to receive any information which our readers may be able to afford him. "The United States Board to test Iron, Steel, &c., appointed by the President of the United States, in accordance with section 4 of the Act of Congress, making appropriation for sundry civil expenses of the Government, and approved March 3, 1875, has assumed, as a part of its work, the investigation of the methods and effects of abrasion and wear of metals in engineering and mechanical operations. This committee is instructed to take up this subject, and to report such valuable data and statistics, and such information as it may acquire by experiment or from other observers, in such form that it may be readily collated and made useful to the Government, the public, and the engineering profession. The committee would be pleased to receive from any reliable source such precise data and such information as enable the secretary to compile, in as concise and exact form as possible, a statement of the mode of deformation, the rapidity of abrasion, and the laws governing wear in any important typical or exceptional cases. The executive officers of all lines of railway may render valuable aid by furnishing statements of the wear of rails per ton of transportation, specifying with care the original weight, the make, and character of the rail, the total amount of transportation, the length of time occupied, and stating whether the rail finally broke or was removed. Specimens of rails remarkable either for endurance or for a lack of this quality, if sent to the committee will be of use in assisting in the determination of the chemical and other properties which most affect the value of the material under the stated conditions of use. Similar statistics and information in regard to the wear of wheels, axles, and other parts of rolling stock and machinery will be equally valuable. Engineers having in any instance noted and accurately recorded such data, are requested to transmit to this committee copies of their memoranda. The wear of journals under heavy loads, or at high velocities, as well as under ordinary conditions, is an important branch of this subject. When possible it is desired that the dimensions of the journal, the maximum, the minimum and the mean weight sustained, and the velocity of rubbing or number of revolutions per minute should be given. The nature of the lubricant is an essential element, and its composition should be stated, the method and frequency of application and the quantity used should be given. When known, or readily ascertained, the coefficient of friction should be given. It should also be noted whether heating occurs, and under what circumstances of pressure and velocity of rubbing surfaces. Peculiar instances of the behaviour or unusual expedients in the management of bearings, if described accurately and concisely, will be accepted with thanks. The wear of tools, under the various conditions of workshop practice, is another subject of investigation. Weighing the tools carefully before and after use, and weighing the amount of metal removed will, perhaps, be found the most accurate method of determining the rate of abrasion. The area of surface finished, and the area of the surface cut by the tool should be accurately ascertained and stated. The description of the tool, its shape, method of operation, the kind of metal used in the tool, the temper adopted, the character of the metal cut by it, the velocity of the tool, and where peculiarities of behaviour were noted, a careful statement of them should be given. This information will be still more valuable if the tool itself and specimens of the chips produced by it are furnished. The power required to drive the tool can sometimes be readily determined, and such information is of great value. The recent investigations of M. Tresca—*Memoir sur le Rabotage des Metaux*, &c.—is an excellent sample of such research. For all information which may properly fall within the limits of their investigation, this committee will return suitable acknowledgment."

SYNOPTICAL TABLE OF DIFFERENT MECHANICAL SYSTEMS OF CONDENSING PEAT ACTUALLY BEING WORKED.

N.B.—Ninety-nine per cent. of the peat used is simply cut and prepared by hand labour.

System, or machinery.	Where worked.	Local selling price of pit coal, per ton, 1873-74.	How long worked.	Average number of working days per annum peat can be cut and dried.	Whether peat bed, a "high moor," or "low bog."	How bog, or moor drained.	How peat extracted from bog or moor.	Proportionate expense of extraction to total cost.	How extracted peat brought to machinery.	Whether peat condensed by maceration or "mastication" in a pug-mill, or by compression.	Whether pugging or other condensing machinery adjustable or not to cutting in bog.	Whether whole vertical section of peat bed amalgamated or not.	Whether moulded or otherwise shaped into bricks or not.	Proportionate expense of moulding or cutting to total cost.	Probable number of machines at work during season.	Approximate total nominal H.P. per mill or press.	How prepared peat conveyed to drying ground.
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q
Hodges' Canadian Peat Company .	Montreal, for Grand Trunk Railway of Canada; and in Oldenberg.	£2 at least ..	Six seasons ..	130 to 140 days ..	"Low bog" ..	Not drained ..	By steam power	.. ..	By machine itself.	Macerated, or pulped in a pug-mill.	Adjustable.. ..	6ft. of vertical section.	Pulp deposited in continuous stratum and cut into pieces.	.. .. ..	Four machines..	16	By machine itself.
Leavitt's	Boston in New England States.	(?)	(?)	140 days..	Not stated ..	.. ..	By hand labour	.. ..	.. ..	Macerated in a pug-mill.	Fixed pug-mill..	Depends on mode of excavation adopted.	Moulded into bricks.	.. .. ..	(?)	10	(?)
Robert's	Pekin, New York.	.. ..	.. ..	140 days..	Not stated ..	.. ..	By hand labour	.. ..	.. ..	Macerated in a pug-mill.	Fixed pug-mill..	Not stated	.. ..	.. .. ..	(?)	13	( )
Box's, on principle of Challeton de Brughat.	Killucan, Ireland.	£1 10s. to £1 15s.	On trial	90 to 100 days or less.	Intended to work in "low" bogs."	.. ..	By French grand louchet.	.. ..	.. ..	Disintegrated by Carr's patent mill.	Fixed	Whole vertical section.	To be cut into bricks.	.. .. ..	1	.. .. ..	(?)
Rahder's	Drenthe, Holland.	Newcastle coal, retailed in the Hague at £1 16s. per ton in 1873.	Eight seasons ..	100 days..	"High bog" ..	Open drains, leading to natural outlet.	By hand labour	(?)	(?)	Macerated in a pug-mill.	Adjustable on temporary railways.	Whole vertical section.	Propelled out of mouth - pieces and cut into lengths.	)	5	Five 8-h.p. portable engines; 1 per machine.	.. ..
The Princes of Schwarzenberg, Ruschmann's machines.	Gratzen, Bohemia.	£2	Three seasons ..	120 days..	High moor ..	Natural drainage.	By hand labour, aided by a sort of Jacob's ladder.	.. ..	By steam power	Macerated; and also caked by treading.	Adjustable on temporary railways.	Whole vertical section.	Not moulded, but cut into pieces from stratum or cake.	.. .. ..	12	Twelve 16-h.p. portable engines; 1 per machine.	Hand trucks on wooden railway.
Clayton Son, and Howlett's.	Great Britain, Germany, and Denmark.	.. ..	Machine brought out beginning of 1873.	70 to 120 days ..	Not stated ..	.. ..	By hand labour	(Brought to machine) 46·16 per cent. (interest and sinking fund not taken).	By hand labour	Macerated in a pug-mill; sometimes previously squeezed.	Fixed pug-mill..	Depends on mode of excavation adopted.	Propelled out of mouth-pieces, and cut into lengths by wires.	Cutting into briquettes, 4·81 per cent.	Fourteen sold by makers.	(?)	.. ..
Exter's; same method tried at Derrylea, Ireland.	Kolbormoor, Upper Bavaria.	.. ..	Fifteen seasons..	.. ..	High moor ..	Natural drainage.	Harrowed by steam power off surface of moor.	.. ..	.. ..	Compressed	Fixed	Only stratum after stratum harrowed off.	Compressed while heated into lengths.	.. .. ..	Three presses ..	30	.. ..
Exter's	Haspelmoor, Upper Bavaria.	.. ..	Fourteen seasons	.. ..	High moor ..	Natural drainage.	Harrowed by oxen off surface of moor.	.. ..	.. ..	Compressed	Fixed	Only stratum after stratum harrowed off.	Compressed while heated into lengths.	.. .. ..	Four presses ..	(?)	.. ..
The Peat Engineering Company, Limited, Danchell's system.	Horwich, Lancashire.	15s.	Three seasons ..	120 to 200 days ..	High moor ..	Natural drainage	Dredged by machinery.	5 per cent. ..	.. ..	Macerated	Both fixed and adjustable.	Depends on mode of excavation adopted.	Propelled out of mouth-pieces, and cut into lengths.	.. .. ..	Six machines ..	3 to 6	(?)
Bocquet's, Paris ..	Oureq Valley (Oise) France.	£2 to £2 10s.	Two seasons ..	140 to 158 days ..	Low moor ..	Not drained.	By French "louchet mécanique."	.. ..	By barges on canals.	Macerated, and also ground between edge runners.	Fixed	Whole vertical section.	Moulded on the ground into bricks. Portable moulding machine.	.. .. ..	One machine ..	.. .. ..	.. ..
De Rosthorn's similar to Bocquet's.	Feldkirchen, Carinthia.	.. ..	One season, or 100 working days in Alpine district.	100 days..	High moor; fibrous peat.	.. ..	De Rosthorn's digging apparatus.	.. ..	By barges on canals.	Macerated, and also ground between edge runners.	Fixed triturating apparatus.	Whole vertical section.	Moulded by machinery into bricks. Portable hand moulding machine.	.. .. ..	One set of 1 steam extractor, 1 triturating mill, 2 moulding machines.	.. .. ..	.. ..
Schlickeyson's, of Berlin.	Numerous places in Northern and Central Europe; also in Ireland.	.. ..	Thirteen seasons	100 to 120 days ..	Working on both "high" and "low" bogs.	.. ..	Generally by hand labour aided by Jacob's ladder.	.. ..	By steam power.	Macerated in Schlickeysen's pug-mill.	Both adjustable and fixed.	Usually whole vertical section.	Streams out of mouth-pieces, and cut into lengths by hand and self-acting machinery.	.. .. ..	85 of different sizes made up to 1872.	8-h.p. for the largest machine.	Hand barrows
Schlickeysen's.. ..	Salzburg..	.. ..	Three seasons ..	.. ..	High moor ..	.. ..	Hand labour ..	.. ..	By steam power.	Macerated in a pug-mill.	Fixed	.. ..	Ditto	.. .. ..	Two machines ..	10	.. ..
Mahlstedt's	Grand Duchy of Oldenberg.	.. ..	Three seasons ..	110 days..	High moor ..	.. ..	By hand labour, aided by a Jacob's ladder.	.. ..	By steam power.	Macerated in a pug-mill, and spread out by treading.	Adjustable on temporary railways.	Whole vertical section.	Not moulded, but cut into pieces from stratum or cake.	.. .. ..	Six, each one cost £37.	.. .. ..	.. ..
Alloway's	Shapwick Moor, Somerset.	£1 12s. to £1 16s.	Since May 1st, 1873. Two yrs. previously in Queen's County	.. ..	Flat moor, 12ft. to 14ft. deep.	By a main drain into river Brue.	Dug up with spades.	.. ..	Wheelbarrows to pulping machine.	Mastication in pug-mill.	Fixed	Whole vertical section.	Moulded into "pats," not bricks.	Not exactly ascertained.	(?)	(?	.. ..
Balbiani's	Le Saussay, near Paris.	.. ..	Several seasons..	140 to 150 days ..	Low bog	.. ..	By steam louchet	11·10 per cent. ..	.. ..	Macerated in a pug-mill.	Fixed	Whole vertical section.	Moulded by hand into bricks.	22·26 per cent.	2	.. .. ..	.. ..
Eichhorn's	Aibling, Bavaria; also in Sweden.	.. ..	Twelve seasons	110 days..	High moor at Aibling.	.. ..	By hand labour	.. ..	.. ..	Macerated in a pug-mill.	Fixed	Whole vertical section.	Shaped into balls by machinery.	.. .. ..	Four at Aibling	(?)	.. ..

NOTES BY MR. PAGET.

(a) Almost all the places where peat is worked for fuel merely are very far from collieries.

(b) At all the places where peat used, coal or wood either cannot be got or is very high in price.

(c) The average time in each year when peat can be worked is at most about 200 days if sheds be used for drying; and from 100 to 120 days without sheds.

(d) Peat, if once frozen, or if, when cut, once completely dried, can never be condensed. As peat machinery can only be employed about one-third of the year, the return on the first capital alone ought to be three times the interest on the investment. The depreciation will not be much diminished by the standing of the plant, &c.

(e and f) Mr. Rees Reece, formerly of Athy, Ireland, has informed Mr. Paget that an Irish low or deep bog before being drained contains only 2 per cent. of solid matter, or 98 per cent. of water. After drainage, it still holds 84 per cent. of water, so that of 100 tons raised, only 16 tons of absolutely dry peat can be obtained. Other estimates, from experience on high moors, testify to still higher proportions of water.

(g) By hand digging, a man can dig and lift 10 tons 5ft. high per day. By hand dredging he can do twice as much.

(i) In 100 tons of fresh peat there are at least 84 tons of worthless water, which have not merely to be raised from the bog, but conveyed to the pug or other mill or condensing machine.

(j) Even if there were no water, it would have to be added to render mastication possible. All the compressing plans tried have proved more expensive than pugging.

(k) Pugging or masticating machinery adjustable to cutting in bog preferred in Germany, Holland, and Austria.

(l) A main advantage of preparing peat by machinery is that the fibrous and recent portions can be mixed up with the latest and bituminous bottom portions.

(m) After its formation, a brick of peat, weighing, say, 13 lb., is reduced to 2 lb. or 2½ lb. by the evaporation of the greater portion of its moisture, down to the average of 20 to 25 per cent. of water in air-dried peat.

(o) The amount of peat worked by machinery is merely a small fraction of that simply cut by hand and consumed after no further preparation. Density, advantageous for transport and resistance to moisture, main advantages of condensation. Calorific capacity not increased.

(p) As a "nominal" horse's power is a very wide expression, these figures are merely approximate.

(q) Here, again, more than two-fifths of the whole weight—useless water—have to be conveyed to distances increasing in a geometrical ratio with the extent of the undertaking.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

Grants and Dates of Provisional Protection for Six Months.

