of details being reduced, and the crowding of machinery in the neighbourhood of the boiler front and foot plate, which has many disadvantages, does not exist; the manholes at the corner of the fire-box are easily accessible, there being no spur wheels or splashers in the way of them, often rendering the cleaning out of the fire-box water space most inconvenient if not impossible in geared engines.

(2) It is well known by all those who have had any experience with chain traction engines, that most, if not all the details may with safety be made considerably lighter than those adopted for spur gear engines. The weak cast iron crank shaft brackets, or saddles, which are constantly used for chain engines for instance, would not last long with gearing. These cast iron brackets would of course in this case be supplanted, and very light and simple, but strong wrought iron plate brackets firmly rivetted to the boiler shell for carrying the crank and counter shafts, take their place, the power being transmitted through two well-made pitch chains, taking on to a light chain ring secured to, and near the periphery of each wrought iron driving wheel. By this simple contrivance, heavy driving discs, large pins, and immense travelling wheel bosses and spokes are not needed; the wheels revolve on the main axle, therefore the axle itself, and its carriages, may be made much lighter than those used on other engines; consequently axle horns may be cut down in size and weight, then the two driving chains take the place of the heavy compensating bevel wheels and pinions, and cast iron centre, and the third motion gearing wheels throughout, with their immense arms and bosses.

(3) Nearly all writers on this subject from the earliest period have recommended the use of springs, and for as many years designers have aimed at scheming some good arrangement for their introduction on to gear traction engines. Many of these plans have been patented, but up to the present time all attempts have ended in complete failure; the question is certainly a difficult one, and can only be carried out at all by the use of an intolerable amount of complication, the "antidote proving a greater nuisance than the bane." All these difficulties and intricacies vanish when chains are used, and the much asked for, and very desirable springs, can be easily applied in the most simple and convenient manner possible.

(4) By the use of the springs the engine details are spared many rough jars and jolts over bad roads, thus reducing the wear and tear of the working parts; not only so, but these engines are noted for being far more economical in repairs, quite apart from the advantage gained from the springs, many of these chain engines costing some 25 to 30 per cent. less for repairs than those needed for heavier geared engines; the chains being the chief item, a few steel pins and links, costing a few shillings, beings all that is wanted for months together. The breakages are less frequent, and those which do occur are of a trivial nature and soon put to rights.

(5) The crowning virtue of the pitch chains is their noiselessness compared with the ringing and grinding spur gearing; the chains and the springs combined cause the engine to run along smoothly, with more comfort to the driver, and less annoyance to the public generally.

From the foregoing advantages claimed for chain traction engines, it will be obvious that if they were well designed—steel freely used in their construction, and manufactured by competent firms—they would, on account of their lightness, simplicity, and freedom from breakages, be well adapted for foreign use, and they might often be used in England with advantage, in fen districts, and amid shaky bridges. The geared engines could be still used in many neighbourhoods where great weight is not of importance; but the chain engines are advocated as a lighter type for special circumstances, and particularly to meet the felt need of our colonies.

Of course, the whole success of this departure from the usual practice rests with the chains. If they cannot be made to stand the wear and tear without constantly giving trouble or breaking, then the scheme is futile. It is well known that these chains have in days gone by caused some makers a good deal of trouble, which is not to be wondered at, when we remember what miserably weak and badly-made articles they were. Notwithstanding this, there is the weighty evidence, on the other hand, of these chains having been used for upwards of twenty years in some engines with the utmost success, and if only the chains are made in a common-sense and honest fashion, they will answer all reasonable requirements.

Again, some people will object to the use of two chains, on the ground that the two cannot work equally. This objection may have some foundation in theory, but in practice no disadvantage exists. In fact, it is impossible for anything to work better. In short, if success is aimed at, the two driving chains are essentially necessary. The following paragraph occurs in an article on the construction of traction engines in THE ENGINEER for 4th August, 1871:—"We are by no means certain that spur gear is the best that can be used; on the contrary, our predilections are all toward the use of chain gear;" and I respectfully beg to say I am of the same opinion on this point.

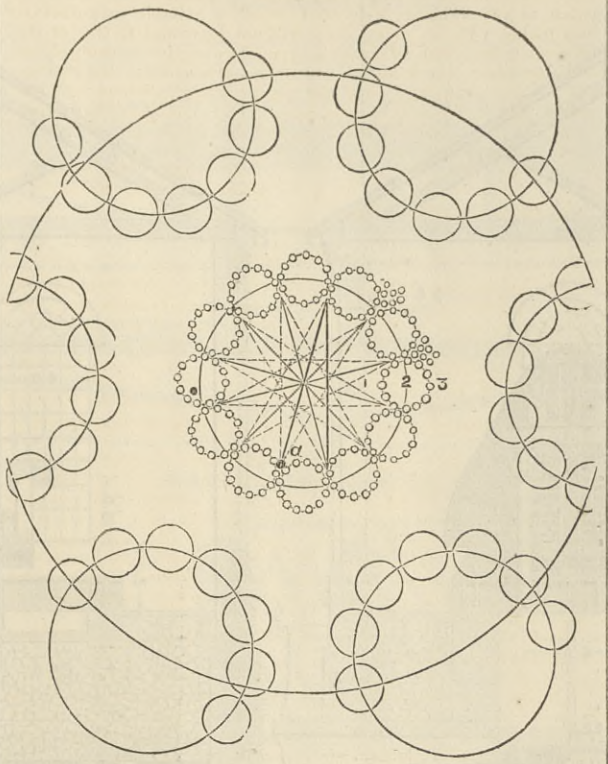
January 8th. DRAUGHTSMAN.

THE CONSERVATION OF ENERGY.

SIR,—Permit me to describe a mode of motion by which matter would be conceivably rendered elastic and energy conserved. In recent correspondence on the mechanical theory of heat and the conservation of energy, and in your suggestive critical observations on Rankine's Miscellaneous Papers, there is clearly apparent an absorbing desire for some intelligible conception or idea how matter is enabled to possess a fitness to receive, to store up, and to re-impart energy. Pure motion is utterly inconceivable, as it excludes all possibility of form or mass, and we are thus constrained to admit the existence of solid bodies, however minute, which bodies are competent by aggregation to convey a sense of form and weight. The idea of absolute solidity in aggregate masses of matter is not at all entertained now, if it ever was, and the specific gravity of ponderable bodies—or the relative density or masses of matter contained in equal magnitudes—has long been duly computed and expressed. But the idea, I take it, is not generally entertained, or not specifically affirmed, that the space which is occupied by ponderable bodies is a relative occupation only, or is due, in reality, to an exceedingly rapid succession of transit passages through these spaces by exceedingly minute atoms traversing them. But this idea simply implies that rapidly recurrent transit passages through the same spaces will produce a sense of occupation proportional to the number of repetitions in the same time. Take a lighted stick and whirl it round briskly, and a visible impression is conveyed of a circle or belt of flame. Thus the space recurrently traversed seems to be wholly occupied. But we know, however, that the ignited stick could not by any conceivable rapidity of motion form any greater solid portion of the girdle than the space occupied by the stick when at rest, and that the apparent occupation is due to recurrent movements. Let us now pursue the illustration further, and imagine a spherical body or atom to be attached by a cord or string to a slightly distant central point, about which this body is made to revolve with immense rapidity. Now if by a little additional effort we suppose the body to describe revolutions that diverge slightly from the circular or tend towards a spiral form of curvature—while at the same time its relation to the centre of revolution is securely retained—then the figure produced by such a mode of motion of the atom would of necessity become a spherical one. Thus it is possible to imagine how a small body or atom may, under the above conditions, be made to convey or yield a sense of form having cubical capacity, or to occupy spherical spaces.

It will be seen by those interested in the correspondence above referred to that a string or cord is required to be used in the illustration. True this is so, but the string attachment is used only for illustration and not to favour any conception of so-called attractive influence—for an external guiding or restraining boundary or environment, constituted of similar but smaller spheres of motion, could be entertained instead, just as the boundary of gaseous matter is determined by so-called solid matter. Thus the accompanying sketch shows an atom A, traversing a globular environment—not a circle—consisting of other atoms similarly occupying the smaller spheres shown in section.

The path of the atom, with larger field of occupation, is shown as bounded or as traversing the spaces immediately betwixt the adjoining spheres of motion, which we may assume to be sufficiently close to impart the necessary direction and to restrain egress tangentially therefrom.



Now, Sir, when we consider that the smaller spheres of motion which form the restraining path for the first or central atom of sphere No. 1 are themselves constituted similarly, or contain similar revolving atoms, the question naturally arises whether the atom which occupies each of the smaller spheres No. 2 will not in turn require its restraining boundary of spheres No. 3. In reply, I may say that there assuredly appears to be a necessity to preclude liberation from the spherical path of the atoms into tangential or other irregular or discursive forms of motion, in order to understand how minute moving points may be locally fixed or organised and assume ponderable forms, and therefore it would be premature to affirm that beyond this third state no further forms of local or organised motion exist, but that vibratory action here commences, and forms an atmospheric or ethereal medium, to which, and from which, the motion of ponderable or organised masses of matter becomes transmitted and returned interchangeably without diminution

I fear the above letter may be deemed an unusual trespass on your excellent journal, but think it may be useful, as I am sure it has been to me, to have some consistent conception or surmise of what would be otherwise felt as obstructive and paradoxical.

Leeds, January 11th. JOHN RAMSBOTTOM.

LOCKED SAFETY VALVES ON TRACTION ENGINES.

SIR,—In reference to your remarks on the Maidstone explosion in your issue of the 7th inst., and especially to your suggestions respecting the employment of locked-up safety valves, which must commend themselves to the minds of engineers generally, will you allow me to call your attention to my looked up—Klotz—Duplex safety valve, which possesses all the requirements you specify, and, being simple and inexpensive, I think it would be found especially suitable for traction, as it has already proved for a large number of locomotive engines. JOHN C. WILSON.

5, Westminster-chambers, Victoria-street, London, January 12th.

THE THOMAS AND GILCHRIST PROCESS.

SIR,—In a paper read by Mr. Jacob Reese, before the Engineers' Society of Western Pennsylvania, and printed in your last issue, there is a statement that the control of the basic dephosphorisation process in the United States is now the subject of litigation in the case of Reese *v.* Thomas. This statement is inaccurate. As I have been intrusted with the prosecution of all the United States patent applications relating to the Thomas and Gilchrist process, I may be credited with a knowledge of their exact standing, and I would say that patents concerning every feature of the Thomas and Gilchrist process as now in daily operation in over a score of converters in Europe have been granted by the United States Patent Office, after their usual full and searching examination. The only point in litigation in Reese *v.* Thomas relates to proposed unimportant modifications of the process which are not in operation anywhere. PHILIP M. JUSTICE.

London, January 10th.

THE BASIC PROCESS.

MONSIEUR, — L'imagination est une belle chose, mais pour l'ingénieur elle n'a de charmes qu'autant qu'elle respecte au moins les faits bien constatés et bien connus. Or Mr. Jacob Reese, dans les prophéties par lesquelles il termine son papier "On the Basic Dephosphorising Process, What it is, and What may be Expected from it"—ENGINEER, 7 Jan., 1881, p. 4—suppose un fer des pores physiques et des pores chimiques. Quand le carbone est renfermé dans les pores physiques, c'est du graphite. Quand au contraire il est logé dans les pores chimiques, c'est du carbone combiné.

Partant de là Mr. Reese semble admettre que ces pores sont comme les chambres d'un hôtel. Le fer dispose d'un nombre determiné de ces chambres; si ce fer est pur toutes ces chambres sont vides et à la disposition des étrangers. Il s'en suit que si c'est du carbone qui se présente a fer pur, ce carbone trouvera toutes les chambres vides. C'est donc dans ces conditions que le fer pourra loger le plus de voyageurs carbone, et présentera au plus trait degré les propriétés que le carbone chimiquement logé peut lui communiquer.

Cette explication est bien simple, et à la portée de toutes les intelligences; malheureusement, elle ne parait pas d'accord avec les faits constatés. Ainsi nous croyons qu'une fonte des plus pures et ne renfermant pas de manganèse ne peut guère loger dans ses pores chimiques, plus de 3½ per cent. de carbone sans faire passer l'excédant dans les logements physiques au moment où elle se solidifie. Si au contraire vous ajoutez à cette même fonte une certaine proportion de manganèse ou de chrôme, ces deux hôtes loin de diminuer le logement chimique disponible du fer, l'augmentent et permettent à celui-ci de loger chimiquement de nouvelles quantités de carbone.

L'assertion de Mr. Jacob Reese que plus un fer est pur plus il pourra contenir de carbone chimiquement combiné n'est donc pas exacte.

D'un autre coté si Mr. Jacob Reese pense qu'en fondant ensemble du fer pur et du graphite il obtiendra comme acier un produit aussi recommandable que celui qu'il obtiendrait en ajoutant en outre au peu de manganèse, nous croyons pouvoir en conclure que Mr. Reese n'en a pas fait l'essai, et n'est peut-être pas bien au courant de l'histoire de la fabrication de l'acier fondu en Angleterre,

Aciéries d'Unieux (Loire), J. H. ET CIE.

10 Janvier, 1881.

TENDERS.

MAKING, METALLING, CURBING, CHANNELING, AND SEWERING PRIVATE ROAD IN THE BOROUGH OF NOTTINGHAM.

Frederick Jackson, C.E., Engineer.

	£	s.	d.
Messrs. J. and W. Russell	267	10	0
Mr. Wm. Cordon	218	11	0
Mr. Thos. Smart—accepted	205	0	0

ERECTION OF A NEW BREWERY AT PORTSLADE, NEAR BRIGHTON.

For Messrs. J. Dudney and Sons. Messrs. Scamell and Colyer, 18, Great George-street, Westminster, architects. Quantities by Messrs. Curtis and Sons.

CONTRACT No. 1.—BUILDING.

	£	s.	d.
Grimwoods and Sons, London	9698	0	0
Morter, London	9200	0	0
Colls and Sons, London	9190	0	0
Patching, Brighton	9069	0	0
Chappell, London	8980	0	0
Brown, London	8820	0	0
Parsons, Brighton	8800	0	0
T. W. Smith and Sons, Islington	8145	0	0

CONTRACT No. 2.—IRONWORK.

Westwood, Bailey, and Co., Poplar	2532	11	3
Handyside and Co., London	2229	19	4
Cochrane and Co., London	2176	10	0
Horseley Iron Company, London—too late	2150	10	0
Morland and Son, London	2150	7	0
Appleby Bros., East Greenwich—too late	2123	19	2
Thornewill and Warham, Burton-on-Trent	1960	0	0

ADDITION TO THE PLANT OF MESSRS. A. GORDON AND CO.'S BREWERY, PECKHAM.

Messrs. Scamell and Colyer, 18, Great George-street, Westminster, Engineers.

Messrs. Blundell Bros.—accepted.

NAVAL ENGINEER APPOINTMENTS.—The following appointments have been made at the Admiralty:—John Murdock and William Irwin, engineers, to the Rifleman, when commissioned on the 18th inst.