1831. Improvements in Shuttles for Looms, James Wilson, Kilmarnock, Ayrshire, N.B.
1832. Improvements in Pyrometers, Robert James Wood, Glasgow, Lanarkshire, N.B.
1834. Improvements in the manufacture of Cloth known as "Indian kutar," and of other cloths of a similar nature, and in apparatus used in such manufacture, John Edward Simpson and Christopher Cross, Manchester.
1835. Improvements in Furniture Castors, Etienne Lasnier, Dijon, Côte d'Or, France.—18*th May*, 1875.
1837. Improvements in the process and apparatus for manufacturing Material Imitating Leather, Fabrics, and the like; also wood, stone, or other surfaces, embossed or otherwise figured, Henry Loewenberg, Southampton-buildings, Chancery-lane, London.
1839. Improvements in the manufacture of Colouring Matter suitable for Dyeing and Printing, John Brennand, Manchester.
1841. Improvements in Bogie Engines, Robert Francis Fairlie, Victoria-street, Westminster.
1843. Improvements in Railway Crossings, Alfred Vincent Newton, Chancery-lane, London.—A communication from Siegerich Christopher Kreeft, Turin, Italy.
1845. Improvements in the treatment of Sewage, Mark French Anderson, Priory-row, Coventry, Warwickshire.
1849. Improvements in Wood Screws, and in machinery for manufacturing the same, William Robert Lake, Southampton-buildings, London.—A communication from Thomas James Sloan, New York, U.S.
1851. Improvements in Horse-hoes, parts of which improvements render them applicable to other purposes, John Thomas Milson Hircock, Upwell, Cambridgeshire, and Robert Hempsted, Grantham, Lincolnshire.—19*th May*, 1875.
1853. Improvements in machinery for Hackling Flax, Jute, Hemp, and similar fibrous materials, William Cunningham, Dundee, Forfarshire, N.B.
1855. Improvements in Deodorising Blood to enable it to be used for manuring and other purposes, John Smith, Cattle Market, London.
1857. Improvements in apparatus and arrangements for Controlling, Arresting, Measuring, and Recording the Flow of Liquids and Fluids, and preventing the escape and waste of the same, Alfred Tylor, Newgate-street, London.
1859. Improvements in Bottles, and in the Stoppers for the same, William Netherwood and Benjamin Shaw, Huddersfield, Yorkshire.—20*th May*, 1875.
315. Improvements in the Actions of Pianofortes, George Henry Brockbank, Montgomery-road, Acton Green, Middlesex.—27*th January*, 1875.
1575. Improvements in Sewing Machines, and in attachments and appliances connected therewith, William Harrison, Manchester, and John Mabson, Sheffield.—20*th April*, 1875.
1601. Improvements in Wood Moulding Machines, Johann Franz Winkler and Albert August Zeidler, Berlin, Prussia.—30*th April*, 1875.
1625. An improved method of and apparatus for Filtering and Deodorising Sewage so as to prevent rivers being polluted thereby, Thomas Pape, Great Alfred-street, Nottingham.—3*rd May*, 1875.
1710. Improved Combinations of Glass and Ceramic Substances applicable for architectural and other ornamentation, and for a variety of useful purposes, Paul Raoul de Faucheux D'Humy, Southampton-street, High Holborn, London.—8*th May*, 1875.
1791. A Photographic Apparatus with Portable Camera Obscura, Auguste Malfroy, Horsley-road, Rochester, Kent.—A communication from Jean Baptiste David, Saint Etienne, Loire, France.—14*th May*, 1875.
1833. Improvements in machinery for Stentering or Finishing Woven Fabrics, William Mather Pollock, Lounsdale Bleach Works, Renfrew, N.B.—18*th May*, 1875.
1836. Improvements in the construction of Bedsteads and Children's Cots, John Key, Birmingham.
1838. Improvements in the mechanism for Holding and Adjusting the Flat Wicks of Lamps, William Frederick Lotz, Carter-lane, St. Paul's-churchyard, London.
1840. An improved Smoking Pipe, Thomas Harman Keble, Margate, Kent.
1842. An improved Casing or Covering for Cops of Cotton, Silk, or other Threads, to be used on sewing machines or for hand sewing, Isaac Pickard, Leeds, Yorkshire.
1844. Improvements in the treatment of Animal Blood, also of fibrous materials, and in the manufacture of manures therefrom, George Frederick Snelling, Edith-terrace, Victoria-road, Upton-lane, Essex.
1846. Improvements in Tube Plugs for marine boilers, William Allan, Sunderland, Durham.
1847. Improvements in apparatus for the manufacture of Earthenware Pipes, Henry Doulton, High-street, Lambeth, Surrey.
1848. Improvements in the method of Impelling, Conducting, or Forcing Air by the influence of a jet of air or steam, and in applying the same to various purposes, Alexander Melville Clark, Chancery-lane, London.—A communication from Henri Félix Louis Worms de Romilly, Paris.
1850. An improved machine for Mitreing, Tenon-cutting, Mortising, and Blind Punching, Walter Herbert Avis, Hastings, Sussex.
1852. Keyless-going Barrel Watches, Richard Whittaker, Eton-grove, Dacre Park, Blackheath, Kent.—19*th May*, 1875.
1854. New and improved means of Propelling Steamships, Henri Adrien Bonneville, Piccadilly, London.—A communication from Jean Christophe Unger, Liége, Belgium.
1856. Improvements in Permanent Way, John Henry Johnson, Lincoln's-inn-fields, London.—A communication from Moritz Hilf, Wiesbaden, Germany.
1858. Improvements in Trucks for conveying cattle and horses, Arthur Henry Beavan, Leadenhall-street, London.—20*th May*, 1875.
1862. Improvements in and relating to the Obtainment of Phosphorus and Phosphides, Joseph Townsend, Glasgow, Lanarkshire, N.B.
1863. Improvements in apparatus employed in the Printing of Photographs, John Louis Sabunjic, Manchester.
1864. Improvements in the manufacture of Sulphates of Soda and Potash, and in Calcining Carbonates of Soda and Potash, William Jones and John Walsh, Middlesbro'-on-Tees, Yorkshire.
1866. A new machine or apparatus for Controlling and Regulating the Power of a Locomotive Engine, Leonard Kleinen, Euston-road, London.
1867. Improvements in Rotary Engines and other similar rotary apparatus, and in machinery or appliances employed in their manufacture, John Henry Johnson, Lincoln's-inn-fields, London.—A communication from Alfred Limmerhirt, of Mülheim-on-the-Ruhr, Prussia.
1868. Improvements in the Treatment of Wool either in the raw or in a manufactured condition, Jacob Behrens, Bradford, Yorkshire.—A communication from Heinrich Caro, Mannheim, Germany.
1869. Improvements in Stoppers for Bottles, Jars, and other hollow articles, Nathan Thompson, Brooklyn, New York, U.S.
1870. Improvements in Self-acting Valves, Richard Hugh Hughes, Hatton-garden, London.
1871. Improvements in Sewing Machines, James Galloway Weir, Carlisle-street, Soho-square, London.
1872. Improvements in Photometers or Photo-Phlogometers for measuring the intensity of the lighting power of gas in accordance with the size of the flame, Victor Bablon, Paris.
1873. Improvements in the Ornamentation of Skirts and other Articles of Apparel, Edmund Lamprell, Cannon-street, London.
1874. Improved apparatus for Indicating and Registering the Fares received by tramway car and omnibus conductors and other persons, Henry Thomas Davis, St. Donatt's-road, New Cross, Surrey.—21*st May*, 1875.
1875. A new or improved Printing Machine, Denis Lane, Strand, London.
1876. Improvements in Covers for Tea-pots and other articles, Louis Mariotti, Etruria, Staffordshire.
1877. Improvements in the construction of Sea and River Walls and Embankments, Colin Mather, Salford, Lancashire, and Edwin Heywood, Manchester.
1878. Improvements in the construction of Jacquard Machines, John Bailey, Fairfield, near Manchester.
1880. Improvements in machinery for Dressing Stone, William Young, Vulcan Foundry, Ayr, N.B.
1881. Improvements in the means or apparatus employed in Melting, Refining, Converting, and Puddling Iron, William Middleton, Leeds, Yorkshire.
1883. Improvements in the Application and Consumption of Fuel in Furnaces and Fireplaces, and in apparatus therefor, William Simpson, London.—A communication from George Kemble Stevenson, Valparaiso, Chili.
1884. Improvements in the Construction and Propulsion of Ships and Yachts, Edward Henry Cradock Monckton, Fineshade, Northamptonshire.
1885. Improvements in the preparation or manufacture of Gunpowder Charges for Blasting, Hunter Henry Murdoch, Staple-inn, London.—A communication from Herman Müller, Clermont, Belgium.
86. Improvements in Machinery, Plant, Utensils, Arrangements, and Buildings of Breweries and Distilleries, and in the working of such machinery and plant, which improvements are also applicable in whole or in part to other purposes, Andrew Barclay Walker, Gateacre Grange, Liverpool.
1887. Improvements in the materials and construction of Casks and other Vessels, Andrew Barclay Walker, Gateacre Grange, Liverpool.
1888. Improved processes for the manufacture of Ammoniacal Salts, and more particularly the Sulphate of Ammonia, Alexander Melville Clark, Chancery-lane, London.—A communication from Th. Moerman-Laubûhr, Antwerp, Belgium.
1889. Improvements in Piston Packings, Alexander Melville Clark, Chancery-lane, London.—A communication from Paul Giffard, Paris.—22*nd May*, 1875.
1890. Improvements in machinery and tools for Cutting or Dressing Stone, Marble, Slate, Coal, and other minerals, Andrew Dunlop, Glasgow, Lanarkshire, N.B., and William Ree, Stonehouse, Lanarkshire, N.B.
1891. Improvements in the means of and apparatus for the Purification of Gas, Corbet Woodall, Phœnix Gasworks, Vauxhall, Surrey, and Thomas Wills, Brixton, Surrey.
1892. Improvements in Furnace Bars, Michael Holroyd Smith, Halifax, Yorkshire.
1893. Improvements in machinery for Cutting Wood, Thomas Newcomb and Thomas Henry Newcomb, Coburg-road, Old Kent-road, Surrey.
1894. Improvements in apparatus for Skimming Beer or other fermented liquors, Ebenezer Savill, Stratford, Essex.
1895. Improvements in the Purification of Gas, and in the preparation of materials to be used in the said purification, Frank Clarke Hills, Deptford, Kent.
1896. Improvements in Attachments for Sewing Machines, William Robert Lake, Southampton-buildings, London.—A communication from John James Thompson, New York, U.S.
1897. Improvements in apparatus for Cooling Air and for applying the same for cooling and refrigerating, Jacob Geoghegan Willans, Saint Stephen's-crescent, Paddington, London.—A communication from Thomas Joseph Willans, Shillong, Assam, India.
1898. Improvements in the manufacture of Cast Metal Blanks for Shovels, Spades, Scoops, and such like implements, and apparatus therefor, Charles Denton Abel, Southampton-buildings, Chancery-lane, London.—A communication from Edward Binns and Elmore Barnes, Pittsburg, Pennsylvania, U.S.
1899. Improvements in Feeding Bottles, William Robert Lake, Southampton-buildings, London.—A communication from Henry Monchovant, Paris.
1900. Improvements in the manufacture of Artificial Fuel, Falle Geary, Great Winchester-street-buildings, London.—24*th May*, 1875.
1902. Improvements in Breech-loading Small-arms, William Middleditch Scott, Birmingham.
1903. Improvements in apparatus for Supporting Ratchet Drilling Braces and other Tools, Henry James Hogg King, Nailsworth, Gloucestershire.
1904. Improvements in Pipes and Pipe Bowls for Smoking, Leopold Maas, Monkwell-street, London.—A communication from F. Kast, Vienna, Austria.
1905. A new or improved method of manufacturing Smooth and Bright Cast Iron, William Edward Gedge, Wellington-street, Strand, London.—A communication from Charles Louis Collignon, Liancourt, Oise, France.
1906. Improvements in the construction of Rotary Engines, Windsor Lewis Morgan, Stockton-on-Tees, Durham.
1908. Improvements in machinery for Elevating, Shooting, Loading, and Unloading Sacks when filled with corn, produce, or other merchandise, also applicable for other hoisting and loading purposes, Gilbert Sinkwell and Edwin Henry Tooley, Dunstable, Bedfordshire.
1909. Improvements in the manufacture of Chlorine, Henry Deacon, Appleton House, Widnes, Lancashire.
1910. Improvements in Range Finders or Apparatus for Measuring Distances, John Henry Johnson, Lincoln's-inn-fields, London.—A communication from General Hiram Berdan, Paris.
1911. Improvements in machinery for Scouring Wheat, Rice, or other Grain, James Higginbottom and Edward Hutchinson, Liverpool.
1912. Improvements in Furnace Bars, Thomas Samuel Dobson, Nottingham.
1914. Improvements in Lathes, chiefly designed for turning shafts or bars, Frederick Foster Burlock, Coventry, Warwickshire.—A communication from Aurin Wood, Worcester, Massachusetts, U.S.—25*th May*, 1875.
1915. An improved Annealing Pot, Charles Williams, Cardiff, Glamorganshire.
1921. Improvements in the manufacture of Cornice Pole and other Rings, Henry Charles Taylor, Birmingham.
1925. Improvements in Hoisting Apparatus, Alfred Vincent Newton, Chancery-lane, London.—A communication from William Draper Andrews, Brookhaven, New York, U.S.
1927. Improvements in Steam Engines, John Henry Johnson, Lincoln's-inn-fields, London.—A communication from Farrelly Alden and Abram Alexander, Pittsburg, Pennsylvania, U.S.
1929. Improvements in apparatus for Cutting Toothed Gearing, Alfred David Turner, Dalston, Middlesex.
1933. Improvements in the construction of Ships, Boats, and other Vessels, and in Preserving the Bottoms thereof from Oxidation and Incrustation, part of which improvements are applicable to the preservation of metal, wood, and other substances, Donald Nicoll, Clement's-inn, Strand, London.—26*th May*, 1875.
1935. Improvements in Sad, Box, and other Hand Irons for Smoothing Fabrics, William Benton, West Bromwich, Staffordshire.
1943. Improvements in Tube Stoppers for Boilers, John Jordan, Liverpool.
1947. An improved apparatus for Facilitating the Taking and Reading of Shorthand and other Reports, Notes, and Memoranda, Joseph Laidler, South Stockton, Yorkshire.
1949. Improvements in the construction of Safety Lamps, Archibald Edward Pinching, Gravesend, Kent.—27*th May*, 1875.

Inventions Protected for Six Months on the Deposit of Complete Specifications.

1937. A new and improved Oven for Baking Bread, Meat, and other Food, applicable for other purposes requiring fire or heat, Henri Adrien Bonneville, Piccadilly, London.—A communication from Charles Lesobre, Rue de l'Estrapade, Paris.—27*th May*, 1875.
1945. Regulating Chronometers, Watches, and Clocks, Leander Eaton, Worcester, Massachusetts, U.S.—27*th May*, 1875.
1956. An improved Sail Hank or Shackle, Flint Ramsay, Woburn-place, Russell-square, London.—A communication from David Granville Low, Chelsea, Suffolk, Massachusetts, U.S.—28*th May*, 1875.
1967. Improvements in Anti-Incrustation Batteries for Boilers, William Morgan-Brown, Southampton-buildings, London.—A communication from George Crompton, Worcester, Massachusetts, U.S.—29*th May*, 1875.
1977. Improvements in the construction of Kilns for Burning Bricks and other goods, William Bull, Portswood, Hampshire.—31*st May*, 1875.
2009. Improvements in Toy Menageries, William Robert Lake, Southampton-buildings, London.—A communication from Charles M. Crandall, Montrose, Pennsylvania, U.S.—1*st June*, 1875.

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

1666. Sewing Machines, Charles Raymond, Guelph, Ontario, Canada.—1*st June*, 1872.
1806. Treating Animal Matters, William Cameron Sillar, Blackheath, Kent, Robert George Sillar, Bolton, Lancashire, and Christopher Rawson, St. Swithin's-lane, London.—15*th June*, 1872.
1877. Kilns, George Burge, jun., Rochester, Kent.—21*st June*, 1872.
1669. Pavement Composition, Joseph Clarence Tucker, New York, U.S.—3*rd June*, 1872.
1754. Steam Gauges, Joseph Ducomet, Rue des Petits Hotels, Paris.—11*th June*, 1872.
1836. Self-closing Valves or Cocks, Thomas Lambert, Short-street, New-cut, Lambeth, Surrey, and Edwin James White, Overton, Maisemore, Gloucestershire.—18*th June*, 1872.
1676. Steam Pressure Regulators, William Robert Lake, Southampton-buildings, London.—3*rd June*, 1872.
1675. Imparting Motion to Liquids, James Robertson, Glasgow, Lanarkshire, N.B.—3*rd June*, 1872.
1679. Gas, Charles Weightman Harrison and Alfred Horatio Harrison, High Holborn, London.—3*rd June*, 1872.
1895. Breech-loading Small-arms, John Field Swinburn, Birmingham.—22*nd June*, 1872.
1690. Paper Pulp, &c., William Riddell, Crosby Hall-chambers, Bishopsgate-street, London.—4*th June*, 1872.
1691. Working Brakes, &c., George Westinghouse, jun., Southampton-buildings, Chancery-lane, London.—4*th June*, 1872.
1705. Printing Machinery, James Hinchcliff, Bromley, Middlesex.—5*th June*, 1872.
1708. Gas, Charles Weightman Harrison and Alfred Horatio Harrison, High Holborn, London.—5*th June*, 1872.
1731. Marking or Scoring at Billiards, &c., Charles Henry Russell, Regent-street, London, and Julius Sax, Great Russell-street, Bloomsbury, London.—7*th June*, 1872.
1795. Iron and Steel, John Imray, Southampton-buildings, Chancery-lane, London.—14*th June*, 1872.
1069. Kilns, Benjamin Wrigley, Arundel-street, Strand, London.—22*nd April*, 1871.
1709. Dyeing, Lorenzo Scala, Clerkenwell-green, London.—6*th June*, 1872.
1720. Heating Furnaces by Gas, Paul Charpentier, Rue Vintimille, Paris.—7*th June*, 1872.

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

1790. Alum, &c., Charles Denton Abel, Southampton-buildings, Chancery-lane, London.—1*st June*, 1868.
1931. Breech-loading Fire-arms, &c., Westley Richards, Birmingham.—12*th June*, 1868.

Notices of Intention to Proceed with Patents.