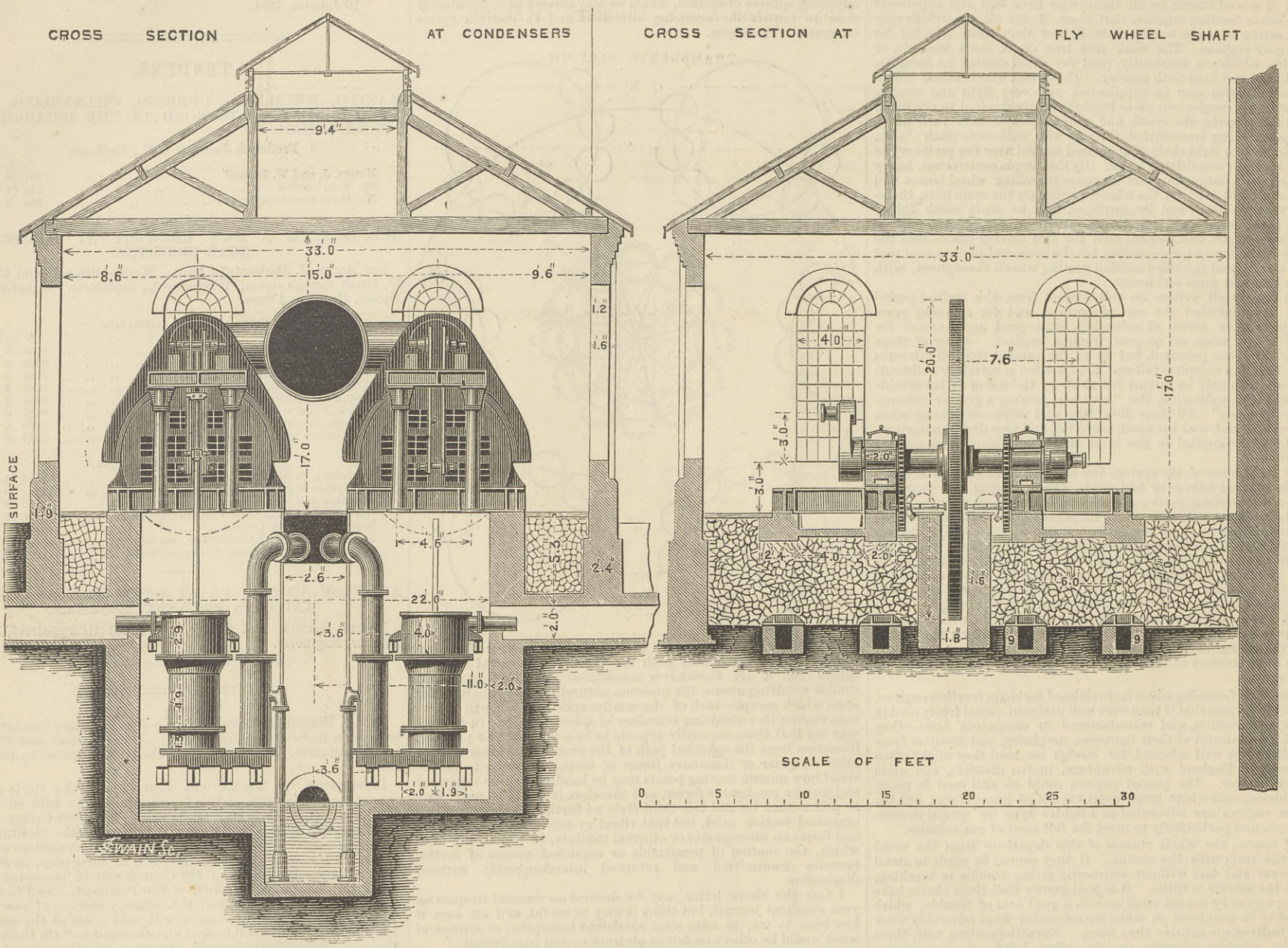
INSTITUTION OF MECHANICAL ENGINEERS.—The thirty-fourth annual general meeting of this Institution will be held on Thursday, 27th Jan., and Friday, 28th Jan., at 25, Great George-street, Westminster, by permission of the Council of the Institution of Civil Engineers. The chair will be taken by the president at half-past seven p.m., on Thursday, 27th, and at three p.m., on Friday, 28th. The annual report of the Council will be presented to the meeting. The annual election of the President, Vice-Presidents, and members of Council, and the ordinary election of new Members, Associates, and Graduates will take place at the meeting. The following papers will be read and discussed:—"On the Various Modes of Transmitting Power to a Distance," by M. Arthur Achard, of Geneva; "On Harvesting Machinery," by Mr. Ernest Samuelson, of Banbury; "On Machines for Producing Cold Air," by Mr. T. B. Lightfoot, of Dartford; "On Machinery for Dressing Silicious Stone," by Mr. J. Dickinson Brunton, of London; "On the Farquhar Filtering Apparatus," by Mr. Henry Chapman, of London; "On Rivetting, with Special Reference to Ship-work," by M. le Baron Clauzel, of Toulon.

THE CLEVELAND INSTITUTION OF ENGINEERS.—On Friday evening, December 3rd, the annual dinner of the Cleveland Institution of Engineers was held in the Queen Hotel, Middlesbrough. The chair was taken by Mr. E. Windsor Richards, the president of the Institute, who was supported by Mr. E. A. Cowper, of London, president of the Mechanical Engineers; Mr. I. Lowthian Bell, F.R.S., Alderman E. Williams, president of the Iron and Steel Institute, Councillor J. Head, Councillor Hanson, Councillor J. Stevenson, Councillor J. F. Wilson, Mr. E. Wethey, Mr. C. A. Head, Mr. E. Gilkes, Mr. M. B. Dodds, Mr. C. L. Bell, and Mr J. W. Willans. The vice-chair was occupied by Mr. J. Gjers, the ex-president, who was supported by Mr. J. T. Belk and Mr. A. C. Downey. Amongst the other gentlemen present were Messrs. C. Wood, L. F. Gjers, J. Thompson, W. Hawdon, A. C. Hill, Geo. Neesham, F. Hilton, M. Robinson, C. Heslop, J. Featherstone, J. G. Swan, J. M. Oubridge, T. Wilson, E. F. Jones, Thos. Wrightson, T. H. Richardson, H. G. Reid, S. E. Thorrold, T. C. Hutchinson, S. While, J. A. Rutherford, Jno. Parry, H. T. Allison, Wm. MacNay, Geo. Wilcox, Wm. Crossley, F. Stoker, R. Hedley, W. H. Burnett, J. A. Birkbeck, J. A. Williamson, T. D. Ridley, Chas. Hall, Jno. Westray, C. J. Dobbs, W. Anderson, and Angus Macpherson, Secretary.

SOCIETY OF ARTS.—The dates for some of the papers which will be read at the Society of Arts before Easter next have been announced. The following are set down for the ordinary meetings—Wednesday evenings—January 19th.—"Causes of Success and Failure in Modern Gold Mining," by A. G. Lock. January 26th.—"Five Years Experience of the Working of the Trade Marks' Registration Act," by Edmund Jackson. February 2nd.—"Trade Prospects," by Stephen Bourne. February 9th.—"The Present Condition of the Art of Wood-carving in England," by J. Hungerford Pollen. February 16th.—"The Participation of Labour in the Profits of Enterprise," by Sedley Taylor, M.A., late Fellow of Trinity College, Cambridge. February 23rd.—"Recent Advances in Electric Lighting," by W. H. Preece, Pres. Soc. Tel. Eng. March 2nd.—"Flashing Signals for Lighthouses," by Sir William Thomson, F.R.S. March 9th.—"Improvement in the Treatment of Esparto for the Manufacture of Paper," by William Arnot, F.C.S. March 16th.—"The Manufacture of Aërated Waters," by T. P. Bruce Warren. In the Indian Section (Friday evenings), the following will be read:—January 21st.—"Forest Conservancy in India," by Sir Richard Temple, Bart., G.C.S.I. February 11th.—"The Gold-fields of India," by Hyde Clarke. March 4th.—"The Results of British Rule in India," by J. M. Maclean. March 25th.—"The Tenure and Cultivation of Land in India," by Sir George Campbell, K.C.S.I., M.P. The dates and papers for the foreign and Colonial section—Tuesday evenings—will be:—February 1st.—"The Industrial Products of South Africa," by the Right Hon. Sir Henry Bartle Edward Frere, Bart., G.C.B., G.C.S.I., D.C.L., LL.D., F.R.G.S., &c. February 22nd.—"The Languages of South Africa," by Robert Cust. March 15th.—"The Loo Choo Islands," by Consul John A. Gubbins. April 5th.—"Trade Relations between Great Britain and her Dependencies," by William Westgarth. For the Applied Chemistry and Physics Section—Thursday evenings—the arrangements are as follows:—January 27th.—"A New Mechanical Furnace, and a Continuous System of Manufacturing Sulphate of Soda," by James Mactear. February 24th.—"Deep Sea Investigation, and the Apparatus used in it," by J. G. Buchanan, F.R.S.E., F.C.S. March 24th.—"The Future Development of Electrical Appliances," by Prof. John Perry.

HORIZONTAL BLOWING ENGINES, STAVELEY IRONWORKS.

MR. CHARLES MARKHAM, M.I.C.E., STAVELEY, ENGINEER.



WITHIN the last few months there has been manufactured, erected, and put to work at the Staveley Ironworks, near Chesterfield, a pair of blowing engines of great power, which are in many respects novel in design. They were designed under the superintendence of Mr. C. Markham, managing director of the Staveley Company, and made on the spot. We illustrate these engines above, and at page 30. It was considered desirable to keep the price of the engines as small as possible, and for this reason there is little or no bright work about them. Whenever it was necessary that surfaces should be machined, they have been planed and fitted, but nowhere else; and we cannot think that the engines have suffered in any way in consequence.