4230. Protecting Buildings against Fire, &c., William Robert Lake Southampton-buildings, London.—A communication from John A. Coleman.—9*th December*, 1874.
279. Treating Ores and Minerals, Benjamin Tanner, Dublin, Ireland.
282. Flattening or Shaping Wire, Daniel Foxwell, Manchester.
283. Carding Engines, Nathaniel Topp, Alfred Topp, and Eugene Nicholson, Farnworth.
285. Crank Shafts of Looms for Weaving, &c, William Haggas, Burnley.—25*th January*, 1875.
326. Carbonaceous Material suitable for Filtering, &c., Robert Weare and Samuel Isherwood, Manchester.
328. Igniting and Holding Matches, Hon. George Cadogan, Park-place, Westminster.
339. Printing Machinery, John Bewsher, St. Thomas's-gardens, Haverstock-hill, London.—28*th January*, 1875.
345. Footsteps, &c., of the Spindles of Mules and Mule Doublers, Henry Thomas Palmer, Middleton.
349. Concentrating Sulphuric Acid, Samuel Chivers, Dumfries-place, Cardiff, and Alfred Chivers, Pontypridd.—29*th January*, 1875.
356. Fog and other Signals, John Richardson Wigham, Capel-street, Dublin.
357. Rollers for Textile Fabrics, &c., Edmund Edwards, Southampton-buildings, Chancery-lane, London.—A communication from Ernest Edwards.
361. Felted Fabrics, Louis Ferdinand Tavernier and John Pyper Matheson, Perseverance Mills, Dewsbury-road, Leeds.
362. Ventilators, John Hill and John Edwards Hey, Halifax.—30*th January*, 1875
366. Preparing, &c., Cotton and other fibres, John Elce, Manchester.
370. Breadthening and Drying Woven or other Web Fabrics, William Stark, Thornliebank, N.B.
371. Floor, Sash, and Bench Cramp, Caleb Hodson, Wolverhampton.
374. Marking and Cutting of Textile and other like Materials, Alfred Henry Cramp, Southampton-buildings, London.—1*st February*, 1875.
398. Guards for Carving Forks, James Russell and George Dominy, jun., Weymouth.
406. Combined Seal and Watch-key, Matthew Wilcox, Birmingham.—3*rd February*, 1875.
433. Asphaltic Fabric for Roofing, &c., William Edward Gedge, Wellington-street, Strand, London.—A communication from Charles Gaudefroy, jun.
434. Quilted Fabric for Covering Steam Engines, &c., William Edward Gedge, Wellington-street, Strand, London.—A communication from Charles Gaudefroy, jun.—5*th February*, 1875.
450. Blowing Glass, Walter Smith, Salford.
451. Straps, &c., Paul Boucley, Nonancourt, Eure, France.
463. Sewing Machinery, William Clark, Chancery-lane, London.—A communication from Désiré Mathurin Legat.—6*th February*, 1875.
476. Call or Signal Bell Apparatus, Henry Brooks, jun., Cumberland Market, Regent's Park, London.
478. Railway Brakes, William Samuel Laycock, Sheffield.—9*th February*, 1875.
497. Raising, &c., Trucks, Robert Aspland Marillier, Kingston-upon-Hull.—10*th February*, 1875.
503. Coffins, William Kirby, St. Peter's-street, Derby.—11*th February*, 1875.
561. Grinding or Preparing Corn, &c., John Henry Johnson, Lincoln's-inn-fields, London.—A communication from Oscar Oexle.—16*th February*, 1875.
569. Motive Power Engines, John Thomson King, Liverpool.—A communication from George Westinghouse, jun.—17*th February*, 1875.
587. Fire-lighters, William Ruthven, Deptford.
599. Permanent Way, James Livesey, Victoria-chambers, Westminster.—18*th February*, 1875.
638. Grate Bars, Horatio Walter Ibbotson, Sheffield.—A communication from Thomas Holt.—20*th February*, 1875.
664. Metallic Handles for Tea-pots, &c., William Garfield, Birmingham.—23*rd February*, 1875.
675. Indicating Water-level in Vertical Boilers, &c., François Paul Henriot, Saint Dizier, France.—24*th February*, 1875.
742. Capsules, John Henry Johnson, Lincoln's-inn-fields, London.—A communication from Rudolf Taetz.—1*st March*, 1875.
799. Nails and Tacks, Henry Bell, Birmingham.—4*th March*, 1875.
828. Registering, &c., Machine, Edme Augustin Chameroy, Faubourg St. Martin, Paris.—6*th March*, 1875.
975. Umbrellas, William Robert Lake, Southampton-buildings, London.—A communication from Uriah Gross Steinmetz.—16*th March*, 1875.
1033. Scaffold Poles, William Robert Lake, Southampton-buildings, London.—A communication from Louis Auguste Bouilliant.—20*th March*, 1875.
1059. Imitation or False Neckties, John Edward Campbell Koch, South Frirth, Tunbridge.—23*rd March*, 1875.
1136. Purifying Raw or partly Refined Sugar, Robert Frazer Smith, Greenock, N.B.—29*th March*, 1875.
1203. Railway Brakes, William Wrench Blades, Nantwich.—2*nd April*, 1875.
1247. Breech-loading Small-arms, John Williams, Liverpool.—6*th April*, 1875.
1282. Regulating and Working the Slide Valves of Steam and other Engines, John Wakefield, Vulcan Foundry, Brynmawr.
1284. Railway Points, &c., John Brierley, Frederick Wade Brierley, and Walter Wright Brierley, Kilburn, and Francis Samuel Reynolds, Edgware-road, London.
1293. Shoe, &c., Cleaning Machine, Marcus Simon, London-street, London.—9*th April*, 1875.
1332. Propellers, Edward Deakin, Southport.—13*th April*, 1875.
1382. Bleaching Fabrics, &c., Frank Wirth, Frankfort-on-the-Maine, Germany.—A communication from Vincenz van Baerle.—15*th April*, 1875.
1458. Artificial Fuels, Christopher Kingsford, Fulham.—21*st April*, 1875.
1582. Sewing Machines, Henry Oram, Bury.—29*th April*, 1875.
1612. Tightly Coupling or Uniting the Actuating Chains or Rods of the Brakes of Railway Vehicles, &c., Edward Stevens, Maycliffe, St. Luke's-road North, Torquay.—1*st May*, 1875.
1627. New Game of Skill, Sarah Ann Hannen, Northampton.—3*rd May*, 1875.
1694. Purification of Gas, Joseph Whitley, Roundhay.—6*th May*, 1875.
1737. Cultivating Land, Frederick Savage, Saint Nicholas Ironworks, Alexandra Docks, King's Lynn.—10*th May*, 1875.
1752. Purifying Illuminating Coal Gas, Samuel Hallsworth, Armley, near Leeds, and Richard Bales, Woodhouse Carr, near Leeds.
1765. Knife-cleaning Machinery, Joseph Atkinson, Manchester.—11*th May*, 1875.
1770. Safety Signals for Railways, Benjamin Joseph Barnard Mills, Southampton-buildings, London.—A communication from Henry Flad.
1771. Motive Power, Johann Ernst Friedrich Lüdeke, Wilmot-place, Camden Town, London.—12*th May*, 1875.
1787. Lamps, Edward Thomas Hughes, Barnes.—A communication from Charles Marschalk.
1788. Tenoning or Relishing Sash, &c., Rails or Frames, Henry Gardner, Fleet-street, London.—A communication from William Abercrombie.—13*th May*, 1875.
1809. Compensating Metallic Pistons, &c., Matthew Prior, Sheffield.—14*th May*, 1875.
1834. Cloth, John Edward Simpson and Christopher Cross, Manchester.—18*th May*, 1875.
1853. Hackling Flax, &c., William Cunningham, Dundee, N.B.
1858. Trucks, Arthur Henry Beavan, Leadenhall-street, London.—20*th May*, 1875.
1862. Phosphorus and Phosphides, Joseph Townsend, Glasgow, N.B.
1870. Self-acting Valves, Richard Hugh Hughes, Hatton-garden, London.—21*st May*, 1875.
1886. Machinery and Plant of Breweries, &c., Andrew Barclay Walker, Gateacre Grange, Liverpool.
1887. Casks, &c., Andrew Barclay Walker, Gateacre Grange, Liverpool.—22*nd May*, 1875.
1890. Machinery and Tools for Cutting or Dressing Stone, &c., Andrew Dunlop, Glasgow, N.B., and William Ree, Stonehouse, N.B.
1895. Purification of Gas, Frank Clarke Hills, Chemical Works, Deptford.
1900. Artificial Fuel, Falle Geary, Great Winchester-street-buildings, London.—24*th May*, 1875.
1909. Chlorine, Henry Deacon, Appleton House, Widnes.
1910. Range Finders, &c., for Measuring Distances, John Henry Johnson, Lincoln's-inn-fields, London.—A communication from General Hiram Berdan.
1912. Furnace Bars, Thomas Samuel Dobson, Nottingham.—25*th May*, 1875.
1945. Regulating Chronometers, &c., Leander Eaton, Worcester, Massachusetts, U.S.—27*th May*, 1875.

1977. KILNS, William Bull, Portswood.—31*st May*, 1875.
2009. TOY MENAGERIES, William Robert Lake, Southampton-buildings, London.—A communication from Charles M. Crandall.—1*st June*, 1875.

All persons having an interest in opposing any one of such applications should leave particulars in writing of their objections to such applications at the office of the Commissioners of Patents within twenty-one days of its date.

List of Specifications published during the week ending 5th June, 1875.

3484, 8d.; 3494, 2s. 4d; 3497, 1s. 6d.; 3507, 1s; 3529, 8d; 3535, 1s. 8d.; 3539, 1s. 4d.; 3544, 10d.; 3552, 1s. 2d.; 3555, 6d.; 3560, 4d.; 3563, 8d.; 3566, 8d.; 3567, 8d.; 3572, 8d.; 3573, 1s. 4d; 3574, 8d.; 3575, 8d.; 3577, 1s.; 3578, 10d.; 3592, 8d.; 3593, 6d.; 3596, 6d.; 3597, 8d.; 3599, 4d.; 3600, 8d.; 3602, 10d.; 3611, 8d.; 3616, 8d.; 3617, 10d.; 3618, 1s. 6d.; 3619, 8d.; 3621, 8d.; 3622, 10d.; 3625, 1s. 4d.; 3626, 1s.; 3636, 8d.; 3647, 1s.; 3639, 10d.; 3640, 2s. 4d.; 3643, 1s.; 3648, 10d.; 3655, 10d.; 3658, 1s. 10d; 3667, 10d.; 3670, 6d.; 3674, 1s 2d.; 3676, 10d.; 3683, 4d.; 3684, 10d; 3686, 4d.; 3688, 10d.; 3689, 4d.; 3692, 4d.; 3693, 4d.; 3695, 4d.; 3697, 6d.; 3698, 8d.; 3705, 4d.; 3706, 4d.; 3709, 4d.; 3712, 4d.; 3715, 4d.; 3716 4d; 3720, 4d.; 3724, 4d.; 3725, 4d.; 3727, 4d.; 3732, 4d.; 3734, 6d.; 3736, 10d.; 3738, 4d.; 3744, 4d.; 3745, 4d; 3746, 4d.; 3751, 4d; 3757, 4d; 3758, 4d.; 3760, 10d; 3761, 4d.; 3765, 4d.; 3772, 4d.; 3773, 4d; 3776, 4d.; 3777, 4d.; 3780, 4d.; 3783, 4d.; 3786, 4d.; 754, 8d.; 812, 8d.

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

ABSTRACTS OF SPECIFICATIONS.

4060. CHAIRS FOR RAILWAYS, *E. J. Grice, Newport.—A communication from R. S. Kirkpatrick, Brussels.—Dated 26th November*, 1874.

This invention consists principally in adjusting the bearing areas of the chair on either side the rail to the load weight or pressure they respectively bear during use. The base of the chair has a wedge or tapering form in plan the breadth of the chair at that end which in use is situated between the rails, being double that of the end situated on the outer side of the rail. The same distribution of the iron is adopted in the bearing surfaces of the chair. The seat of the chair is slightly curved at and near its edges, so that as the rail undulates under the weight of a passing load, it is not brought against a sharp edge, and there is, consequently, no cutting action of the edge of the seat on the rail, as occurs with ordinary chairs. A notch is made in the top inner edge of the chair into which a nail is driven, which takes into the wood key, and the latter is prevented from working out between the chair and rail.

4078. LASTING BOOTS AND SHOES, *W. R. Lake, Southampton-buildings, London.—A communication from F. D. Ballou, Abington, and G. W. Copeland, Malden, U.S.—Dated 27th November*, 1874.

This invention has for its object the lasting of boots and shoes with rapidity and precision by machinery. The said machine has two jaws formed at the edges in plan to lap upon the last along a line parallel to the outer conformation of the last. The last is hung upon a spindle or bracket secured to one standard or to the frame of the machine with the toe resting on a toe block. A girth of elastic material is attached to the lasting plates; sometimes two girths are used.

4094. EXTRACTING THE JUICE FROM SUGAR CANE, *G. W. Risien, Demerara.—A communication from W. Russell, Demerara.—Dated 30th November*, 1874.

The features of novelty which constitute this invention consist in passing the cane stalks through two mills spaced about thirty feet apart, and connected by a chamber. In this chamber works an endless band or carrier, and the chamber is provided with two tiers of pipes, through which a continuous supply of hot water, or steam, or cane juice passes in a spray and saturates the expressed cane stalks or begass on passage of same from mill to mill. The hot water, or hot water and steam, is supplied from the cane juice heaters used in the manufacture of sugar, and the juice from the second mill may also be used for saturation by passing it through a juice heater, and then to the supply pipes for saturating the begass before mentioned.

4116. ASSORTING NAILS, *J. Imray, Southampton-buildings, Chancery-lane.—A communication from J. Coyne, Pittsburgh, U.S.—Dated 1st December*, 1874

This invention relates to a method of and apparatus for assorting nails or separating waste pieces of metal without heads from properly headed nails discharged from a nail-making machine. Spouts, consisting of two strips of metal set at an angle to each other, with a slit along the bottom, are mounted in an inclined position under a hopper receiving the nails as they are discharged from the machine. The slit of the spout is adjusted by the use of a taper gauge, so as not to let the nail heads pass through, except through a widened part near the lower end. The spout being kept in vibration by the action of the nail machine, the headed nails slip down it and are delivered through the widened part of the slit, while the headless pieces fall through the slit.

53. BOTTLES, AND STOPPING THE SAME, *J. Bowman, Montpelier-road, Peckham.—Dated 6th January*, 1875.

The features of novelty in this invention consist in the formation of the upper part of the necks, or heads of bottles, and in the construction of stoppers for the same, whereby the bottles are more readily opened or closed, and the use of any corkscrew is entirely dispensed with.

957. STEAM BOILERS, *J. Alison, Lancaster-gate, London — Dated 15th March*, 1875.

This provisional specification describes a cylindrical boiler with concentric fire-box within it; and a flue passes up from the top of the fire-box and out through the domed top of the outer shell. This joint is made with packing held in a stuffing-box, so that it may readily be taken apart, the outer shell being in two lengths and connected by flanges bolted together. A steam chest is arranged within the upper part of the boiler, to prevent water being carried over with the steam. A safety valve is employed which is coned on the underside.

1823. MACHINERY AND DIES FOR PRODUCING ELONGATED OR SOCKET EYES &C., UPON PICKAXES, *L. Chapman, Collinsville, U.S.—Dated 15th May*, 1875.

This invention upsetting and forming machine and dies for use in this machine for producing elongated eyes upon pickaxes, adzes, hammers, plasters' and other tools, and articles generally having similar eyes. The machine has a larger cast iron rectangular body with a main shaft at one end, bearing a crank from which a pitman runs to a constantly reciprocating cross-head, in front of which is another cross-head, which can be made to reciprocate when desired by means of a pawl latch, which falls in between the two cross-heads, there being a piston and key to drain the foremost cross-head back. When the foremost cross-head moves towards the front, it closes a movable die upon a stationary die, which clamps the stock between them and a punch attached to the foremost cross-head punches and elongates the eye. The foremost cross-head opens the dies and drains back the punch, so that the stock can be removed. To the front of the machine is attached a water container, and a punch stem, resting in and against the water, projects in towards the piercing punch before mentioned. The water in this container is suddenly or gradually automatically or by hand released, so that this last punch will suddenly or gradually move, the office of this latter punch being to form a hole or partial eye in the back of the stock. There are various sets of dies for use in this machine for operation in different manners with the same general result.

1860. TEASLING APPARATUS, *M. W. Fürth, Strakonitz, Bohemia.—Dated 21st May*, 1875.

This invention relates to a system of rotary metallic teasles by which the dressing, raising, or finishing of cloth of every description and degree of fineness can be effected more rapidly and with a less expenditure of power than with ordinary vegetable teasles, which, owing to their inferior durability and bellied-shape, cannot be employed in this way.

1830. SCOTCH CAPS OR BONNETS, *D. Hands and T. Scampton, Leicester.—Dated 23rd May*, 1875.

In the manufacture of Scotch caps or bonnets the band portion is woved in knitting machinery by comparatively tight courses which are slackened for the skip or bell. In the formation of the crown the action of the single thread carrier thus far used is suspended, and four or other number of thread layers are brought into use to form the crown in sections, each of which is narrowed to or near a point by the use of narrowing tackle arranged to move in either direction. These sections are then united. The cap or bonnet is then subjected to milling and brushing processes, is lined, and trimmed. The improvements are applicable in the manufacture of parts of stockings and other looped or knitted fabrics. Fancy patterns may be produced by the use of tuck or divided presser, or other arrangements.

4014. RAILWAY BRAKES, *J. Clarke, Heaton Norris.—Dated 23rd November*, 1874.

This invention consists of a peculiar combination of brake blocks and chains acting upon friction discs mounted upon some or all of the axles of a train of carriages, the chains being hauled tight so as to apply the brakes by longitudinal coupled shafts, worked by hand or by steam, or other power, or both combined.

4016. FIBROUS SUBSTANCES, *T. S. Kennedy, Leeds.—Dated 23rd November*, 1874.

This invention relates to that class of preparing machines in which endless chains are used for carrying the gill bar or combs, and it consists mainly in a novel construction of the chain, the object being to bring the gill bars closer together or to obtain a finer pitch of gills than heretofore, and to insure the steadiness of their pins while in action.

4016. PREPARING AND SPINNING FIBROUS SUBSTANCES, *H. W. Whitehead, Holbeck.—Dated 23rd November*, 1874.

The First part of these improvements consists of a series of toothed or gill rollers or porcupine rollers fixed in pairs one above the other, or the top roller may be placed in the hollow formed by contiguity of the bottom rollers, having the teeth of such rollers leaning backwards and not straight from the centre. The Second part of the invention relates to the mode or manner in which the endless chain or links may be made, so as to enable the inventor to adapt them to any fineness in pitch by fixing the hackle bar directly above one of the pins in one link and over one of the holes in the other link.

4021. AIR GAS, *C. F. Schüssler, Hamburgh.—Dated 23rd November*, 1874.

The novelty of this invention consists in the production of a heating and illuminating gas by the construction of a chamber containing tubes or channels, in which hydrocarbon liquid is caused to flow and impregnate atmospheric air, which is fed thereto under pressure of an arrangement of bellows worked automatically.

4022. SELF-ACTING NOSING MOTION FOR MULES, *J. Drabble, Ashton-under-Lyne.—Partly a communication from W. Crighton, Fall River, U.S.—Dated 23rd November*, 1874.

The features of novelty in this invention consist in securing the nosing peg upon a double armed lever mounted upon a stud at the upper extremity of the radial arm; and in applying a screw star-wheel and spring catch, so as to depress the nosing peg as the cops become built upon the spindles; and also in a novel clutch-box method of securing the spring upon the building faller shaft so as only to come into play at the required moment.

4023. BRONZING OR POWDERING PRINTED PAPERS OR OTHER MATERIALS, *W. Crosland, Manchester.—Dated 23rd November*, 1874.

The features of novelty in this invention consist in applying the bronze or other powder directly to the top of the revolving cylinder and distributing it on the printed surface of the paper or other material by means of a circular brush revolving in an opposite direction to the cylinder. The cylinder being fitted with one or more grippers for holding the material to be bronzed, and the machine being capable of self-actingly stopping itself at every revolution, and controlled at pleasure by the hand or foot of the attendant. This stopping motion being also applicable to lithographic presses, printing and other machines requiring an intermittent motion.

4025. SECURING BUTTONS TO WEARING APPAREL, *W. R. Lake, Southampton-buildings, London.—A communication from Z. K. Young, Philadelphia.—Dated 23rd November*, 1874.

The object of this invention is to produce a detachable fastening for buttons and similar articles having an eye stem or tuft back that will not require an eyelet hole or other opening to be previously made through the fabric of the material to which the said article is to be attached, and that will be strong and reliable as a fastening, simple and inexpensive of construction, and, moreover, can be attached and detached with great facility, as occasion may require. The said invention consists in an open single metallic ring in combination with a swinging metallic tongue or pin.

4026. WATERPROOFING, *A. Wilkinson, High-street, Marylebone.—Dated 23rd November*, 1874.

This relates to forming a composition of ingredients such as bisulphuret of carbon, benzine, sulphuret of zinc, ammonia mixed with naphtha, india-rubber, gutta-percha, or other like gum, for the purposes stated in the title. In some cases an exterior coating, composed of sugar of lead and linseed oil, mixed with whiting and litharge, is applied, and before being completely dry an extra coating of the first-mentioned composition is applied to render the materials completely waterproof.

4027. GAS STOVES, *W. Harrold, West Bromwich.—Dated 24th November*, 1874.

When the stove is in operation the impure air evolved by the combustion of gas passes away through the flue or waste pipe provided, and the vertical tubes becoming heated, the outer or atmospheric air circulates through them without coming into contact with the gas flame, and the air contained between the two casings with which the stove is provided also becomes heated, and the heated air thus created being of pure quality is allowed to escape and mix with the outer air of the room in which the gas stove is in operation by means of small openings provided at the top of the said outer casing.

4028. GLASS FURNACES, *W. McAdam, Glasgow.—Dated 24th November*, 1748.

The features of novelty which constitute this invention are the water vessel steam boilers or non-conducting material in the bridges of tank furnaces, also the hollow bridges divided by one or more cross partitions.

4029. LEATHER CLOTH, &C., *T. Thompson, Glasgow.—Dated 24th November*, 1874.

The features of novelty which constitute this invention are, First, commingling air with substances used in the manufacture of leather cloth and similar fabrics, by mechanical agitation or stirring, or by blowing and mechanical agitation or stirring used in combination. Secondly, acting upon compounds consisting of hydrocarbons, gelatinous, and oleaginous substances, having colouring materials mixed therewith, by means of air blown into or mechanically agitated therewith, so as to reduce the time occupied in curing or ripening leather cloth, floor cloth, and similar fabrics.

4031. ALARUM AND HEATING APPARATUS, *A. Sharp, Glasgow.—Dated 24th November*, 1874.

One modification of the improved apparatus is adapted for the use of common or other illuminating gas, and comprises a Bunsen burner arranged beneath a small steam boiler, made of tinned plate, brass, copper or other suitable material. The boiler is fitted with a steam whistle which is always open. At the proper time, a clock weight sets free another weight which turns on the gas. For the ignition of the gas a separate minute jet of gas is lighted when setting the apparatus, and keeps lighted until required. Where gas is not available, an ordinary paraffine or other suitable oil lamp may be placed beneath the small steam boiler, and may be adjusted to burn with the least possible flame until the time for the action of the alarum arrives, and on the clock setting off the alarum weight it turns up the wick.

4032. MANIFOLD WRITING, *A. W. Hosking, Manchester.—Dated 24th November*, 1874.

This invention relates to an apparatus to be employed in manifold writing, for the purpose of giving intermittent motion to the carbonised paper, or other similar transfer medium used for giving the impression, in order to change the position of the same as often as may be required, so as to present a fresh portinn thereof to the action of the style or other instrument used in writing.

4033. LEGGING OR GAITER BOOT, *J. Plant, Birmingham.—Dated 24th November*, 1874.

This invention consists in combining the legging and the boot in one in such a manner that the legging shall be attached to the boot and be inseparable from it.

4035. ROTARY MOTORS AND PUMPS, *B. J. B. Mills, Southampton-buildings, London.—A communication from J. H. Teal, Edgefield, U.S.—Dated 24th November*, 1874.

This invention consists in the combination of a cylindrical piston slide valve used as a partition with ports and passages for the admission or emission of steam, air, or fluid. Also, in a cylindrical regulator. Also, in a compensating ring on an eccentric controlled by a screw and spring. Also, in an oval form of eccentric. Also, in vertical projecting hooks on the lower extremity of the before-mentioned cylindrical slide valve for coupling with the eccentric. Also, in a cam on the main shaft to drive the valves direct.

4036. METERS FOR LIQUIDS, *F. W. Brooks, New York.—Dated 24th November*, 1874.

This invention relates, First, to means whereby any discoloration produced by the contact of the water with the counter gearing or with other parts of the meter is prevented from obscuring the index or dial. The invention relates, Secondly, to means whereby it may be seen whether the meter is in a vertical or other position.

4039. LOOMS, *H. H. Murdoch, Staple-inn, London —A communication from H. Lejeune-Vincent, Dison, Belgium.—Dated 24th November*, 1874.

This invention relates particularly to power looms in which the shuttle boxes are caused to rise and fall. Motion is communicated to the driver on the side of a loom where a shuttle is in a box on a level with the batten. A projection on a lever is made to press upon the movable piece of the box, which being pushed back by the shuttle keeps the loom in gear The said lever is attached by an arrangement of very light jointed levers to the cam or catch, which is pushed back by the mechanism giving motion to the driver. On the side of a loom where a shuttle is on a level with the batten the said lever is pushed back, and the movable cam or catch is in position to operate the throw of the shuttle, whilst on the opposite side of the loom, where the shuttle box is empty, the cam or catch is put out of position for operating the throw of the shuttle.

4040. FURNACES, *A. C. Moffat, J. Allerton, jun., and S. H. Handscomb, Halstead.—Dated 24th November*, 1874.

This specification describes apparatus for feeding forward the fuel upon the furnace bars and for keeping the spaces from between the bars free from clinker.

4041. COTTON BALE TIES, *P. D. Roddey, Tuscaloosa, Alabama.—A communication from W. Cooper, Tyler, Texas.—Dated 24th November*, 1874.

In one end of the tie is formed a slot of corresponding shape and size to the bolt which is fixed on or nearer the other end of the tie. The bolt is wedge-shaped, and is constructed with a catch or hook at its small end and with a groove the whole length of each of its sides of sufficient width to admit the thickness of the tie.

4042. SAFETY APPARATUS FOR LIFTS, *H. A. Davis, Appleby-road, Dalston.—Dated 24th November*, 1874.

This invention relates to simple apparatus to be applied to the cage, box, chamber, or platform of a hoist or lift used in an hotel, warehouse, or other buildings, or in mines, or otherwise, for raising or lowering persons or merchandise; and is designed to prevent the falling of the said cage or box, in case the rope or chain supporting the same should be broken or detached.

4043. UTILISING HEAT, *C. Ritchie, Brixton.—Dated 24th November*, 1874.

This invention is based in part on that which is described in letters patent No. 3227, A.D. 1873, and effects the various results above named, and some of the arrangements described may be used in combination with those above referred to in said letters patent, and some otherwise.

4044. GUARDS OR SHIELDS FOR WHEELS, *J. C. Aitken, Leith.—Dated 25th November*, 1874.

The feature of novelty constituting this invention consists in constructing the guards or shields of tramway cars and similar vehicles in the form of a box partly covering the wheels and mounted on a small wheel or antifriction roller, and so attached to the car frame as to maintain their position with respect to the rail irrespective of the amount of vertical oscillation of the car, and thus may be placed so close to the rails as to effectually prevent contact between the wheels of the car and any obstacle, human or otherwise, which may obstruct the track, and also prevent the mutilation thereof consequent on the height of the guards or shields above the rails.

4045. TAPS AND VALVES, *J. Wetley, Salford.—Dated 25th November*, 1874.

This invention relates to the construction of all taps or valves employed for steam, water, or other purposes wherein a valve or clack fits on to or into a seating. It consists principally in providing taps or valves of this description with loose seatings, the principal object being to afford facility for the repair or renewal of such seatings when required without the necessity for a new tap or valve altogether, and thus to effect a considerable economy or saving of expense.

4046. REFINING SALTPETRE, *G. Haycraft, Faversham.—Dated 25th November*, 1874.

This invention relates, First, to the arrangement of the vessels in which the several stages of the refining process are performed, in such a manner that the saltpetre will be caused to pass by gravitation alone from vessel to vessel, whereby hand labour and the use of pumps for lifting the saltpetre from one level to another is dispensed with. Also, to the method of boiling the grough saltpetre by introducing steam among the mass, with or without the use of a steam coil. Also, to the method of recovering saltpetre from the mother liquor which drains from the refined saltpetre. Also, to the method of cooling the saltpetre during crystallisation, as well as to the construction of the boiling and reducing vats, the agitators, and the arrangement of gearing for driving the same.

4049. STRINGS FOR MUSICAL INSTRUMENTS, *J. B. Hamilton, Oxford, G. Wade, Soho-square, and R. W. O. Voysey, Hampstead.—Dated 25th November*, 1874.

A means of compensating for derangement of pitch in musical strings by a spring in connection with them.

4051. SAFETY ENVELOPE, *E. Harris, Ringwood.—Dated 25th November*, 1874.

The feature of novelty of this invention consists in cutting a slot or hole in three of the flaps of an envelope in such a position that when the envelope is folded or made up, the aforesaid slots shall come over one another. The fourth flap is made with a tongue furnished with gum or other adhesive. When it is required to close the envelope, the said tongue is passed through the three slots aforesaid, and made to adhere inside the envelope.

4052. IRONING FABRICS, *H. E. Newton, Chancery-lane.—A communication from T. S. Wiles and A. P. Adams, Albany, New York.—Dated 25th November*, 1874.

This invention consists in the combination of two sets of ironing rollers and elastic clothed rollers, whereby articles with seams and of different thickness in various parts can be first ironed on one side only, and next ironed on only the other side at one automatic operation. Also, in the combination of two sets of ironing rollers and clothed rollers, with a set or sets of drying or finishing and clothed rollers, whereby articles can be ironed or partly ironed first on one side and next on the other side, and next dried or finished on one side, or on both sides in succession, all at one progressive operation. Also, of a conducting or directing guide or guides arranged between and in combination with two or more sets of ironing and clothed rollers, to assist or insure the passage of the articles from one set of the rollers to the other set. Also, of a stationary frame which supports the ironing and clothed rollers that operate on one side of the article to be ironed, in combination with a movable and adjustable frame, which carries the ironing and clothed rollers that act on the other side of the article. Also, in the combination of two or more ironing rollers, with and against one and the same clothed drum or rollers.

4055. TOOLS FOR DRILLING, SHAPING, OR PLANING, *E. Weild and J. G. Cochrane, Longsight.—Dated 26th November*, 1874.

First, it relates to radial drilling machines, and consists in arranging the pillar for the radial arm to slide up and down in the box bed or base, and in arranging "double speed" or "back gear" upon the radial arm, the cone or speed pulleys being placed upon a shaft projecting from the box bed or base part. Secondly, it relates to machines more especially designed for shaping or planing the sides of screw nuts, and consists in arranging and combining several rams in a horizontal position upon the same bed.

4057. UNLOADING BULK CARGO, *W. Poulsom, Liverpool.—Dated 26th November*, 1874.

This consists in the use of a single endless travelling band or chain and buckets supported by a pulley in the warehouse or discharging place, by two pulleys over the hatchway, one of which acts as driving pulley, and carries the ascending portion of the travelling carrier, the other carries the descending portion of the travelling collecter, and is formed like a trundle wheel or lantern pinion. A weighted framework and pulley is provided at the collecting end to keep the endless travelling carrier stretched. Parts of the framework telescopes to allow the endless band or chain to dip into the hold as required.

4058. CARTRIDGE SHELLS, *E. T. Hughes, Chancery-lane, London.—A communication from W. F. Parker, Meriden, U.S.—Dated 26th November*, 1874.

This invention consists, First, in a cartridge shell made from paper, with a metallic head, constructed with a central recess for the primer, and with radial grooves leading into the said recess for the purpose of extracting the primer. Secondly, a cartridge shell composed of paper sides, and a metallic head, the said head constructed with a central recess in which is a permanent anvil, upon which to explode the primer. Thirdly in forming the radial grooves leading to the central or primer recess in the head of a cartridge shell by indenting or "striking up" the metal forming substantially radial corrugations in the head, whereby the resisting power of the head is greatly increased.

4059. CARRYING PIPE OR HOSE, *H. Barton, Chantry-road, Stockwell.—A communication from her late husband, S. Barton.—Dated 26th November*, 1874.

This invention relates to a machine or apparatus for carrying hose or flexible pipe for watering gardens, croquet lawns, and other grounds, and for other like purposes. The said invention is designed to supply a machine which will combine simplicity of construction with convenience and efficiency in carrying and paying out and picking up the hose. The reel is concentric with the travelling wheels, and has one hollow journal; and the hose is passed through a hole in the reel and the said hollow journal.

4061. WINDING YARNS, *J. Stubbs and J. Corrigan, Manchester.—Dated 26th November*, 1874.

This invention relates, First, to improvements upon the patent granted to the present inventors dated 24th June, 1873, No. 2201. Secondly, to stopping the winding when the bobbin is full.

4062. CIRCULAR KNITTING MACHINERY, *W. T. Rowlett, Leicester.—Dated 26th November*, 1874.

This invention relates to a mode of manufacturing on circular knitting machines ribbed and plain knitting, with the view of forming on one and the same machine, by one continuous operation, socks with ribbed tops, or stockings with plain and ribbed work, the same being relatively disposed in any desired manner.

4063. AUTOMATIC CHEMICAL TELEGRAPHS, *A. M. Clarke, Chancery-lane, London.—A communication from W. B. Sawyer, Washington, U.S.—Dated 26th November*, 1874.

The present invention relates to a new and improved system of automatic chemical telegraphs, comprising transmitting and receiving instruments, circuits, and apparatus connected therewith.

4064. UMBRELLAS, SUNSHADES, TENTS, &c., *I. L. Pulvermacher, Hampstead.—Dated 26th November*, 1874.

This consists mainly in forming a cover of two thicknesses of material, air being supplied under pressure to uncemented parts to keep the cover extended.

4066. TWIST LACE MACHINES, *G. J. Newton, Old Radford.—Dated 27th November*, 1874.

The inventor encloses the perforated top bars between two horizontal

slotted bars which carry pins to support the top bars. The whole of the bars are pressed together while the carriages or bobbins pass from one comb to the other. The bars are opened out while the jacquard operates upon them. By such arrangement and action the inventer is enabled to employ a greater number of top bars than heretofore.

4067. NAILS, BUDDS, SPRIGS, AND RIVETS, *P. Purdie, Glasgow.—Dated 27th November*, 1874.

The features of novelty which constitute this invention are:—First, the new or improved nails, budds, sprigs, and rivets. Secondly, the dies or revolving wheels constituting the means or mechanism for producing the same.

4068. ROLLING TEA-LEAF, *W. Lyle, Dibrooghur, Assam. — Dated 27th November*, 1874.

The machine consists of a cylinder or barrel which revolves inside a cylindrical fixed frame. The tea to be rolled is put into bags, which are inserted into the annular space between the revolving barrel and the inside of the frame. The cylindrical frame has for its ends two discs, in which are slots radiating from the centre, and the periphery of such frame consists of a series of bars which fit into the slots of the disc ends; these can be moved simultaneously to or from the centre of the discs. By this means the annular space in which the leaf is being rolled can be regulated at will.

4070. LOOMS, *J. Smith, Bradford.—Dated 27th November*, 1874.

This invention relates to employing a self-acting apparatus for the delivery of the warps, and consists of a spring lined with leather or india-rubber, and made to pass under the bottom part of the warp beam ring and over the top. To the back part of the spring is fitted a kind of parallel motion to give ease to the warps to get the weft in; this motion is fitted to the loom frame. The front end of the spring is fitted with a bolt having an opening, through which is passed a hook formed on a lever having a projection and movable catch on which is fixed a lever and movable weight. Also in employing a spring which passes over the ring of the warp beam encircling it; this spring is loose. A stud with a screw and T-handle is fitted on the back part of the spring and made to pass through a slot hole formed on the front of the spring. The spring is kept fixed by turning the handle, and the pressure is kept by a lever and sliding weight. A motion is fitted in front of the loom to pull back with when the warps become deranged.

4071. BUTTONS, *A. Macmillan, London.—Dated 27th November*, 1874.

This invention relates to improvements in that class of buttons which are secured to garments and other articles by separate fastenings, and for which no sewing or eyelet holes are required. Such improved buttons and fastenings being applicable for garments, gloves, boots and shoes, gaiters, and other articles where buttons are required. The improved buttons may be made of metal, wood, bone, ivory, or other materials of which buttons are usually made.

4072. SCREW PROPELLERS, *W. G. Rothwell, Liverpool.—Dated 27th November*, 1874.

This consists, First, in securing each blade to the boss by forming an annular recess in each boss, fitting such recess with a metal ring, and securing the blade to the ring by bolts. Keys or their equivalents are provided to prevent the blades shifting. Secondly, each blade is formed by two or more bladelets so disposed that a line joining the leading edge of the first or leading bladelet and the rear edge of the second or following bladelet shall be parallel or nearly parallel to the screw shaft. The same thing takes place with the other bladelets.