The principal dimensions are shown in our engraving. The engine-house is built against the side of another house, in which is a large beam blowing engine, and the house is accordingly not quite symmetrical in its arrangement. It is 33ft. wide inside in the clear, 87ft. long and 17ft. high to the eaves. The engines are founded on a thick bed of concrete, and a peculiar arrangement has been adopted for securing the holding down bolts. The cast iron anchor plates rest on 9in. walls, and the holes in the plates are oblong slots with corresponding holes in the concrete and cills. The pins are fitted with cotters driven tightly in; these will pass through the orifices in the anchor plates, and then the pin being turned one quarter round, the cotter comes across the slot and the pin is secured. Should a pin break, the upper portion can be withdrawn, and the lower portion can be either turned round and then taken out with long tongs, or if this be found impracticable, the fragment can be pushed to one end of the slot out of the way of the new pin. This we regard as an excellent arrangement deserving to be imitated.

The blowing tubs are 100in. in diameter, by 6ft. stroke, the entrance valves are vertical flaps working on grids in the tub covers; the delivery valves are also flaps working on seats disposed in the legs of two breeches pipes, which straddle across the blowing tubs at each end as shown. These breeches pipes are of thin iron plate, and are fitted with readily removed lids, so that the valves can be examined or repaired with the least possible delay. The breeches pipes deliver, as shown, into one large wrought iron plate main pipe, 6ft. in diameter, which acts as a reservoir; a down pipe, 3ft. in diameter, puts it in connection with the horizontal blast main, 4ft. in diameter, which leads the air to the furnaces.

The two steam cylinders are each 50in. in diameter, and of course 6ft. stroke. Each cylinder has four separate double-beat valves—that is to say, an exhaust and an admission valve at each end. The valves are worked by two horizontal shafts fitted with cams, and driven by spur and bevel gear from the fly-wheel shaft. At the moderate speeds of blowing engines these valves work without the least noise, and give a very good diagram. The fly-wheel shaft has bearings 1ft. 3in. diameter by 2ft. long. The shaft is 1ft. 5in. diameter in the middle. The fly-wheel is 20ft. in diameter. The rim is 9in. thick and 15in. deep. The total weight of the wheel is not far short of 18 tons. The connecting-rods are of wood, strapped with iron, as shown. They are 15ft. long between centres. The condensers are placed at one end of the house, as shown. The bell cranks look rather heavy, but they were not made for the engine. They are two old bell cranks which had been used for pumping, each with one end cut off. Mr. Markham had them in stock, and utilised them.

It is well known that the great objection to horizontal blowing engines is the rubbing of the piston in the blast cylinder, or blowing tub on the bottom. To overcome this difficulty it has been the practice to use very thick rods, and to carry them on a slipper at each end; but even this does not answer, as the rod springs and lets the piston drop. Mr. Schonheyder read a paper some years ago before the Society of Engineers, in which he showed how a piston-rod might be made with a camber, and yet turned. Such a rod, when put into a cylinder, would have the camber up, and the weight of the piston would make it straight. We are not quite sure that this elegant and somewhat delicate expedient could be adopted with the rods of a great blowing engine such as we are describing. We have never heard of it being applied on so large a scale. Mr. Markham seems to have got over the difficulty by using a very stout rod. He proposes, however, to use hollow cast iron rods, which would be immensely stiff; but as objection may be taken that such a rod would be brittle, and might by its giving way cause a bad breakdown, he has fitted the cast iron tubular rod to one blowing tub only, and has carried a wrought iron rod through it from end to end as a measure of precaution. Standing at the blast cylinder end of the house and looking towards the fly-wheel, we have the cylinder with the experimental cast iron rod on our left hand. The plan so far appears to work admirably.

These engines, known at the works as the "Violet Engines," have been doing excellent duty for some months. They run very steadily, and are beyond question more economical in fuel as well as first cost than the beam engines used for the same purpose. The diagrams are very good, and thanks to the coupling of the engines at right angles, and the use of a heavy fly-wheel, it is possible to work with a fair degree of expansion, and thus save fuel. Taken as a whole, the engines reflect great credit on Mr. Markham and the Staveley Works, and the type deserves to be reproduced. We may add, that the first cost of these engines was almost absurdly small, as compared with that of other machinery of equal power, and we believe that the Staveley Company are quite prepared to put up similar machinery for any firm desiring to have it.

TURTON'S BUFFER SPRINGS.

IN our last impression we illustrated one of several new goods engines built to the order of the Lancashire and Yorkshire Railway Company. These locomotives are fitted with Turton's

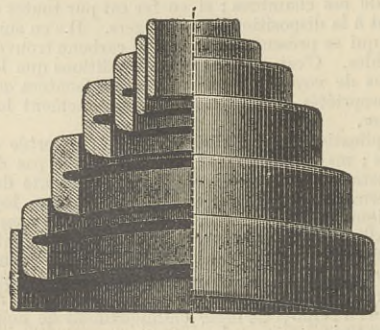


FIG. 3.

buffers, and as the springs of these buffers present certain peculiarities, we illustrate them in the accompanying engravings.

Mr. Turton—of Westminster-chambers, Victoria-street, Westminster—has carried out numbers of experiments on buffer springs, and has found that they do not stand the test to which they are submitted as well as is desirable. To make a conical spring, a bar of the required section—usually a flat oval—is rolled; it is then coiled while hot into a disc. It is then forced into a conical shape by driving a taper mandril through it,

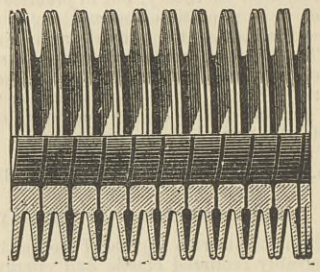


FIG. 4.

tempered, and compressed to its angle of repose. In ordinary work, these coils are driven home until each becomes a dead stop, and should there be any irregularity in the rolling of the bars, the thickest portion gets the most punishment. It appeared to Mr. Turton that the only way to get over the difficulty was to

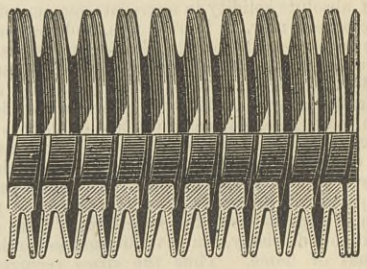
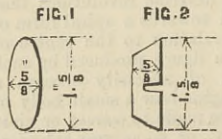


FIG. 5.

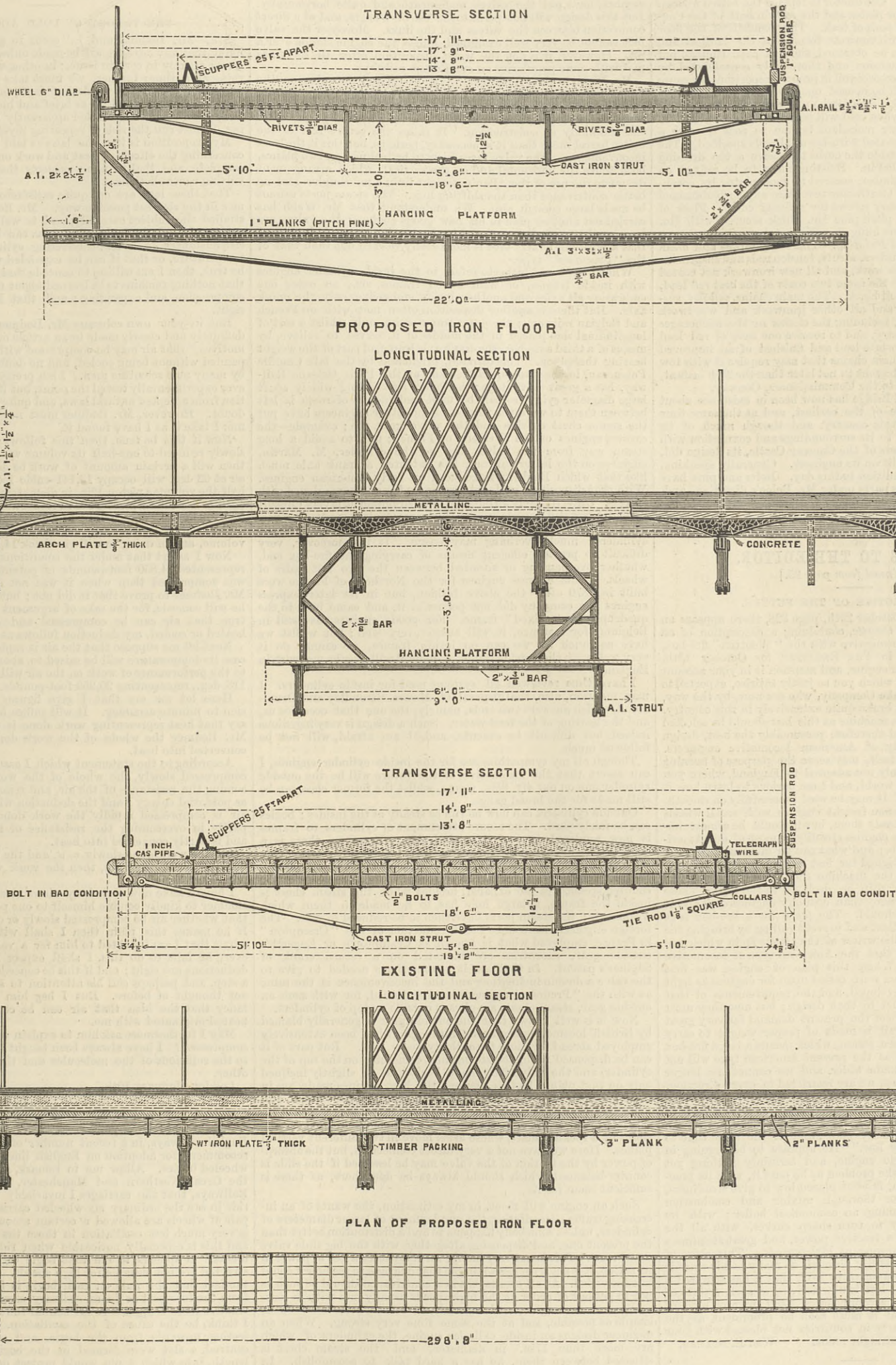
leave some small residue of elasticity in the spring even when dead home, and this he has done by adopting the sections shown. He has tested the ordinary section, Fig. 1, against that shown in Fig. 2, and he finds that the grooved section will carry more than the oval, and cannot be broken by the ordinary drop-weight test, whereas the solid sections, whether as in Fig. 1 or as in Fig. 2, but without the groove, were broken by the same testing.