4073. PROJECTILES AND ORDNANCE, *P. Pieri and W. Smith, Salisbury-street, London.—Dated 27th November*, 1874.

Constructing the shot or projectiles for ordnance, such as light field guns and mountain artillery, by making them up of, say, three parts or portions of white or brittle cast iron or hard brittle steel, separated by means of two discs or washers of compressed sheets of paper or cardboard of larger diameter interposed between the metal portions of the body; and the whole is held together under great pressure by a cheese-headed, screwed, hardened, steel pin, the nut whereof forms the point of the cylindro-conical projectile. The gun for discharging these and such like projectiles consists of two portions longitudinally, the muzzle and barrel portion and the breech portion; these are securely screwed together. The rifling is continued backward to a chamber consisting of two portions longitudinally, and of two larger diameters for receiving the projectile and the cartridge case. The breech portion has a long opening on its upper face for the reception of the projectile and the cartridge, and to enable the cartridge case to be withdrawn upon firing and discharging the projectile; and another slot of lesser length is left on the under side of the breech, and so leaving a clear way through when the breech block is withdrawn and the gun is off the carriage. This latter opening forms a recess into which takes and enters a corresponding stud or projection from the tail end of a longitudinal bearing-bar or upper carriage, whilst the front or fore end of this carriage has a crutch, fork, or saddle piece on the upper side to support the gun, a collar upon which comes in front and against it to take the recoil, whilst on the under side of the fore end is a circular boss or projection, the periphery of which rests on the axle of the (lower) gun carriage, and by a pin or bolt passing through it and through cheek plates fixed to the gun carriage, the gun is secured firmly without trunnions and is free to be elevated or depressed. The cartridge, into the fore end of the metal case of which the rear end of the projectile is inserted up to and against the second (or rearmost) of the compressed paper or cardboard rings or washers, is composed of a metal tube or case enveloped with india-rubber or other suitable material, having an enlarged ring or washer-like projection at its base, with a metal washer within it, as also the percussive and igniting charge contained in a thimble, or small metal chamber embedded therein, on being inserted through the breech opening and into the chamber for its reception, is forced up into its proper position by the forward motion of the breech block, which is a cylindrical block or piece of peculiar construction, having its axis bored to receive the percussion or firing pin with its spring, and which are held back by a detent acting at the rear. The breech block is moved forward and backward as required by a helicoidal cam-like piece of peculiar construction by being acted on by a double handle projecting therefrom. When the breech block has been forced forward, and the discharge has taken place, the withdrawal of the breech block operates an extractor, the lower portion of which is fixed, whilst the upper portion moves with the breech block and cants the cartridge case with the fore end up through the opening in the breech, when it can readily be extracted.

4074. KNITTING MACHINERY, *J. W. Lamb and S. Lowe, Nottingham.—Dated 27th November*, 1874.

This invention relates mainly to improvements on the patent granted bearing date 14th November, 1871, No. 3068, for "Improvements in machinery for the manufacture of looped fabrics," the object being to enable the machine which is capable of narrowing, splicing, and striping, to produce a single or an uneven number of courses of a thread of a given colour and automatically to change the carrier for one holding a thread of another colour and operate with that in a similar manner, then, if required, to work even courses, and so on to vary the work and produce stripes of varying widths as may be desired.

4075. ELECTRIC TELEGRAPHS, *Sir J. K. Anderson and W. H. Ash, Old Broad-street.—Dated 27th November*, 1874.

According to this provisional specification in duplex working an electro-magnet or induction coil is put in circuit in the actual line. In single working an electro-magnet is placed immediately after the sending key.

4076. ESCAPEMENTS, *B. J. B. Mills, Southampton-buildings.—A communication from Messrs. Tiffany and Co., New York.—Dated 27th November*, 1874.

According to the present invention, the "guard pin" ordinarily employed is dispensed with, and in lieu in forming the end of the lever into a fork as heretofore, such end is pointed and is substituted for the guard pin and acts in connection with the small or safety roller. Two steel pins are placed on the top part of that lever which was formerly the fork, which pins receive between them the ruby pin, the said ruby pin being fixed horizontally in the thickness of and on the same plane with the large roller.

4077. SPINNING RINGS, *W. R. Lake, Southampton-buildings, London.—A communication from C. A. Shaw, Boston.—Dated 27th November*, 1874.

This invention relates to the repairing of spinning rings which have become unfitted for use by wear or breakage. The inventor employs a race attached to the neck or body of the ring by means of ordinary soft solder, the object being not only to facilitate and cheapen the process of repairing but to preserve the base or body of the ring when once fitted to the rail.

4079. COMPOSITION FOR PRESERVING SHIPS, *G. Younghusband, G. T. Younghusband, W. Rockliffe, and J. W. Rockliffe, Sunderland.—Dated 28th November*, 1874.

An improved composition suitable for preserving the bottoms of ships, boats, and other similar vessels, is described, consisting of gutta-percha, copper bronze, and arsenic, mixed in suitable proportions. Also the method of applying the same.

4080. IRON AND STEEL, *W. A. Lyttle, The Grove, Hammersmith.—Dated 28th November*, 1874.

The features of novelty are, First, the employment of the pure pig iron melted in accordance with the inventors' several letters patent of this year for improvements in the smelting of iron as the raw material for making steel; its special feature for this purpose being that, whereas only some iron ores have hithero been found to answer for providing suitable pig iron for steel making under the present old system of smelting iron, all ores answer for the Bessemer and every existing method of steel making, when pig iron is produced from such ores under this process. Secondly, the use of a modification of the well-known Hoffman's patent kiln for drying, or drying and coking, the consolidated mixture of crushed ore fuel and fluxing ingredients required in making the aforesaid new pig iron or for a like drying, or a drying and coking, of any artificial or moulded fuel for smelting or other purposes.

4081. LAWN MOWERS, *W. Parkinson, Ripon. — Dated 28th November*, 1874.

This invention embraces the driving of the counter shaft from a spur wheel situate between the two drums and gearing into a pinion in the centre of the counter shaft, so as to be in a line with the operator; also grooved wooden runners provided with india-rubber tires; also a knife cylinder made open in the centre and having extra metal in the rim; also a loose swinging handle and projecting supporting stud on the frame to keep the handle off the ground. The gearing is all within the frames in lieu of outside thereof, and the blades extend close up to the insides of the frames.

4082. LATHES FOR SHAPING OVAL FORM, *J. Phillips, Birmingham.—Dated 28th November*, 1874.

The object of this invention is to form an oval of any required size or shape from any kind of material to be used for buttons, brooches, or other articles where the oval form is desired. And the main feature of the invention consists in causing the material which is to be formed oval to be stationary and the cutters movable to and fro, and revolving in an oval or elliptical orbit.

4083. COMMUNICATING BETWEEN A TRAIN IN MOTION AND THE STATION-MASTER, *G. Pocknell, Exeter.—Dated 28th November*, 1874.

This consists in an arrangement of wires and stops close to the edge of the line or sleeper, said stops being acted upon by a spring from beneath. The guard's carriage is furnished with means for pressing down the stops so as to break the current of electricity which passes up into carriage and connected with electro-magnetic telegraphic apparatus.

4084. COOLING AIR, *A. V. Newton, Chancery-lane.—A communication from Capt. T. J. Willans, R.E.—Dated 28th November*, 1874.

This invention relates to the compression of air by and in the presence of water, whereby it will, while undergoing compression, be robbed of a great part of its latent heat, and in consequence will on liberation be applicable for cooling and ventilating.

4085. STRAPS OR BELTS FOR DRIVING MACHINERY, *E. Wigzell, J. Pollit, and W. Mellor, Sowerby Bridge.—Dated 28th November*, 1874.

This invention relates to improvements in the method of making straps, whereby strips of paper are stuck together by cement or varnish, the latter protecting the strap from the effects of damp, and to give greater adhesion for driving purposes, linen or canvas is placed on the driving side. The inventors also make straps of the pulp and face with canvas in the process of manufacture.

4087. BLEACHING, *T. N. Palmer, Lansdowne-road, Dalston.—A communication from L. P. H. P. Balna, Reims.—Dated 28th November*, 1874.

The inventor uses a bath composed of bicarbonate of soda and subcarbonate of magnesia, into which air is introduced by pressure. The inventor puts into an apparatus the above-mentioned matters with the addition of sulphuric acid; the gas which is emitted from this apparatus saturates the bath, and in order to continue the application the inventor saturates the same bath with sulphurous gas accompanied by the introduction of the oxygen of the surrounding air. The inventor also uses chloride of lime in the water saturated with sulphurous gas, always with the addition of the oxygen of the air. The inventor reserves to himself the use of all the means producing sulphurous, carbonic, and oxygen gas applied to the bleaching of the above-mentioned materials.

4088. LUBRICATING, *W. R. Lake, Southampton-buildings, London.—A communication from C. A. Shaw, Boston, U.S.—Dated 28th November*, 1874.

This invention relates to means for lubricating the spindles of spinning frames and the like, and consists primarily in the use of a ring in the oil cup of the step or bolster so arranged and operating as to deliver the proper quantity of oil to lubricate the spindle and prevent the passing of the sediment and impurities in the oil through the oil apertures; it also consists in a novel construction and arrangement of the parts, by which a greater saving of oil is effected and better results produced than with the steps and bolsters in ordinary use.

4089. LAMPS, *F. Rhind, Brooklyn.—Dated 28th November*, 1874.

This invention consists, First, in a combined extinguishing device and flame spreader, which is so hinged to the ends of the wick tube that when opened outward it forms a break or check to the current of air that rises up along the ends of the flame and prevents it from spreading. Secondly, in a ring secured to the upper end of the operating rod, and the spring by which the extinguisher and spreader are operated. Thirdly, in the devices by which the operating rod is prevented from closing the extinguisher; and, Fourthly, in forming through the bowl, a little to one side, a tube, up through which the rod for operating the extinguisher passes. Pivoted to the side of the lamp standard near its base is a hand plate extending upward to the base of the bowl, and having a small metal ring or loop attached thereto, and passing the operating rod in order to connect the plate and rod together. When the rod is moved upward this ring draws the plate inward towards the standard, in which position it causes the ring to assume a vertical position, and thus prevent the movement of the operating rod. Upon the upper end of the rod is formed another ring, which fits over the mouth of the bowl and upon which the lower part of the operating spring rests. By thus forming a continuous ring for the bearing of the spring, the spring will always have a bearing; and it entirely dispenses with the need to adjust a foot under the spring each time the lamp is moved. Pivoted to the upper end of the wick tube are two curved wings, which swing up over the top of the wick so as to extinguish the flame from the ends of the tube instead of from the side, as customary. These wings are made sufficiently wide that when pressed back over the top of the wick they strike against the top of the burner and break the current of air rising along the edge of the flame and prevent its spreading. By these means an extinguisher and flame spreader are formed by the same device. The wings are operated by the spring, which catches into ears formed on the outside of each wing. The tube for the operating rod is open at both ends, and is blown in one piece with the bowl.

4090. INK-PENCIL, *J. L. Petit, Birmingham.—Dated 28th November*, 1874.

This new or improved ink-pencil consists of aniline dies or mixtures thereof thoroughly incorporated with finely powdered plumbago or black or deep coloured chalk, together with gum water or other adhesive material soluble in water. The paste produced may be made into sticks and dried and be used as a crayon or chalk, or be enclosed in cedar as an ordinary black lead, or be made into fine rods to be used as an ever-pointed pencil. The writing produced by the use of the ink-pencil may be copied by pressing moistened paper upon it. The original writing is thereby made more legible as the moisture dissolves more or less of the aniline compound in the composition, and the dissolved matter dyes the vegetable fibre and deepens the colour of the writing. Several copies of the writing may be taken. The ink-pencil may be produced in different colours.

4091. ROADS AND WAYS, *C. L. Light, Great Winchester-street, London.—Dated 28th November*, 1874.

The main feature of this invention is cutting or dividing cubes or blocks of wood by a diagonal cut or severance that one end shall be thicker than the other, the thicker end to form the base and the thinner the wearing surface; the spaces between the blocks, consequent upon this arrangement, being filled in wholly or partially with gravel or other material.

4092. COLLECTING AND TURNING HAY AND STRAW, *J. W. Wagstaff, Pershore.—Dated 28th November*, 1874.

Consists of a centre bar with front guiding wheel and two hind wheels carried by a crosshead. Round the crosshead is a ring of tines held by deepening chains from another crosshead, this ring being worked from the axles of the driving wheels by bevel or friction gearing.

4095. WASHING FIBRES, *J. Clough, Bradford.—Dated 30th November*, 1874.

In conveying wool or other fibrous material (after being washed) from the washing bowl or trough to the squeezing rollers, a carrying fork is employed operated by crank motion with balance wheel on the end of the shaft, and worked in a curved plate, the curve of which is suited to the movement the fork is desired to describe; this curve may be flatter or quicker according to the distance the squeezing rollers may be from that part of the bowl or trough where the wool is lifted by the last washing fork and placed upon the curved plate. The curve of this plate begins at the point where the wool is leaving the sud or wash liquor and continues upwards far as is necessary to give the wool sufficient fall down an incline leading to the nip of the rollers, and so to pass it through the rollers. This curved plate has two sides or guards to prevent the wool from falling off it when being taken forward by the carrying fork to the rollers. Stationary holders are placed at the foot and on the top of the curved plate to retain the wool, when lifted from the bowl or trough and placed upon it, until the carrying fork working in the curve comes and takes such wool forward to the top of the inclined plane and from whence it slides down to the the nip of the rollers. There are holders called ratch tooth holders (by the teeth taking the form of ratch teeth). The head of the carrying fork which works in the curve is fixed upon a square part of the lower end of the stalk, and is movable up and down it; an adjustable steel spring, being placed on the stalk above the head of the fork, gives way by compression according to the thickness of the body of wool which it may for the time be carrying, and by which it readily suits either a larger or a smaller amount of material under operation. The prongs of this fork are formed slightly rounded at the front part, running out conically to the back part.

4099. HARNESS, *G. D. Sampson, Brentwood.—Dated 30th November*, 1874.

This invention relates to an improved contrivance to be styled Lennan's safety tugs, for connecting the traces, backbands, and the straps of harness, instead of by the ordinary buckles hitherto used for that purpose and consists of a sliding loop made of metal, leather, wood, or any other suitable material, and which is passed on to one strap, whilst on the other strap is riveted a projecting pin made of iron or other metal which fits into holes made in the first or loop strap similar to the holes made in the strap in the case of the buckles above referred to.

4101. SEWING MACHINES, *T. B. Bishop, Regent-street, London.—Partly a communication from G. H. Bishop, Newport, U.S.—Dated 30th November*, 1874.

This invention relates to an arrangement of inclined recess made either in the shaft or inside the boss of the driving or fly-wheel of a sewing machine in combination with a metal roller and blade spring, whereby the wheel will run freely in one direction, thereby acting as a brake to prevent the machine being driven the wrong way, whilst if driven in the opposite direction the wheel will become self-locking. No adjustment on the part of the operator is required and no noise produced when at work.

4104. SUSPENDING AND CONTROLLING BERTHS, CABINS, &C., *W. Morgan-Brown, Southampton-buildings, London.—A communication from T. P Ford and T. S. Dick, Brooklyn, U.S.—Dated 30th November*, 1874.

This invention describes a combination of suspension bars or frames with carrier frames and connecting rods, together with a fixed arm and connecting rods, attached to and in connection with the berth so that it shall be kept in equilibrio during the movements of the vessel.

4105. RECTILINEAR WEB LOOMS, *A. C. Henderson, Southampton-buildings, Holborn.—A communication from Madame Auroy, Paris.—Dated 30th November*, 1874.

The object of the invention is to manufacture automatically, and with greater rapidity, better and finer tissues than those made by existing looms, whether for the manufacture of stockings, drawers, or whether generally for the manufacture of webs of all dimensions and forms. The improvements consist:—First, in the mode of collecting or gathering the threads in more or less numbers, and the formation of the mail differing on the division of the gathering and forming plates, by means of a single box bearing all the plates. This box divided internally, guides the side plates of the gathering plates, and holds the articulated bar which receives the forming plates suspended outside. The movements of the plates are sometimes dependent and sometimes independent of one another. In descending, the gathering plates submit to the action of a jack moving on a bar of peculiar mechanism to admit of making the mail more or less slack, the other movements of the plates are due to the combined effects of a movement of the box and lift which draws the forming plates, that is to say, which acts automatically on all the plates. Secondly, in the conduction and pressing by means of the play of the pressers articulated with the forming plates, and all united by a common mechanism combining these effects with those of the internal box, and of the needle bar Thirdly, in the swipes of the racks of the conductor bar, and in the addition of a conductor check with double swipe, whose object is to displace the conductor by a needle at the end of all its courses. Fourthly, in the novel disposition of a punch bar on which the carriage of the punch bearers slides. One of the bearers has nine needles, another thirty-one, and a third five slides, each bearing two needles. The punch bearers and their mechanism combine their effects with those of the motor organs; they are neutralised at determined times by self-acting means, for the retreat and advance of the punches. Fifthly, in the combination of a regulator with endless metallic blades furnished with projections at suitable distances, and admitting by a single mechanism of making all the desired variations necessitated by the dimensions of the different working of the web, whether for stockings or otherwise. Sixthly, in the combined effects of the punch bar with those of the regulator, and of the government of the cams of the bar and of the conductor bar, admitting of the automatic manufacture of the diminished part of a stocking without stopping the loom. Seventhly, in the general disposition of the loom whether worked by hand or steam. Eighthly, in the employment of the improvements, together or separately, for the manufacture of all kinds of web to which these effects relate.