We are not quite certain that the facts will quite bear the explanation given above, and put forward by Mr. Turton. The behaviour of different sections of steel is under the same conditions something very peculiar and difficult to explain. In the present case, however, the explanation is not of so much importance as the fact, and the circumstance that Mr. Barton Wright has specified for Mr. Turton's buffers, is ample testimony to their excellence. It will be remembered we illustrated Mr. Turton's buffers on the 30th of April, 1875. The new springs are now fitted to these buffers, as shown in Fig. 3. Figs. 4 and 5 show a different kind of spring, compressed and free.

CONTRACTS OPEN.—REPAIRING CONWAY SUSPENSION BRIDGE.

MR. C. BELOE, M.I.C.E., ENGINEER, LIVERPOOL.



CONTRACTS OPEN.

THE CONWAY SUSPENSION BRIDGE.

TENDERS are required for certain works to be executed and materials supplied for the re-construction of the floor, repairing and painting the Conway Suspension Bridge for the Conway Bridge Commissioners, and in accordance with the plans, specification, sections, and detail drawings as prepared by the engineer, Mr. Charles H. Beloe, M. Inst. C.E., of 13, Harrington-street, Liverpool. The drawings are given above. The contract to be in two sums: (1) For the new floor and repairs to the bridge, including painting or coating of all new ironwork, cross girders, and hanging platform. (2) Painting the bridge above the floor, and the chains in the anchorages. The Commissioners may accept either of the two tenders separately. The whole of the works comprised in first contract shall be completed within three months from date of signing contract; and the second contract shall be completed within three months from the completion of the first contract. £10 per week for non-completion of contract No. 1, and £5 per week for non-completion of contract No. 2. All wrought iron to be of best quality, and to bear a tensile strain of 10 tons per square inch of sectional area without deflection, and not to fracture with a strain of less than 22 tons per square inch of sectional area, free from blisters, scales, and all defects; and strictly in accordance with the dimensions shown on the detail drawings hereafter to be prepared by the engineer. The engineer shall have power at all times to submit any of the iron employed at such tests as he may consider necessary at the expense of the contractor. All rivet holes to be drilled, and care taken that the holes correspond perfectly when plates are in position for rivetting. The rivets to be of the best possible quality of iron, and, in rivetting up, the whole body of the rivet to be heated, and every precaution used to ensure the rivets filling the rivet holes completely so as to draw the plates into close contact with each other. All surfaces to be rivetted together shall receive two coats of red lead before being rivetted, unless specified to be coated. All cast iron used, to bear a tensile strain of 6½ tons per square inch before fracture, and a bar 1in. square placed on supports 3ft. apart shall sustain a weight of 800 lb. without fracture. All bolts and nuts to be of best quality, with the threads accurately cut and tapped. Samples to be approved by engineer before any are used in the work. Contractor to provide new suspension rod from main chains to the cross girder near the centre of bridge. New rod to be of exact *fac simile* of existing one, and to have eyes at each end formed by setting up the ends of the bar to the required shape and drilling the holes for the pins. The new bar to be tested to a strain of 10 tons, and old bar to be removed and new one substituted, and all damage to railing, &c., made good. The old suspension bar to be forwarded to Mr. David Kirkaldy, London, and tested by him, the result of the test being forwarded by him, together with the old bar to the engineer. The floor plates to be carefully curved, as shown upon the drawing, and edges planed. The plates at both ends of bridge to be carefully fitted to abutments as shown. Each plate to have the L or T iron rivetted to it before it is dipped in the composition. The T irons at joints of plates to be cut accurately to fit against cross girders. The plates to be secured to cross girders by rivets passing through wrought iron clips on underside of cross girder; these clips to be made to fit the cross girders exactly, and the width of the cross girders varies from 2½in. to 3in., and where the rivets cannot be inserted at the sides of the bridge wrought iron straps must be rivetted to the plates and passed round the cross girders as shown and made to fit the cross girders exactly. After plates and L and T iron covering plates have been curved, cut, and drilled, they shall be heated over an open clear fire in a boilermaker's plate furnace to "black redness" about 700 deg. Fah., and dipped edgeways into a mixture of coal tar boiled in an open vessel until all mixed water has been thoroughly evaporated, and to each gallon of tar must be added while boiling 1 lb. avoirdupois of finely ground caustic quicklime, ¼ lb. red lead, all thoroughly mixed. The plates to be left to drain and cool, standing on edge. After plates have been rivetted in position on the bridge, all rivet heads, any places where the composition has been knocked off or injured, and the inner surface of the face plates above the flooring plates shall receive two coats of above specified composition, applied hot. Bolts connecting suspension rods and tension rods of cross girders with the latter are all to be removed and replaced with new ones which must be long enough to secure L irons to support rails. While this is being done, the cross girders must be lowered suffi-

ciently to enable the eyes at the lower ends of the suspension rods to be thoroughly examined. If required, new suspension rods must be provided and fixed by the contractor at the price stated in the schedule. Contractor to provide and fix new cast iron struts at the schedule price where required. Contractor to include in his tender for supplying and fixing twelve oak blocks between the chains in the anchorages. Contractor to replace the rotten wooden wedges between the anchor plates and the rock in both of the Conway anchorages with new ones of teak. The spandrils of the floor plates must be filled up with concrete formed of the hardest and lightest materials that can be obtained, such as coke cinders, not exceeding 2in. in any dimension and thoroughly consolidated by rolling; boiled pitch and creosote oil in proper proportions to ensure a tough hard mixture shall be poured upon it until all the interstices are thoroughly filled. The pitch must be applied boiling and any that becomes brittle when cold will be rejected. Roadway to be formed of Penmaenmawr macadam broken to pass through a 2in. ring, rolled out and treated with tar as already specified. The surface of the roadway outside the curbs to receive a top dressing of limestone chippings rolled in. Existing curbs to be refixed on balks of creosoted Baltic timber, secured to floor plates by coach-headed screws as shown. Contractor to replace any curbs damaged by him, and find all necessary screws for refixing curbs. Floor of hanging platform to be of pitch pine 1in. thick secured with $\frac{3}{8}$in. screws to framing of L irons hung on rollers as shown.

Cleaning, Caulking, and Painting.—Thoroughly scrape and clean all ironwork in the cross girders, struts, tension rods and suspension rods up to bottom of trellis work, and all new ironwork not coated with composition, and give the same two coats of the best red lead, and two coats of the best oil black. The main chains, saddles, suspension bars, trellis work, and all other ironwork and woodwork connected with the bridge, including the chains in the anchorages to be scraped where necessary, and to receive one coat of red lead and two coats of the best white lead and finished of an improved tint. Caulk all joints in main chains that may require it with tow and red lead. Tenders to be sent in not later than the 25th instant, to Mr. T. E. Parry, Clerk to the Commissioners, Conway.

The Conway Suspension Bridge has now been in existence about sixty-five years. It is one of the earliest, and at the same time most elegant bridges in this country, and though much of its beauty is, no doubt, due to its surroundings and connection with the fine old cluster of towers of the Conway Castle, its design did, and does, reflect great credit on its engineer. Generally speaking, the bridge is in good condition to this day. Bolts and pins have been removed from various parts under Mr. Beloe's direction, and, with the exception of those connecting the suspension rods to the floor-girders, all are in good condition.

LETTERS TO THE EDITOR.

[*Continued from page* 25.]

THE LOCOMOTIVE OF THE FUTURE.

SIR,—In your issue of October 29th, page 328, there appears an extract from the *Railroad Gazette*, containing a description of an extraordinary pattern of locomotive with the "Wootten" fire-box. You illustrate this box in THE ENGINEER for October 15th, attached to a Consolidation engine, and mention it in your account of the "Express" engine, which you so justly satirise, exported to England by the Eames Brake Company, who are now, by the way, introducing their excellent brake quite extensively in this country. It seems a pity that such a machine as this last should be selected to represent the latest, and therefore presumably the best, design produced by the ingenuity of American locomotive engineers. This Wootten fire-box, in itself, may serve the purpose of burning dust and dirt, but is certainly not adapted to England, where you have the best coal in the world, and I am curious to learn how it succeeds with English fuel. It may be used successfully on smooth, straight roads on Consolidation freight engines with small wheels and a long wheel base to steady them, but it would be almost impossible to run such express engines steadily on most of our American rough and crooked roads; and what can be more absurd than placing it on an engine designed for fast running, where all possible means for steadying the machine should be adopted? As well put the ballast of a ship on deck, or in the tops. These engines confessedly "roll more than ordinary engines do," and it is not surprising that they should. The place for a fire-box is as low as possible to act as ballast and prevent rolling by bringing the centre of gravity down. The writer of the article from which you quote is correct in stating that the American type of locomotive has reached its limit. When this plan of engine was first designed, locomotive builders were called upon for engines as light as possible for the power developed, and the requirements of that day were admirably well met by that design; but now they must be as heavy as possible to meet the present demand for very great tractive power, and the rail is made of proper weight to carry them. To get power we need steam, which means a large fire-box with room for combustion; as the present American type will not allow the fire-box to be made wider, and we cannot use longer parallel rods than we do now, we are restricted in every direction. The correspondent of the *Railroad Gazette* rightly states "the problem to be that of constructing an engine with two pairs of driving wheels comparatively near together, a fire-box wider than can be obtained by the ordinary plans, and at the same time to keep the centre of gravity low." He appears to be arguing in favour of the double bogie engine, and certainly nothing yet invented can so well solve the problem as he puts it, with its practically unlimited grate area, fire-box placed low to give steadiness, and high enough inside for thorough mixing and combustion of the gases, thus furnishing an economical boiler; with its short side rods and ability to turn sharp curves, with all the weight on the drivers to give tractive power, and great steadiness to render it capable of running at high speeds. This class of engine has passed unsuccessfully through so many hands since it was first designed by the Chapmans in 1812, that it has acquired a bad name in some quarters; but is now arriving at such a state of perfection, and so readily accommodates itself to any kind of rough road and curve, that it must soon be prominent as the "coming engine," particularly in countries not blessed with your perfect English tracks and straight roads. WM. E. SPARKS.

Boston, Mass., 1880.

SIR,—I have noticed in your issue of the 3rd inst. a letter on the "Locomotive of the Future," by Mr. Pearce. As I am taking great interest in the study of this question, I shall esteem it a favour if you will kindly consent to insert the present letter in one of your next numbers. The proposal of Mr. Pearce seems no doubt very good at first sight, but a close investigation will show us it is not practical, and he need not wonder that it has not been applied before. There is one great failure about it; how can he get the slides driven without having recourse to means that are not simple, and besides that will be very indirect? If we draw the plan of such an engine we shall see, in fact, how difficult it is to obtain a direct connection of the links with the valve rods; the centre lines of both are thrown considerably apart without avoiding the inconvenience inherent to the present systems, and of which I will speak hereafter. It must not be forgotten that there are two things to be aimed at in designing a modern locomotive: A large axle-bearing surface with a suitable disposition of the steam chest, enabling the valves to be placed without reducing their proper dimensions. The pressure of rolling weight on axle bearing should not exceed 160 lb. per square inch, and the least depth of the slide valves 2in. Besides, the valve rods should be connected with their links as direct as possible. All engineers in the locomotive department know how difficult it is to secure all these requirements when the engine is an inside cylinder one, and the bore of the same exceeds 17in., and that they want to keep the vertical disposition of the slides between the cylinders. This applies chiefly to the normal gauge engines. When it is a question of the broad gauge, the above conditions are more easily fulfilled.

To obtain a proper bearing surface, various dispositions are now resorted to. Sharp disposed the valves underneath the cylinder at a certain inclination above the horizontal plan. Mr. Stroudley, in his 17½in. goods engines, and Mr. Stirling, in his 19in. goods engines, have put the valves underneath and quite horizontally. But this design will not permit the use of a bogie, and of a direct connection between the valves and the links. Moreover the valve face cannot be very well examined, unless the engine stands over a pit. However, it is not the worst disposition after all, as it has met with some popularity on our French railways.

Mr. Webb in the "Precursor" type has placed the valve on the top of cylinder. Surely he can get large bearing surfaces, for the axes for the cylinders are not to be more than 2ft. apart from centre to centre, but this advantage is gained at the prejudice of the simplicity of construction. It raises the centre line of the boiler barrel more than it is necessary, perhaps, but this is the least inconvenience. The valve faces have to be inclined on two planes, both above the horizontal and on the vertical, which arrangement demands the use of the Allan's straight link, a no simpler and no better contrivance than the shifting link. The steam ports cannot be made large enough also. We understand that Mr. Webb has carried out another plan in his new goods engines; the valves are horizontal and the link replaced by Joy's valve gear. It is evident that a horitontal valve face is more easily worked out than that of the "Precursor" type.

What I have said hitherto refers to the inside cylinder engines with inside frames, or with mixed frames, viz., an outer one embracing all axles and another inside embracing only the crank axle. But there is another disposition often met with on French and Belgian railways; the outer frame exists only whilst a sort of longitudinal slab placed in the middle of it serves to relieve, by means of a third axle-box, the crank axle frame, of part of the weight bearing thereupon. This disposal, originated by the late Camille Polonceau, locomotive superintendent at the Paris Orleans Railway, has a great advantage; the outer slabs being widely apart large diameter cylinders can be used and plenty of room is left between them to work the valves. Some other engineers have put the steam chest outside and the valve gear too; example—the express engines of the Western of France; and to avoid a long steam way from the valve face to the cylinder, M. Martin, engineer on the latter railway, has patented a crank axle much like that which Baldwin introduced on early American engines. With that disposition no doubt large cylinders can be employed with success. Unfortunately an outside frame so employed is very difficult to render very stiff, especially with the large wheels of express engines. The leading wheels must come immediatcly after the rear of the cylinders; much overhang may ensue. It is, moreover, very difficult to provide efficient means of carrying the fire-box end, whether overhanging or situated between the two last pairs of wheels. Some express engines for the Northern of France were built in 1870 after the above fashion, but in its later express engines the company did not persist in it, and came back to the quadruple or "mixed" frame. For goods engines, as used in Belgium, for instance, it will answer very well; but whilst we have as much as we can on inside frames, we cannot do it very well with the outside frame. I doubt it will ever be met with in England.

I have thus reviewed all systems used for inside cylinders. I may mention, also, the disposal of Messrs. Stroudley and Drummond, which answers two ends, namely, the one that occupies us, and the heating of the feed-water. Such a design is very ingenious indeed, but difficult to execute, and, I am afraid, will not be followed much.

Though all my sympathies are for the inside cylinder engines, I can assert that the locomotive of the future will be the outside cylinder one on our 4ft. 8½in. gauge, whilst the former class can be still made for the broad gauge.