4107. FURNACES FOR STEAM BOILERS, *J. A. Salmon, Manchester.— Date 30th November*, 1874.

The invention consists principally of the combination of a large air aperture in the furnace door provided with baffle-plates both inside and outside the door with a series of revolving fire-bars, and a coke chamber or oven at the end of the bars.

4108. PREVENTING INCRUSTATION IN BOILERS, *J. B. Deluy, Naples.—Dated 30th November*, 1874.

This invention is an improvement on all the discoveries made until now, and consists in a powder made out of one only vegetable produce pulverised, which is introduced in the boiler through the manhole when the supply of water is completed. The disincrusting powder, which is named "disincrustant Marseillais," is neither a compound nor a mixture, and it disincrusts, cleanses, clears out all deposit by spontaneous action. By the ebullition the incrustation is dissolved and goes out through the tap purger.

4122. ROTARY PUDDLING FURNACES, *E. A. Jones and J. A. Jones, Middlesbrough.—Dated 1st December*, 1874.

This invention relates to improvements in rotary puddling furnaces, and consists, First, in admitting water intermittently to the space between the casings of the furnace (when the furnace is composed of two casings) by various modes or contrivances; one mode being by means of valves or cocks, another method is by means of scoops or bent pipes, or in some cases by a coil of pipes or annular space or duct formed round the outside of the revolving furnace, and another plan by means of buckets arranged at intervals around and attached to the outside of the outer casing. Secondly, in effecting the egress of the water from the water space of the rotary furnace by means of pipes, channels, or ducts, one or more of which are coiled round the outside of the outer case, and communicate at one end with the water space. Thirdly, in forming the rings which are secured round the ends of the furnace, and which are divided into two or more segments, with recesses on their outer faces respectively, which recesses fit over corresponding projections on the outer faces of the rings against which the furnace rings revolve, and serve to maintain a tight joint and to prevent the waste of cinder and iron thereat; also, in connecting the water pipes, which are cast in the bodies of the rings, at their external ends outside the furnace with the water space between the casings by means of branch pipes or connecting pieces. Fourthly, in constructing the cast iron or steel end of a single cased rotary furnace in two or more pieces or segments, which are respectively attached to the circular flanged end of the furnace by bolts, and to each other by internal or external flanges and bolts.

4123. ARTIFICIAL PALATES, *J. H. Johnson, Lincoln's-inn-fields, London.—A communication from J. Peyer, Berne.—Dated 1st December*, 1874.

This invention relates to means of, or appliances for, compensating for natural defects in, or accidental injuries to the velum or curtain of the palate, and consists in the employment of a peculiar arrangement of obturator for the roof of the mouth, composed of hardened india-rubber or vulcanite, in combination with a valve or movable portion of similar material, whereby a clear articulation is obtained, and the operation of deglutition is effected with the same facility as if the velum or curtain of the palate existed in its natural condition. This system of artificial palate is applicable in all cases of injuries to the velum or curtain of the palate known under the denomination of *rictus lupinus*, that is to say, whether such velum or curtain exists partially or is entirely absent.

4325. REGULATING THE PRESSURE AND FLOW OF STEAM, *W. L. Wise, Chandos-chambers, Adelphi.—A communication from A. Coignet, Paris. —Dated 15th December*, 1874.

The First part of this invention consists of an apparatus constructed with a vessel partly filled with mercury, which is caused to rise or fall in a tube containing a float by means of the pressure of the steam in the service pipe on the mercury. The float actuates, by means of suitable connections, an equilibrium valve cock in the service pipe, by opening and closing which the pressure of the steam is regulated. The Second part of this invention consists of a digester placed below the condenser of a steam engine with which it is connected by a pipe or pipes. In the digester a hollow port moves, connected to an equilibrium valve below the digester, by the opening of which the water of condensation is allowed to escape.

4375. THRASHING MACHINES, *W. Morgan-Brown, Southampton-buildings, London.—A communication from H. Rose and G. Rose, Paris.— Dated 19th December*, 1874.

This invention describes a cleaning apparatus attached to a thrashing machine by means of a riddle working to and fro, moved by the straw shaker for separating matters larger than the corn, in causing the corn to fall thence upon a riddle, which separates the smaller particles of refuse, and also in falling down a shoot, where an ascending column of air draws up the matters of less specific gravity than the corn, in suspending across the shoot a series of pallets, which allow the corn to pass but excludes air, and in utilising the back motion of the straw shakers to bring back the corn thrown out with the straw by a series of cleats or cross boards fixed on the underside of the shakers.

1046. UMBRELLAS, PARASOLS, *E. Charegeat, Paris.—Dated 22nd March*, 1875.

This provisional specification describes improvements, the chief object of which is to dispense with the spring catches usually employed to retain the umbrellas in their opened and closed positions, and, consequently, to dispense with the notches in which these catches are fitted, and which are a source of weakness. The specification describes a particular construction of the parts of the frame whereby the umbrella is kept open or closed automatically.

1882. LAMPS AND LAMP BURNERS, *J. H. Johnson, Lincoln's-inn-fields.—A communication from H. G. Moehring, Philadelphia, U.S.—Dated 22nd May*, 1875.

The essential features of this invention consist of, First, in an argand lamp burner, the combination with two or more independent wick tubes of a central draught tube, and an external wick assembling shell, which, with the central draught tube, forms an annular chamber to receive the wicks from the independent tubes and assemble them in the form of an

annular wick. Secondly, in an argand lamp burner, the combination of the following instrumentalities, namely, two or more independent wick tubes, a central draught flue or tube, a wick assembling shell, which extends above the wick tubes, surrounds the central draught tube, receives the wicks from said independent tubes, and assembles them around the central draught tube in the shape of an annular wick; one or more lateral air passages located between the wick tubes and leading to the central draught flue or tube. Thirdly, a lamp burner, formed with a filling orifice or passage extending through it from top to bottom. Fourthly, in an argand lamp burner, a central draught flue or tube, which communicates with the oil reservoir of the lamp, and constitutes a passage through which the lamp may be filled. Fifthly, in an argand lamp burner, the combination of a central draught flue or tube formed to communicate with the lamp reservoir as described, of a plug or stopper within the tube, closing the said channel of communication, and removable through the upper end of the tube. Sixthly, in combination with the central draught flue or tube of an argand burner, an inner draught regulating tube concentric with the central draught flue, and formed with an opening or openings, for the reception of a portion of the air admitted to the said draught flue. Seventhly, in combination with the central draught flue the inner concentric draught regulating tube, and one or more transverse vertical plates or partitions. Eighthly, the removable plug or stopper for the central draught flue, formed with a stem, by which it may be lifted out from the flue, and a cup or receptacle for catching the refuse that may drop from the wick into the draught flue. Ninthly, a wick tube formed on one of its sides with an offset bulge or corrugation to receive a portion of the wick, which is crimped or bent therein, in combination with a wick raiser working through an opening in the said bulging part or offset of the tube upon the crimped portion of the wick. Tenthly, the combination of two or more wick tubes, each formed with an offset bulge or corrugation, to receive a crimped portion of the wick as described, with wick raising pinions or ratchets, one for each tube, working through openings in the bulging parts of the tubes upon the crimped parts of the wicks, and a single rotary shaft or spindle upon which all the pinions are fixed. Eleventhly, the annular oil receiving recess, formed in the top of the metallic lamp body, around the lamp collar, in combination with an oil conducting tube or tubes leading from said recesses into the lamp body. Twelfthly, the lamp body, or oil reservoir, in combination with an extension or well, projecting below the bottom of and communicating with the oil reservoir, and a central draught tube, which at the bottom is united with said well, and forms with it an annular chamber for the reception of the lower portion of the tubular wick. Thirteenthly, the lamp body and the annular receiving chamber projecting below the bottom of the said body, and formed by the union of the central draught tube, and an outer enveloping jacket as described, in combination with a drip-cup constituting the base of the lamp, and provided with a tubular perforated stem, which is detachably connected with the lower end of the annular wick receiving chamber. Fourteenthly, the lamp body, the detachable drip-cup constituting the base of the lamp, and the tubular connecting stem, through which air is admitted to the central draught flue of the lamp, in combination with an outer perforated shell or receptacle, into which the lamp fits, and from which it is removable. Fifteenthly, the detachable drip-cup, formed to constitute a base for the lamp, when the latter is removed from the outer shell, or jacket, and provided with a discharge spout and shield, and a central perforated stem, having at its base an opening through which the drip may pass into the cup.

1937. OVEN, *H. A. Bonneville, Paris.—A communication from C. Lesobre, Paris.—Dated 27th May*, 1875.

This invention consists in constructing portable or stationary ovens, formed of two concentrical casings, separated from each other by a space filled with non-conducting matter, the said ovens being provided with a turning lower sole in combination with other stationary or turning upper soles.

1945. REGULATING WATCHES AND CLOCKS, *L. Eaton, Worcester.—Dated 27th May*, 1875.

The nature of this invention consists in the construction and arrangement of a device for regulating chronometers, watches, and clocks. The regulator frame is provided with two arms to preserve the rigidity of the frame. The inventor uses a hair-spring lock for holding or locking the hair-spring. The said hair-spring lock consists of a plate with a jaw, a bolt, and levers attached to the regulator frame. The inventor uses a hair-spring holder, provided with a plate, a fixed and movable jaw and levers. And in combination with the above parts the inventor uses a sight connected with a lever for fastening the index.

1956. SAIL HANK OR SHACKLE, *F. Ramsay, Woburn-place, Russell-square.—A communication from D. G. Low, Chelsea, U.S.—Dated 28th May*, 1875.

An improved sail hank. The object of this invention is to provide a simple, substantial, and effective device for connecting a jib or stay sail with its stay, one which can be readily applied to the stay and sail, or removed therefrom with greater facility and ease than the hanks as ordinarily employed. This improved hank is intended as a substitute for the common iron hank now in use on board of vessels of every description. The body of this hank is made of a metallic bar of a U shape, and is provided with a spring-locking bolt, passing through the lower ends of its arms. The bolt is so applied to body portion as to be incapable of becoming accidently detached therefrom, while it can be readily drawn backward so as to afford a free open passage to the eye of the hank. This bolt is provided with a stud, which not only performs the function of rendering the bolt nondetachable from the main part of the hank, but also that of locking the bolt when desirable. This bolt is also furnished with a spring, which not only serves to maintain the stud in its locking-socket when the hank is locked, but allows the bolt to be thrust forward so as to withdraw the stud from its locking-socket, and allow the bolt to be rotated and drawn backward so as to give a free opening to the eye of the hank, and thereby enable it to be readily applied to a sail and its stay, or removed therefrom, as circumstances may require. The sail hank may also be employed as a shackle for blocks, and various other appliances used on shipboard; also for gun carriages, harness, and other purposes. This improved hank is simple, strong, and reliable, not to get out of order, and very durable, and can be applied to a sail and stay with facility in the roughest weather.

3836. TOOLS FOR CUTTING STONE, &c., *B. Munro, Forfar.—Dated 6th November*, 1874.

In carrying out the invention the cutter is made in the form of one-half of a hollow truncated cone, and is held in a conical socket formed for it in the holder. The cutter fits a recessed part of the conical head of a spindle, and is prevented from turning by the shoulders of the recess, whilst the spindle is itself prevented from turning by a projection on it entering a groove in the side of the socket.

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

(*From our own Correspondent.*)

BECAUSE of the cheapening rates at which Scotch pig iron is to be got, and the weakening influence produced thereby upon the Cleveland product, which, practically shut out of Scotland, is now accumulating in its own stores, the common irons were to-day—Thursday—in Birmingham, much pressed upon the market at prices more in favour of consumers than have before for some time been noted. Nevertheless, best hematites were strong; No. 4, being 80s. short weight at the furnaces, becomes from 95s. to 100s. long weight delivered at the mills and forges in the district. There were slight sales of almost all classes, but the orders represented scarcely more than insignificant lots. The quantities which now regulate transactions were spoken of by agents in terms of much disappointment.

Good boiler plates could not be bought under £12 10s., and at that figure the mills of the firms most known for the excellence of the quality they produce are proportionately better employed than are the mills at which an inferior plate is produced. Buyers of sheets tried hard to shake the firmness of the makers of best 24 gauge iron, but they could not get a quotation from such producers under £11 15s. A very attractive specification might perhaps have been entertained at £11 12s. 6d., and it may be £11 10s.; but no order would induce such firms to accept less. Still there is a class of singles to be had at £11 7s. 5d., and upon a great deal of pressure at half-a-crown under that figure. No maker will, however, consent to book large requirements at so low a price. Bars of all kinds were plentiful. While it was difficult to get a trustworthy smithy bar at under £9 10s., there yet were a few men who would accept a small bar order at £8 7s. 6d.; and South Wales merchant bars were freely upon offer at £8 2s. 6d., which is 2s. 6d. reduction upon previous quotations.

The Pelsall Iron and Coal Company have just issued the report they intend to present to the next half-yearly meeting of their shareholders. It recommends, upon the half-year's working a dividend at the rate of 2½ per cent. per annum; but it makes no allowance for depreciation of ironworks plant. There were suggestions for increasing the value of the property in respect of an extension of the valuable mineral possessions of the company, in which the shareholders will no doubt readily concur.

The ironworkers are deliberating cautiously and secretly upon the nature of the reply which they believe it will be best for them to make to the ironmasters on the 16th inst., when they have to pronounce upon the employers' offer as to 8s. 6d. instead of 9s. 6d. being the minimum of the proposed new sliding scale for the regulating of the wages in the mills and forges, as also in relation to the extension of the notice for any change in the scale. The men in this district held a great representative district meeting at West Bromwich, on Monday, when certain propositions were agreed upon which it was determined should be submitted to the votes of the several lodges. The question will therefore be settled by the men upon the democratic principle by which they have hitherto been mostly guided.

Most mill and forge proprietors who are doing a fair business are giving considerable attention to the best method of puddling iron at the minimum of labour and fuel cost.

Satisfactory accounts are given about the working of the Casson-Dormoy puddling furnace at the Round Oak works of the Earl of Dudley. In a single furnace it takes nearly 27 cwt. of coal to produce a ton of iron. The double furnace is more economical even when fed with cold pig iron; but when the furnace is not only a double furnace but possesses a Dandy, or chamber in which the cold pig iron is heated before it is thrown into the puddling chamber, and where the iron is stirred by a mechanically-moved rabble upon a concave bottom, kept cool by underlying water, the economy in fuel is so considerable that a ton of iron can be made, it is claimed, at a consumption of no more, perhaps, than from 13 cwt. to 14 cwt. of coal.

The Siemens-Martin process keeps in full operation at the ironworks at Wellington, where Messrs. Nettleford, of Birmingham, produce the metal of which they make their celebrated wood screws. Twenty-seven furnaces are there worked by gas, which the process supplies, but it cannot be said that much economy in fuel is secured. Taking the works throughout, I understand quite as much coal is burned as though gas were not the ultimate heating power. Certainly the heat is much fiercer, and greater purity attends the application of gas, but I also understand that there is considerable expense in repairs because of the intensity of the heat. The workmen deserve commendation for the sturdiness with which they labour. They go on in three relays, and work five heats apiece, but because of the great heat they have to endure, are, if I mistake not, paid as if they worked six heats upon the old plan.

A wide difference still prevails in the quotations for coal. As low a price as 8s. is being asked by some vendors of forge coal, whilst 18s. is still the price quoted west of Dudley for the best thick coal of that district, 13s. for furnace coal, and 4s. 6d. for slack. The reduction for which consumers are looking is still retarded by the Warwickshire strike.

The old cry of South Staffordshire done for is again heard by men who are working pits but seldom profitable, and by ironmakers who have to buy everything they require, and have neither pits nor blast furnaces. Scarcely ever, however, in modern times, were the natural resources of Staffordshire more promising. Success is attending the reopening of old pits and the sinking of new ones upon almost all hands. Last August a new company, with the title of the South Staffordshire Colliery Company, commenced to re-work certain pits at Lyndon, in the West Bromwich district. Here, on Tuesday last, the workmen came upon a seam of heathen coal seven yards thick, which it is believed is, in a maiden state, extending over a considerable area of the estate.

As arbitrators in the dispute as to wages, between the mine owners and the miners of North Staffordshire, Mr. John Brown, of Hednesford, and Mr. John Adamson, of Manchester, have been nominated by the employers, and Mr. Burt, M.P., and Mr. W. Crawford, of Durham, have been similarly selected by the miners.

Of the foreign competition now going on, plenty was made in Birmingham to-day by those traders who were interested in bringing down prices. The producers of charcoal iron had to hear of the trade which is being done by the Round Mountain Co., of Alabama, in particular, who are still sending—from their one furnace, it must not be forgotten—charcoal iron to Liverpool, where they sell it at £7 per ton, which at present exchanges and ballast freights is more money by about half-a-dollar than can be got for the same iron at Cincinnati.

The American transactions in no way affected the quotations in Birmingham to-day of the firms who produce the iron with which the small shipments of the Alabama product compete. Their chief customers, who are the chilled roll founders, the makers of mowing machines, and the producers of high class thin sheets, take all they can turn out; whilst the consumers on their part complain that the supply is much too restricted. As to the mower, it is in the making of the somewhat massive bar, to which the cutters are attached, that the charcoal iron is being used.

Amongst the hardware makers, who, on Birmingham Exchange, quoted the competition of foreigners in the finished article, as a reason why they should get finished iron at lower prices, were the makers this time of padlocks and curry-combs. It is no new thing for the Americans to make curry-combs, and in so doing to beat even the firms of Willenhall, where, till the Americans began to make them, almost every curry-comb used anywhere in the world was produced. Alike as to metal and wood, the Transatlanti curry-comb is superior to the English high-class article; and now that dear labour and materials have increased the cost of the low-class goods, the Americans are running this district hard in that class of comb likewise. But to have padlocks of American make more than uncomfortably elbowing the goods turned out by the noted locksmiths of South Staffordshire should disturb the repose of even George the Fourth, who entertained the highest opinion of the trade skill of the Black Country locksmith—based, it is said in a whisper, upon his cleverness in picking the prison locks with whose aid it was alas, often attempted to keep him from returning to his cups.

Orders for machinery and bridges, girders, and other constructive ironwork for Spain, are being executed at local foundries, and at the edge tool and implement forges the workpeople are well employed upon plantation hoes, and other similar edge tools for India, Australia, and South America. On home account the iron-founders are well supplied with orders for mill gearing and machinery, gas and water mains, and other heavy castings; while for seasonable horticultural implements there is also an active home demand.

There was an interesting meeting on Monday, at Dudley, of the South Staffordshire Institute of Mining Engineers, when Mr. Alexander Smith, C.E., the secretary, read a paper on "Neuss's Litter, and Suggestions for the Immediate Treatment of Accident Cases." The secretary explained that he had recently received a letter from Sir Edmund Lechmere, secretary to the order of St. John of Jerusalem, in England, in reference to the introduction into that institute and to the general mining population of a new and improved litter for the conveyance of injured persons. He had obtained the loan of one of the litters, and he submitted it to the inspection of the members. It need hardly be described here, inasmuch as its construction is well known, because of the publicity given to it during its extensive use throughout the Franco-German war. It immediately presented itself to the engineers as of great merit, and, after a discussion, it was determined that the secretary should bring the matter under the notice of the masters, and that the best thanks of the meeting should be sent to Sir Edmund for the trouble he had been at in bringing his litter under the notice of the institute.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

TOWARDS the end of last week there was rather a tendency towards some improvement in the iron trade of this district; there were more inquiries, with an apparent disposition for business on the part of consumers. This, however, has proved to be only a temporary revival, and the metal market is again excessively flat. Beyond one or two speculative transactions, at prices considerably under the current rates, there has been very little legitimate business doing, and, led by the Scotch market, the price of pig iron here is steadily falling. Consumers are still holding back their orders in the hope of touching the market at its lowest point, but there is little doubt that there is a large quantity of iron which must be placed, and it is simply a question of how long it can be withheld from the market. In Lancashire makes, nominally, there is no material alteration, the prime foundry iron, delivered in the Manchester district, being quoted at 68s., and in some cases at 66s. per ton, and forge numbers at about 65s. per ton, but these figures are altogether above the market, and makers are even being undersold in the immediate locality of their own works. They complain, however, that even these relatively high prices are not remunerative, and I understand that preparations are being made for blowing out some of the furnaces. In Middlesbrough iron the nominal quotations for No. 3 foundry delivered in the Manchester district are about 64s. a ton, but merchants, who in some cases were very anxious to get rid of their stocks, are offering at 2s. per ton under the above price. Some rather large inquiries for manufactured iron have been put forth within the last few days, but the terms of delivery were such that very little actual business has resulted. There has, however, been a very fair demand for ordinary iron bars, and some of the works are now tolerably busy, but many of the forges are only poorly supplied with orders, and generally the finished iron trade is dull. The nominal quotations for ordinary bars delivered are about £8 10s. per ton, but Middlesbrough makes have given way a trifle during the week, and concessions are necessary to secure good orders.

The coal trade continues quiet, and prices are weak, but there has been no material increase in stocks during the past week. In the Manchester district they are some thousands of tons below what they were at this time last year, and in the large coal-producing districts of West Lancashire there has been almost a general stoppage of the pits for the Newton races. Both men and masters seem to be fully alive to the necessity of restricting the output as much as possible if the present rate of wages and prices is to be maintained, and there is a prospect that during the next few weeks there will be a continual interference with work by holidays. So far as the larger firms are concerned there is no material alteration in prices, but the smaller proprietors continue to push in the market, and common coal has now been reduced to so low a point that it scarcely pays for the raising; and I am informed that in one or two cases colliery proprietors are seriously contemplating turning off their common seams altogether for the present. In gas-making coal there is a tolerably good inquiry, and as prices may now be considered low, good screened Wigan 4ft. being quoted 11s. 6d. per ton at the pit, contracts are being given out rather freely. Cannel, however, which is not plentiful, maintains its price. The shipping trade continues dull; consumers will not buy for more than a month, and only then at reduced prices, and good Lancashire steam fuel delivered alongside in Liverpool can be readily bought at 11s. 6d. per ton.

For coke there is a steady inquiry at late rates.

The wages question causes some perplexity in the West Lancashire district. On all hands, it is admitted that a reduction of wages is necessary, and the smaller colliery proprietors, who have been underselling the market in the anticipation of reduced wages, are very anxious that some step should be taken, as they are, in some cases, raising coal at an absolute loss. The leading coal-owners, however, show no signs of making a move, and I understand they are influenced in this by the action some of the smaller concerns took when the last reduction was made, the large houses being left to fight the battle with the men, whilst the others reaped the advantage of the principal pits being closed. Naturally, the large coalowners do not care to enter into another struggle, which would be almost inevitable, in which they might again be unsupported, and they seem determined to leave the initiative in the present case to be taken by the smaller collieries.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

AS was announced in a portion of last week's issue of THE ENGINEER, there was considerable agitation late on Thursday of that week as to what the probable result of the London and other failures might be. It was well known, as stated in my last week's letter, that a local concern, the Phœnix Bessemer Steel Company, Limited, was a creditor for a large amount in the estate of Gilead Smith and Company. The fact was so soon established that the shares of the Phœnix Company began to be "knocked out" on the Stock Exchange, and so roughly treated that from 29 dis. they fell to 43 dis., the amount actually paid up being £40 per share. In the afternoon of the day named the directors, after several preliminary consultations, met and finally determined to go into liquidation. A circular was got out the same evening for issue to the creditors next day stating this fact, and that owing to the heavy and unforeseen loss sustained by a London failure, the scheme of re-construction, which was nearly complete, could not be carried through. The creditors consequently met at Sheffield on Wednesday, June 9th, with the result detailed below, and the shareholders will meet on Friday at Rotherham. The capital of the company is £100,000, of which £80,000 are paid up. The trade liabilities were not precisely known, but were stated to be somewhere about £100,000. The works have been stopped in a great measure, 400 to 700 men being employed. At the meeting of creditors on Wednesday, however, an authoritative statement both of facts and accounts was given. Mr. Josiah Smith, manager of the Barrow-in-Furness Steel and Hematite Company, was voted to the chair, there being also present Mr. Jackson, Solway Iron Company, Maryport, Mr. Buckton, Leeds, Mr. Robinson, London, and gentlemen from Darlington, Manchester, Liverpool and other towns. The report read by the company's solicitor stated some of the foregoing facts, and in addition that Gilead Smith and Co.'s order was for 5000 tons of rails, 4500 of which had been sent off. The arrangement for these rails was that three-fifths of the payments should be made in cash and-two-fifths in acceptances. Warrants had been issued for the quantity delivered, or held as per arrangement, and these had got into third hands, the present holders claiming that they had a lien upon them superior to that of the vendors. This will of course have to be decided by the court. The statement of accounts submitted gave the following details:—

Liabilities.

Open accounts	£89,061	0	2
G Smith and Co.'s acceptances, under discount	14,155	18	2
Mortgages and debentures	45,205	0	0
Total	£139,421	18	4

Assets.

Book debts	£30,023	0	0
Stock and tools	50,267	0	0
Cash and sundries	570	0	0
Uncalled up capital, estimated	17,000	0	0
	97,860	0	0
Deduct for secure creditors	13,000	0	0
Total	£84,860	0	0

After considerable discussion it was resolved that the affairs of the company would be best wound up by adopting a voluntary liquidation under the supervision of the Court of Chancery.

In addition to the case of the Phœnix Company, there were very ominous rumours in circulation here, on Friday and Saturday last, as to the credit of certain other firms and persons said to have been involved in the recent failures, or by other circumstances. I have some pleasure, however, in stating that, although some con-

cerns in this vicinity were creditors for heavy amounts with one London house a fortnight or so since, they "backed out" in time, having had early warnings from their London agents. Had this backward movement not been accomplished, the result would, I am afraid, have been far more disastrous than in the case of the Phœnix. I can also state, on most excellent authority, that the rumours which have for some time been in circulation here, may, and ought to, cease, seeing that there is no longer any ground for whispering in the one particular instance to which I allude. I also believe that in two or three other directions unfair suspicions are being entertained, there being very little reason indeed for their propagation or existence.

A somewhat sensational story having been circulated by the newspapers as to an alleged very serious fire having taken place at the new collieries of the Barrow Steel Company, at Worsboro', South Yorkshire, Mr. George E. Chapman, the company's colliery manager, writes to make several corrections. He states that the pit in which the fire took place is 324 yards deep, not 325ft., and that during the last twelve days, prior to Thursday, the sinkings had passed through thin beds of Cannel coal which held gas, necessitating the use of safety lamps. On reaching hard spavin the shaft was bricked up and the flues were collected above the seams where the gas lodged in three 6in. pipes, 24ft. up the back side of the brattice boards. After firing a sump shot on Thursday morning, however, a flash of light was seen and a slight concussion felt, the lowest length of brattice being observed to be on fire. Water was at once pumped in, promptly extinguishing the blaze, and on Friday water drawing was commenced. Mr. Chapman believes that the fire was caused by a splinter from the spavin sent up by the shot striking and breaking one of the pipes, the liberated gas being ignited by coming in contact with the burning fuse.

At the Rockingham colliery of Messrs. Newton, Chambers, and Co., great progress has been made since March last, when the shaft got on fire, a depth of 290 yards having now been reached.

Taken as a whole, trade remains in a very quiet condition, but there is a clearly more healthy tone than was apparent last week. The transactions on record are not numerous, and the lots of iron changing hands are not large, so far as pig and merchant irons are concerned, despite the downward tendency of prices. Hematite pig irons are nominally quoted at the following figures:—Maryport hematite, No. 3, 82s. 6d.; No. 4, 82s.; mottled and white, 80s.; Bessemer, No. 1, 85s.; No. 2, 82s. 6d.; and No. 3, 80s. per ton, less 2½ for cash. Millom Bessemer, No. 1, 90s.; No. 2, 87s. 6d.; and No. 3, 85s.; ordinary, No. 3, 85s.; No. 4, 83s.; No. 5, 87s. 6d. to 90s.; mottled, 93s.; and white, 88s. per ton on the usual terms.

There is a good inquiry for ship, boiler, and armour plates, but very little new business in rails. Such orders as have recently been placed locally for steel rails have been at exceedingly bare prices, one concern being especially spoken of in the trade for its cutting propensities.

The cast iron industries are a little busier, there being a fairly good call for plough plates, wire, tool steel, and crucible steel castings.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THERE has been a further decline in the prices of warrants in Glasgow market since last week, and trade was dull almost throughout. On Friday only a small business was done at 59s. 6d. cash, and 59s. 3d. one month fixed. The market was very quiet on Monday, with few transactions, and these were effected at from 3d. to 1s. 3d. below the rates with which the previous week closed. On Tuesday prices further receded from 58s. 6d. at the opening to 58s., with buyers offering 57s. 9d., and business was inactive.

To-day (Thursday) the Glasgow warrant market was quiet throughout. There was only one transaction in the forenoon, while business was dull in the afternoon, and closed buyers 58s. 1½d. month open, sellers 58s. 3d. The reduced price of No. 3 G. M. B. enables founders to take this quality instead of English iron, so that the demand seems about to improve.

Makers' prices also show a fresh reduction this week, as will be seen from the following quotations:—G.m.b., at Glasgow, No. 1, 60s.; No. 3, 58s. 6d.; Gartsherrie, No. 1, 65s. 6d.; No. 3, 61s.; Coltness, No. 1, 67s.; No. 3, 63s.; Summerlee, No. 1, 65s.; No. 3, 62s.; Langloan, No. 1, 64s.; No. 3, 62s.; Carnbroe, No. 1, 61s.; No. 3, 60s.; Monkland, No. 1, 60s.; No. 3, 59s.; Clyde, No. 1, 60s.; No. 3, 59s.; Govan, at Broomielaw, No. 1, 60s.; No. 3, 59s.; Calder, at Port Dundas, No. 1, 65s.; No. 3, 63s.; Glengarnock, at Ardrossan, No. 1, 68s.; No. 3, 61s.; Eglinton, No. 1, 61s.; No. 3, 59s.; Dalmellington, No. 1, 61s.; No. 3, 59s.; Carron, at Grangemouth, No. 1, 70s.; Shotts, at Leith, No. 1, 66s.; No. 3, 63s.; Kinneil, at Boness, No. 1, 62s.; No. 3, 59s.

The shipments of pig-iron from Scotch ports for the week ending the 5th inst. amounted to 8708 tons, showing an increase of 3348 as compared with those of the corresponding week of 1874. The shipments of Middlesbrough pigs at Grangemouth for the week were 1221 tons, being 1160 tons less than in the corresponding week of last year.

Though undoubtedly improving, the malleable trade does not very quickly grow in activity. Some sorts of manufactured iron have been considerably reduced in price within the past few days, bars and nail rods to the extent of 10s. per ton, their respective prices now being £8 10s. and £9.

The demand for coal in the western Scotch markets has materially contracted during the last two weeks, and the markets for both home and foreign supply have been dull. Attempts have been made by holders of large stocks to press their sale at a reduction, which has induced some amount of speculation on foreign account. The foreign shipments last week were less than those of the corresponding week of 1874. Stocks are nearly everywhere on the increase. Household coals are selling in Glasgow at from 8s. 6d. to 10s. 6d. per ton; steam, 8s. 3d. to 11s.; smithy; 14s. 3d. to 14s. 6d.; splint, 8s. 3d. to 9s.; Wishaw Main, 7s. 6d. to 8s. At the pit bank, coal dross is selling as low as 1s. per ton. It is expected that in a short time the output will be greatly lessened by the large number of miners who are leaving the collieries, and engaging in other employments. I have heard it stated, that about 30 per cent. of the miners have left the pits in this way since the present low wages were paid, and I am inclined to believe that the statement is not very much exaggerated. This will, of course, tell upon the trade in a little time, though as yet its effects have not, in the slightest degree, been felt. Boys are now prevented from entering the mines before they are twelve years of age; and, as the children of the miners are sent to partial employment at other kinds of work, wherever practicable, before they have attained that age, the number of pitmen will, no doubt, be also reduced in this way. In the eastern mining counties prices have a downward tendency. There is a slight improvement in the demand for shipping, but it is completely neutralised by the backward state of the home trade. At West Wemyss, in Fife, where a new dock has been erected for vessels, there was an unprecedentedly large shipment of coal during the month of May, and the Hugo Pit there is being connected with the harbour by an underground tramway. The activity at West Wemyss Colliery is, unfortunately, an exception to the state of things prevailing in many other places.

The Flemington Coal Company, Limited, are about to open two large collieries at Cambuslang near Glasgow. The minerals extend over 800 acres, and have been leased from the Duke of Hamilton. Machinery of the most approved kind is being obtained for the pits. At one of them it is estimated that an output of 1000 tons per day will be attained, and the other will not fall much short of the same amount. Workmen's houses are now being erected at these collieries.

The miners at Pollock Colliery, near Glasgow, after being on strike for a fortnight resisting a reduction of 1s. per day in their wages, have been received back to their work at the former rates of 5s. and 5s. 6d. a day. At Balaclava, near Johnstone, where I informed you last week that Merry and Cuninghame had obtained warrants to eject the miners from their dwelling-houses, the strike continues, and the place is well-nigh deserted, only the "on cost" men remaining. In some of the larger coal producing districts in Ayrshire, notice has been given of a further reduction of 1s. per day in the colliers' pay. There is an exception in the case of the Kilmarnock district, where, at a meeting the other day, the coal-masters resolved not to make any change at present either as to wages or prices.

On Monday the miners of Fife and Clackmannan, to the number of about 5000, had a "demonstration" at Perth. Proceeding to that town from the various districts by train, they paraded the streets with flags and bands of music, and assembled at noon on the North Inch common, where they held a great public meeting. Resolutions were passed in favour of a reform of the laws affecting labour. Mr. Macdonald, who had come from London to attend the gathering, delivered a long address, in the course of which he condemned strikes and locks-out as antiquated and barbarous, and predicted that in a short time they would be superseded by courts of conciliation and arbitration as means of settling disputes. He complimented the miners of the two counties on their having so long enjoyed the eight hours' day.

During the week there has been an unusually large number of launches on the Clyde.

THE NORTH OF ENGLAND.

(From our own Correspondent.)

ANOTHER fall has taken place in the price of pig iron during the last week. At Tuesday's market at Middlesbrough, No. 3 was quoted generally at 54s., but I was able to trace one or two cases in which this number had actually changed hands at 53s. cash. This is a drop of fully 3s. per ton within a fortnight, and is indicative of increased weakness in the demand for the principal brand of Cleveland.

The condition of affairs as here indicated is not perhaps to be wondered at. There has been a slight falling off in the quantity of pig iron made during the month of May, but still the total is higher than that of any except the immediately preceding month; of the 156 blast furnaces built, 131 are in operation. There has been a considerable addition made during the past month to the stock of iron in makers' hands, and otherwise the appearance of trade indicates a drooping tendency. To some extent this will no doubt be attributable to the fact that considerably more iron is now being produced in Scotland and Wales, but it is probably still more due to a commercial and industrial crisis that has almost bordered on panic.