Outside cylinders can now be run as steady as the insides; bogies can be fairly used. The secure attachment of cylinders to frames is now rendered as perfect as desirable. However, there is a necessity for not keeping the valve face too far apart from the centre line of the cylinder, the steam ways are too long, and, therefore, conducive to a reduction of pressure and to an increase of the counter-pressure in the exhaust, besides when the steam chest is inside the frame, a large hole has to be made in them which weakens it; the steam ports have then to be reduced in size. The foreign engineers have since the introduction of the "Crampton" in France, employed what is known as Crampton's or Engerth's outside gear, excentrics are mounted on a return crank of Saginer's patent. In that case it is sometimes needed to give to the valve a double inclination and the inconvenience is the same as with the "Prcursor" engine afore-mentioned, for with such an outside gear, steam chests are always outside on top of cylinders.

Now it is well known that the outside gear is generally blamed by British locomotive engineers, although it has been extensively employed abroad for more than thirty years now. But part of it can be dispensed with, the steam chest remaining on the top of the cylinder, and the valve face made horizontal or slightly inclined only on that plan. In this manner the best engines made are in my opinion those of the Great Eastern Railway bogie express, and "Mogul" type of Mr. Adams. As for the links, they are kept inside as in American engines; their motion is communicated to the slides by a rocking shaft, whose arms move in two different vertical planes. Here we have not a very direct connection, but the absorp- of power by the motion of the valve may be lessened if the slide is counter-balanced, which should always be done here, as there is sufficient room for it.

Such an engine will meet, in my estimation, the wants of an increasing traffic necessitating the employment of larger diameters of cylinders, unless somebody happens to find a distribution better than the present one, and dispensing altogether with the big slide valve now in use. This is not very likely, for if it causes a loss of power in its action, it is nevertheless so simple that one fails to see how it could be superseded. At all events, the new contrivance should be such as not to get out of order at the high speeds usually met with in locomotives. An engine, and especially a locomotive, must be as simple as possible, and at the same time very strong. When an engineer designs an inside cylinder engine, the cylinders of which are more than 17in. in diameter, and the steam chest is situated between them, he has a hard task to accomplish. In order to get sufficiently large axle bearings, the crank arms next to the wheels are reduced in width—sometimes it is the crank pin; the wheel boss's inner face stands within the tire in order to add ½in. or more to the length of the bearing. All this does not tend to simplify the construction, and besides not much advantage is obtained. An eminent French engineer considered the Fairlie engine as the locomotive of the future. In my own opinion this statement applies more fully to our narrow gauge and colonial railways, where the way is steep and has many sharp curves; but the principle may be extended to the standard gauge. I venture to say I quite agree with this gentleman, and would not be astonished that in years to come the Fairlie engine would get more into use when the traffic requires more powerful engines than those of to-day, and the newly built lines are steeper and have sharper curves than on the English railways, but as far as it is consistent with economy.

I think I am not far wrong in my opinions, especially when I see them shared by eminent men of the profession, and I hope that this letter will prove interesting to your readers.

New Radford, Nottingham. A. E. GOBERT, B. Sc. Ing.

SIR,—The letter from Mr. E. L. Pearce on the above-named subject, published in THE ENGINEER for December, 3rd, 1880, brings up a subject which was considered in this country many years ago, and it will probably be interesting to Mr. Pearce to know that precisely his proposed arrangement of parts was used on the Boston and Providence Railroad, by Mr. G. S. Griggs, when he was master mechanic of the road. Several of the engines are still running. Later Mr. Griggs abandoned this arrangement and placed the valve directly above the cylinder. The Boston and Providence Railroad was about the last one in America to give up inside cylinder engines. F. W. DEAN.

Cambridge, Mass., December 16th, 1880.

THE THEORY OF COLD AIR MACHINES.

SIR,—Mr. Bodmer and I "seem to get no forrader," nor is it likely that any advance will be made unless we agree to confine ourselves strictly to certain issues; in other words, we must settle one thing at a time; further, we must take pains to understand each other, and discuss not words but facts, or what are assumed to be facts. I shall try and be as brief and lucid as I can in this letter; but as Mr. Bodmer has failed apparently as yet to catch my meaning, I must run the risk of repeating myself once more.

My proposition is that the laws as laid down in most text books concerning the effects of heat and work on permanent gases are not complete, and that in many respects they are imperfect, and involving contradictions.

That these laws are not quite satisfactory is proved by Mr. Bodmer in the clearest possible way. Mr. Bodmer, who has evidently studied the subject carefully, and is well up in its mathematics, nevertheless flatly denies that a gas can be compressed unde any circumstances in a non-conducting cylinder without raising its temperature, or that it can be expanded without cooling. If this be true, then I am willing to concede that I am quite in the wrong; that nothing remains to be learned about the behaviour of gas under compression and expanding; and that Mr. Bodmer has set me right.

But in your own columns Mr. Bodmer will find the statement definitely and clearly made in an article on "Compressed Air Locomotives," that air may be compressed without being heated and expanded without being cooled, and no doubt this is the opinion held by many able scientific men. I am pretty certain that no one has ever experimentally tested the point, but it is a mathematical deduction from accepted natural laws, and quite a legitimate deduction no doubt. However, Mr. Bodmer must not father the proposition on me; I take it as I have found it.

Now if this be true, then this follows: If one pound of air be slowly reduced to one-half its volume while its pressure is doubled, then will a certain amount of work be done on it. The pound of air at 62 deg. will occupy 13,141 cubic feet. To reduce it to one-half the volume a piston 12in. in diameter must move through 6·57 ft. against a constant pressure of in round numbers 20 lb. on the square inch. The work done will be 14,850 foot-pounds, in round numbers.

If I remove the weight by degrees, the gas will resume its original volume, and in doing so will give back 14,850 foot-pounds of work.

Now I assert that under the conditions stated the pound of air represented 14,850 foot-pounds of potential energy more when it was compressed than when it was not compressed. I must ask Mr. Bodmer to prove that it did not; but I venture to hope that he will concede, for the sake of argument let us say, that if it is true that air can be compressed and expanded without being heated or cooled, my deduction follows as a matter of course.

Next let me suppose that the air is rapidly compressed. In that case its temperature will be raised to about 180 deg. The rise due to the performance of work on the air will be 180 deg. — 62 deg. = 118 deg., representing 20,953 foot-pounds.

Here let me say that I give figures which have no pretension to minute accuracy. It will suffice for my present purpose to say that heat representing work done is produced. According to Mr. Bodmer the whole of the work done in compressing air is converted into heat.

According to the statement which I assume to be right, if air be compressed slowly, the whole of the work is expended in overcoming the resistance of the air, and remains stored up in the air as potential energy; and the deduction which I draw is, that when air is compressed rapidly the work done on the air is expended partly in overcoming the resistance of the air, as stated above, and is partly converted into heat.

Let the work done slowly $= x$, and the heat produced when the work is done quickly $= y$, then the work when done quickly must invariably $= x + y$.

I hope I have now stated my views clearly, and I will ask Mr. Bodmer to kindly confine himself to one point, namely, to showing that whether air be compressed slowly or quickly it must be heated. If he makes this plain then I shall with the greatest pleasure admit that I am indebted to him for a valuable lesson. If, however, he fails to do this, I shall expect him to admit that my deductions are right; and if this be conceded then I hope to advance a step, and perhaps call his attention to something which he has not thought of before. But I beg him above all things not to fancy that the idea that air can be compressed without being heated originated with me.

May I furthermore ask him to explain why air becomes hot when compressed? I have always been taught that the heating was due to the collisions of the molecules and their friction against each other. Φ. Π.

London, January 10th.

BOGIE ROLLING STOCK.

SIR,—I noticed in your remarks on an American's opinion of English railways, in a recent number of THE ENGINEER, that you recommend for adoption on English lines carriages with two four-wheeled bogies. Allow me to remark, as a frequent traveller on the Great Northern and Manchester, Sheffield, and Lincolnshire Railways, that the carriages I invariably find most comfortable to ride in are the ordinary six-wheeled carriages, in which the centre pair of wheels are allowed a certain amount of side play. There is very much less oscillation in these than in the bogie carriages; and this is especially noticeable when riding in the end compartments. It appears to me that bogie carriages as at present constructed are not suitable for high speeds. Does not this arise from the fact that the pull on each bogie is from the centre, and not from the fore part as in an ordinary carriage? The fact that the tractive force is applied so far behind the first pair of wheels must, I think, be the cause of the oscillation. If instead of a pin projecting upwards from the bogie, and on which the carriage is centred, a slot were formed in the bogie in the direction of its length, into which a pin would project downwards from the carriage, the pull would always be from a point as forward as desirable for steadiness, in whichever direction the carriage were travelling. This need make no difference to the weight being distributed equally on each pair of wheels of the bogie. The only difficulty apparently would be that the forward bogie would bear more than its share of the weight of the carriage, and this must often be the case in six-wheeled carriages, and need not be a serious disadvantage. VIATOR.