A good deal of discussion takes place in commercial circles as to the position and prospects of the pig iron trade. It is maintained by gentlemen, who are not insignificant authorities in the trade, that pig iron cannot be made for less than 50s. to 52s., and if this is true, it follows that the profit now made is miserable in the extreme. It is no secret, indeed, that some firms engaged in this department of the trade have recently made heavy losses, and that only the most favourably situated firms have any chance of making a fair profit.

The commercial situation shows signs of improvement. A feeling of uncertainty is, however, still prevalent, and is almost inevitably the consequence of recent failures and compositions. A good deal of danger is always supposed to attend the 13th and the 18th of the month, when acceptances fall due, at a critical time like the present, and I know that some firms are looking forward to the 13th of July with fear and trembling. But the apprehension may be much worse than the reality, and I have not heard of any new failures, either accomplished or anticipated.

The annual meeting of shareholders of the West Hartlepool Iron Company, Limited, held last week, was a very unsatisfactory one. Owing chiefly to the failure of Messrs. Thos. Richardson and Sons, the vendors of the works, the company have been involved in pecuniary embarrassments of great magnitude, and things have become so bad that a voluntary winding up was proposed. Instead of this, however, a scheme has been proposed by Major Beaumont, M.P., one of the directors, for the resuscitation of the company by means of debentures. The scheme is now before the creditors and shareholders of the company, but some time will necessarily elapse before it can be adopted, if it is adopted at all.

The heaviest cloud has its silver lining, and it is gratifying at a time when everything else connected with the iron trade of the north is looking so gloomy, to find that the Skerne Iron Company, Limited, have made a profit on the operations of the past financial year of about £12,000. The greater part of this amount will, however, be carried forward to meet the deficiency on last year's working, and hence the directors are unable to recommend any dividend.

The Eston Grange Iron Company have now entered upon their new works, near the junction of that name, between Middlesbrough and Redcar. The company make refined iron, &c., and make use of Mr. Thomas' patent puddling furnace.

A Glasgow firm have commenced the erection of a new iron foundry at Port Clarence, on the Durham side of the Tees, near to the extensive ironworks of Messrs. Bell Brothers.

There is a tolerably steady business being done in the coal trade. Some North-country coalowners and merchants have been severely "bit" by the recent heavy failures, and suspensions are in some quarters talked of as probable. Hopes, however are entertained that the strength of most of the firms engaged in the coal trade during recent years will be sufficiently husbanded to enable them to tide over present difficulties without any absolute stoppage.

The shipments of coal from the north-east ports are largely in excess of this time last year. From some ports, indeed, the quantity of coal shipped is more than double what it was at this time in 1874. Prices are unchanged.

The ironstone miners of Cleveland have wisely determined that they will not at present proceed with their proposed application for a further advance of wages.

A lockout of ironstone miners is said to have taken place at the mines of the Rosedale and Ferryhill Iron and Coal Company.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

MUCH satisfaction has been given by the decision to carry on the Plymouth and Aberdare properties, and, so far as coal is concerned, there is no doubt this can be done at a profit. The Plymouth coal-field is an extensive one, but seven to ten years' working would exhaust the celebrated 4ft. seam, unless other appliances were brought to bear. The present coal manager, Mr. Howells, has been steadily increasing the output from the time when the lock-out was brought to an end. He began at a few hundred tons, increased this to a thousand, and I expect will soon bring up his total output to 4000 tons per week. The estimated yield of 350,000 tons per annum in the whole coal-field owned by the companies is under rather than over the mark. I should be inclined to put on another 20,000 tons at least. One of the principal firms buying this coal is that of Stephenson, Clarke, and Co., and I have a strong impression that, during the great season of prosperity which preceded the disastrous strike, the buyers had the best of it by having the advantage of a long contract. I give it for what it is worth, but at one colliery in the district, where the output was 3000 tons per week, the owner produced his coal at 10s. and sold at £1, realising £1500 per week. Those like Mr. Fothergill, who had long contracts to struggle against, could not, of course, do so well. The prospective plan of Mr. Fothergill's intentions, but for this unlucky turn, promised well. A coal-field in the Darran Valley would have been developed when the new railway was employed, and a connection made between that line and Penydarran Works, by which this compact little property would have been profitably worked.

What is now required is that the estate should, if possible, have the benefit of Mr. Fothergill's management. With that the ironworks may be restarted satisfactorily; without it I can well foresee that the concern will degenerate to a colliery establishment. As a coalfield, for extent and resources, that of Plymouth surpasses the one owned by Mr. Crawshay, but it was unfortunate that neither should have taken the new taking henceforth known as Merthyr Vale Colliery, which is almost naturally appurtenant to Cyfarthfa, and could well have been worked by Plymouth.

Now that the strike has been brought to an end a good deal of vigour has been infused into the coal departments. Some improvement and a degree of hopeful prospect can be noticed at Ebbw Vale, Tredegar, Rhymney, and Dowlais; but the much-longed-for turn in the tide of iron affairs yet lingers. Managers cannot see how iron can be worked at a profit. Indeed, at one large establishment the manager said lately, "There is no chance of starting the ironworks profitably. All that I can see is to work them at the least amount of loss practicable, and recoup themselves by carrying on the coal trade vigorously."

The South Wales Institute of Engineers met last week at the Castle, and had an interesting gathering, concluding as usual with a banquet, banquets and pleasant gatherings amongst the men and masters being the order of the day, and it is gratifying to note this as inaugurating the new course of things.

Strikes now may be confidently assumed as passed, for once a basis can be arranged, and masters and men are committed to a sliding scale, all will go on comfortably. But there is much food for thought presented in the wonderfully many inventions cropping up, principally in the large towns, to do away with or lessen the use of coal.

I shall expect new movements shortly in Cwm Clydach, and in the Monmouthshire district.

PRICES CURRENT OF METALS AND OILS.

	1875. £	s.	d.	£	s.	d.
Cuttings—Large—						
Birmingham	9	10	0	18	10	0
Cleveland	7	10	0	8	0	0
Lancashire	7	0	0	9	0	0
Staffordshire	9	10	0	18	10	0
Scotland	7	0	0	9	0	0
Wales	0	0	0	0	0	0
Yorkshire	7	0	0	9	0	0
Castings—Small—						
Birmingham	10	10	0	24	10	0
Cleveland	10	0	0	15	0	0
Lancashire	9	10	0	12	10	0
Staffordshire	10	10	0	24	10	0
Scotland	12	0	0	16	0	0
Wales	0	0	0	0	0	0
Yorkshire	10	0	0	17	0	0
Copper, per ton—						
British—cake	88	0	0	89	0	0
Australian, per ton	86	0	0	91	0	0
Best Selected	89	0	0	91	0	0
Bottoms	96	0	0	99	0	0
Chili Bars	82	0	0	82	10	0
Do. refined ingot	0	0	0	0	0	0
Sheet	93	0	0	96	0	0
Spanish Cake	0	0	0	0	0	0
Coke—						
Cleveland	0	15	6	0	17	0
Derbyshire	0	18	0	0	0	0
Wales	0	13	0	0	16	6
Sheffield	0	17	6	0	0	0
Coals, best, per ton—						
Birmingham	0	15	0	0	19	0
Cleveland	0	7	6	0	9	6
Derbyshire—						
Best ordinary	0	13	0	0	15	0
Converting	0	12	0	0	0	0
Other sorts	0	10	0	0	14	0
Slack	0	3	6	0	5	0
Glasgow	0	8	6	0	10	6
Lancashire—						
Engine	0	10	0	0	10	6
Furnace	0	12	6	0	14	0
House	0	14	6	0	17	6
London—						
Best	1	0	3	1	1	6
Other sorts	0	18	0	1	0	0
South Yorkshire—						
Best ordinary	0	12	0	0	14	6
Converting	0	12	0	0	0	0
Slack	0	3	6	0	5	0
Wales	0	0	0	0	0	0
Steam	13	0	0	0	0	0
House	12	0	0	0	0	0
Iron—						
Angle in Glasgow	9	0	0	0	0	0
Bar, Welsh, in London	8	5	0	8	15	0
Glasgow	8	10	0	0	0	0
Staffordshire	8	10	0	11	12	6
Wales, bars	8	10	0	8	12	6
Do., common	8	15	0	9	0	0
Yorkshire best	10	0	0	12	0	0
Common	8	0	0	9	10	0
Cleveland—						
Angle and bulb	8	5	0	8	10	0
Boiler plates	9	10	0	10	10	0
Cable iron	10	10	0	11	0	0
Nailrods	8	10	0	9	0	0
Rivet iron	10	15	0	11	0	0
Ship plates	8	15	0	9	5	0
Cleveland, common	8	0	0	8	10	0
Best	8	10	0	9	0	0
Best best	9	10	0	10	0	0
Puddled	5	5	0	5	7	6
Hoops, first quality—						
Birmingham	11	0	0	13	0	0
Cleveland	11	10	0	11	15	0
London	10	10	0	11	10	0
Staffordshire	11	0	0	12	10	0
Wales	9	10	0	11	10	0
Yorkshire	11	0	0	12	0	0
Nailrods	9	5	0	10	0	0
Glasgow	9	0	0	0	0	0
Swedish	17	0	0	17	10	0
Yorkshire	11	0	0	12	0	0
Pig in Cleveland—						
No. 1	3	0	0	0	0	0
No. 2	2	18	0	0	0	0
No. 3	2	14	0	0	0	0
No. 4	2	12	0	0	0	0
M	2	10	0	0	0	0
W	2	11	0	0	0	0
Pig in Wales—No. 1	5	0	0	6	10	0
Pig in Scotland—						
No. 1	3	0	0	0	0	0
No. 3	2	18	6	0	0	0

	1875. £	s.	d.	£	s.	d.
Iron (continued)—						
Pig in Yorkshire—						
No. 1	3	5	0	0	0	0
No. 2	3	2	6	0	0	0
No. 3	3	0	0	0	0	0
Pipes in Glasgow	6	0	0	7	5	0
Plates in Glasgow	9	0	0	9	10	0
Yorkshire	10	0	0	2	10	0
Rails—Cleveland	7	5	0	7	12	6
Glasgow	9	0	0	9	10	
S. Yorkshire, Steel	9	5	0	9	7	6
Do. Iron	7	2	6	7	10	0
Wales	6	10	0	7	0	0
Rails—Old—						
Cleveland	4	0	0	4	5	0
Staffordshire	0	0	0	0	0	0
Yorkshire	4	5	0	4	10	0
Railway Chairs—						
Glasgow	5	10	0	6	0	0
Refined metal	4	0	0	4	10	0
Do. in Wales	7	0	0	8	5	0
Sheets, single, in—						
Cleveland	11	0	0	11	10	0
London	12	0	0	13	10	0
Staffordshire	11	5	0	17	0	0
Wales	12	0	0	12	10	0
Yorkshire	12	0	0	14	0	0
Lard	60	0	0	0	0	0
Lead, per ton—						
Pig, Foreign	21	15	0	22	5	0
English, W.B.	23	5	0	23	10	0
Other brands	22	10	0	22	15	0
Red or minium	25	0	0	0	0	0
Sheet, milled	23	10	0	0	0	0
Shot, patent	26	10	0	0	0	0
White, dry	29	0	0	0	0	0
Ground in oil	0	0	0	0	0	0
Oils, per tun—						
Seal, Pale	36	0	0	0	0	0
Brown	30	0	0	32	0	0
Yellow to tinged	33	0	0	35	10	0
Linseed	24	10	0	24	12	6
Olive, Gallipoli	0	0	0	0	0	0
Spanish	42	10	0	43	0	0
Palm	34	10	0	0	0	0
Rangoon Engine (C. Price & Co.'s), p. gall.	0	3	6	0	0	0
Rapeseed, English pale	33	0	0	33	5	0
Brown	31	0	0	31	5	0
Foreign pale	33	10	0	0	0	0
Brown	0	0	0	0	0	0
Sperm, body	0	0	0	0	0	0
Whale, South Sea, pale	35	0	0	0	0	0
Brown	29	0	0	30	0	0
E. I. Fish	25	0	0	0	0	0
Yellow	32	0	0	34	10	0
Phosphor Bronze, per ton						
Bearing Metal	120	0	0	0	0	0
No. VII	145	0	0	0	0	0
Quicksilver, per bottle	25	0	0	0	0	0
Spelter, per ton—						
Silesian	23	10	0	24	10	0
English, V. and S.	0	0	0	0	0	0
Steel—						
Bessemer, rough	8	10	0	9	0	0
Do., manufactured	9	0	0	10	0	0
Do., cast, Sheffield	20	0	0	24	0	0
Do., best, do.	30	0	0	55	0	0
Do., spring	17	0	0	22	0	0
Swedish keg	19	10	0	0	0	0
Tallow	23	0	0	28	0	0
St. Petersburg, YC new	43	10	0	0	0	0
Old	0	0	0	0	0	0
Tin, per ton—						
Banca	88	0	0	89	0	0
English	90	0	0	91	0	0
Bars	91	0	0	93	0	0
Refined, in blocks	92	0	0	93	0	0
Straits, fine—cash	84	0	0	84	10	0
For arrival	84	0	0	84	10	0
Tinplates, per box, 135 sheets—London—						
IC. coke	1	5	0	1	8	0
IX. ditto	0	0	0	0	0	0
IC. charcoal	1	13	0	1	18	0
IX. ditto	0	0	0	0	0	0
Tinplates, per box, 225 sheets—Wales—						
IC. coke	1	7	6	1	10	0
IX. ditto	1	16	0	1	18	0
IC. charcoal	1	15	6	1	16	0
IX. ditto	2	2	0	0	0	0
Yellow Metal, per lb.	0	0	7½	0	0	8
Zinc, sheet, per ton	29	0	0	30	0	0
Sulphate in Glasgow	12	0	0	14	0	0

PRICES CURRENT OF TIMBER.

Per Load.	1875. £	s.	£	s.	1874. £	s.	£	s.
Teak	11	10	13	10	12	0	14	10
Quebec, red pine	3	10	6	10	3	10	6	10
Yellow pine	4	0	6	10	4	0	6	10
Pitch pine	3	10	4	10	4	5	5	0
Quebec, oak	7	0	8	0	8	0	9	0
Birch	5	10	6	0	5	10	8	0
Elm	5	10	6	0	7	10	8	0
Ash	5	10	6	5	7	0	8	0
Dantzic & Memel oak	5	0	8	0	5	0	8	0
Fir	2	15	5	10	3	10	6	10
Undersized	2	5	2	10	2	15	3	5
Riga	3	10	4	5	4	0	4	5
Swedish	2	5	2	15	2	10	3	5
Wainscot, Riga	4	15	6	0	4	15	6	15
Masts, Quebec, red pine	4	0	6	0	4	10	6	0
Yellow pine	4	0	6	10	4	0	6	10
Memel & Dnt.	0	0	0	0	0	0	0	0
Oregon	9	0	12	0	9	0	12	0
Lathwood, Dantzic fm.	5	0	6	0	8	0	9	0
St. Petersburg	8	0	8	15	10	0	11	0
Deals, per C. 12ft. by 3in. 9in.								
Quebec, Pine, 1st	20	0	24	0	22	0	27	0
2nd	13	0	15	0	15	0	17	10
3rd	9	0	10	10	12	10	14	0

Per Load.	1875. £	s.	£	s.	1874. £	s.	£	s.
Canada, Spruce, 1st	10	0	12	0	13	0	13	10
Do. 2nd	8	10	10	0	10	10	11	10
Do. 3rd	8	10	10	0	10	10	11	10
New Brunswick	8	0	9	10	10	0	11	0
Archangel, yellow	12	0	16	0	14	10	17	10
Petersburg do.	13	10	15	0	13	10	15	10
Finland	8	10	13	10	10	10	14	10
Memel and Dantzic	0	0	0	0	0	0	0	0
Gothenburg, yel.	0	0	0	0	0	0	0	0
White	0	0	0	0	0	0	0	0
Gefle, yellow	0	0	0	0	0	0	0	0
Christiania, best	13	0	14	10	13	0	14	10
Other Norway	9	0	11	10	11	10	13	10
Battens, all sorts	5	0	9	10	9	10	10	10
Flrng. bds., sq. of 1in.	s.	d.	s.	d.	s.	d.	s.	d.
1st yellow	14	6	17	6	14	6	15	6
1st white	13	6	14	6	13	6	14	6
2nd quality	12	6	15	0	12	6	14	0
Staves, pr. stndrd. M.	£	s.	£	s.	£	s.	£	s.
Quebec pipe	75	0	80	0	80	0	85	0
Puncheon	22	0	23	0	20	0	22	0
Baltic crown pipe	230	0	250	0	270	0	300	0
Brack	180	0	200	0	250	0	260	0

ENGINEERING SOCIETY, KING'S COLLEGE, LONDON.—At a general meeting of this society, held on June 4th, a paper was read by Mr. E. Samuelson, on rotary furnaces. The author, after giving a brief history of mechanical puddling, proceeded to describe Danks' and Crampton's furnaces, dwelling more particularly upon the latter, describing the furnace and water jacket, and showing how the fuel is mixed with a proper proportion of air before it is injected into the furnace. He then pointed out what he considered to be the many advantages the Crampton system possesses over that of Danks. Specimens of iron and steel rails, &c., kindly lent by Mr. T. R. Crampton, were shown as a proof of the superior quality of the iron produced by this process.