Manchester, January 6th.

FAST TIME ON FREIGHT.—"Train 36—New York, Lake Erie, and Western—says the *Port Jervis Gazette*, forty loaded cars, mostly stock, Tim Welch conductor, engine 372, a Danforth and Cooke engine, A. J. Goble engineer, received orders at Lackawaxen last Friday morning at 2.43 to run twenty-five miles an hour, and make Port Jervis ahead of train 12 if possible. They ran the twenty-three miles in forty-six minutes, arriving here at 3.28. They left Lackawaxen nine minutes ahead of train 12, arriving here ten minutes ahead of her time. This is claimed by old conductors to be the best time made by a loaded freight train. About one-third of the distance is up grade, the balance down." If this is the best time they can make in the United States with goods trains of forty cars, on a road two-thirds of which is down hill, it is evident that American engineers have something to learn about goods locomotives, and if they propose to do much in the way of quick running, they will do well to take a lesson or two from English engineers.

RAILWAY MATTERS.

THE Hoosac Tunnel is about to be lighted by electricity.

AT the meeting of the Darlington Town Council on the 6th, it was stated that the new tramway in that town would be commenced, at the latest, next month. The contract had been turned over from the company which originally undertook to make the tramways, to another.

IT was stated in the *Toronto Globe*, of the 8th inst., that a syndicate of well-known capitalists and others has been formed for the construction of the Canadian Pacific Railway, on terms eminently more favourable to the Dominion than those now awaiting ratification by the Canadian Parliament.

THE correspondent of the *Times*, writing from Candahar, says:—"The railway now being constructed in a half-hearted way to some undetermined point between Sibi and Candahar is another prolific source of waste, and unless the Government mean to complete it rapidly and efficiently, which they do not, it ought to be abandoned."

OF the 6000 men employed in the London and North-Western Railway Works at Crewe, 4803 have signified their intention to join the proposed new insurance society, in lieu of the Employers' Liability Act; 109 have declined to do so, and nearly 500 remain undecided. A special insurance fund has been created for Crewe, offering additional facilities and benefits to the employed.

AT a meeting of the Dundee Guildry on the 5th inst., it was agreed that the erection of the Tay Bridge was a work of urgent necessity, that it should be of such a substantial character as to ensure public confidence in its security, and that the proposed height of 88ft. was much beyond the requirements of the traffic to Newburgh and Perth. It was resolved to forward a petition to Parliament embodying these resolutions.

ON its trial trip in the middle of last month, the American Fontaine engine, with driving-wheels on the top of other wheels—road wheels—hauling four coaches, ran forty miles in forty minutes, and, according to the *American Journal of Industry*, "the engineer says she had not attained her highest speed then. He says, with a light train the engine will be a perfect success, and can travel like the wind; she is one of the easiest riding engines ever built, no rocking or side motion perceptible, is now at Grosse Isle, where she will undergo a few slight *repairs!* and will then have a thorough trial on the Canada Southern road."

A COPY of a petition to be presented to the Queen on behalf of Mr. Alexander Atkinson, who has spent his time and money, to the neglect of his business, in endeavouring to secure the adoption of a system of prepaid parcel post at uniform rates, is being circulated. The system he proposed has been favourably received by the Prime Minister, Postmaster-General, and the railway companies, and there is some prospect of its being brought into actual operation. The German Postal Department has a long time been before us in this matter, and the advantages and convenience of a simple parcel post are so many that it may be hoped we shall ere long enjoy them.

THE first electric railway in Europe built for ordinary traffic has now been nearly completed. It is situated in the city and suburbs of Berlir. It runs from the central cadet establishment in Lichterfelde. It is the first actual experiment with the system in ordinary traffic. It may be remembered that in the summer of 1879 Dr. Siemens achieved great success with the electric railway, which was constructed, as a scientific experiment, in the grounds of the Berlin Exhibition of that year. The line will, it is expected, be opened for traffic before the close of the present month. The contractors who are constructing the railway are Messrs. Siemens and Halske, of Berlin.

ON Tuesday the purchase of one of the Rhine railway lines by the State formed the chief subject of interest and importance discussed in the Lower House of the Prussian Parliament. The Government desire to buy this line for strategical purposes, in order that the transport of troops to the French frontier may, in case of necessity, be facilitated in every possible way. The Liberals opposed the purchase, principally on the ground of expense, but the Minister of War pointed out that in any case a second line of rails would have to be laid down, so that the question resolved itself into this—either the State must buy the railway or have an extra line of rails laid down. The Minister added that France had made every effort to improve her network of railways, and it was incumbent on Germany to follow the example and adopt every means for quickly forwarding troops to Alsace and Metz. The question has been referred to the Railway Commission, and it is highly probable that their decision will be in favour of a second line of rails being laid down in preference to the purchase of the railway by the State.

THE deeper works of the Severn Tunnel have now been freed from water by the new 35in. pump added to the two 26in. pumps already fixed in the pumping shaft, and a dam has been built across the inshore heading through which the great spring of water came that flooded the works more than a year ago. The large pumps above referred to were designed and erected by Messrs. Harvey and Co., of Hayle Foundry, Cornwall, from the instructions of Sir John Hawkshaw and Mr. Charles Richardson, C.E., engineer for the tunnel. The main works under the river will thus be safe from such an accident in future; and the contractor will proceed with the arching of the tunnel under the shoots, or deep-water portion of the Severn, as soon as his arrangements have been completed for this work. A working shaft and a separate pumping shaft have been put down on the other, or landward side of the great spring, and large pumps fixed, by means of which the spring can be commanded from that side without interfering with the river portion of the tunnel. The building of the tunnel has been commenced at this working shaft, and a heading driven nearly up to the spring. On the east or English side of the river the building of the tunnel has also been commenced, and already made some progress.

DURING the month of November there was a total of 145 accidents on the American railways, by which 40 persons were killed and 165 injured. Twenty-three accidents caused the death of one or more persons; thirty-two caused injury to persons, but not death, while in ninety cases, or 65·5 per cent. of the whole number, there was no injury serious enough for record. As compared with November, 1879, there was an increase of fifty-nine accidents, of twenty-four in the number killed, and of 101 in that injured—an extraordinary increase on all points. Five collisions were caused by trains breaking in two; four by mistakes in train orders or failure to obey them; no less than three by runaway engines; two by misplaced switches, one by a flying switch, and one by snow. There were forty-two accidents resulting from defect or failure of road or equipment, two from the weather, nine from purely accidental causes which could not be foreseen, fifty-nine from carelessness or defects in management, and thirty-two were unexplained. Forty-three accidents took place in the hours of darkness, eighty-six in daylight, while in sixteen cases the hour is not determined. There is an improvement in the matter of misplaced switches, only, the *Railway Gazette* says, eight accidents—two collisions and four derailments—being traced to that cause. There were no malicious derailments. The only broken bridge was a temporary structure on a new road, used until the permanent bridge could be built. One case, however, appears again of that familiar but inexcusable piece of carelessness, the removal of a rail by trackmen without putting out proper signals. The number of accidents was the largest of any month for the year. The unusually early and sudden appearance of winter has had something to do with this, as, for instance, in the case of the twelve broken rails recorded, but beyond that no special cause can be assigned. Traffic was very heavy all over the country, and the extra demands on equipment, with probably some overworking of train men, may have contributed to swell the number.

NOTES AND MEMORANDA.

M. CRULS has recently redetermined the time of rotation of Jupiter, and makes it 9h. 55m. 36s. in mean solar time.

AN ink, which can be employed for writing upon glass, has lately been brought out by Messrs. Sabatier and Co. It consists mainly of hydro-fluoric acid; but there are some other ingredients mixed with it, which enable it to be used as an ink, and which prevent the dangerous fumes which are found so inconvenient in using the simple acid.

THE wire ropes for the great East River bridge between New York and Brooklyn are each 1550ft. in length, 3in. in diameter, and their aggregate weight 102,495 lb. Each rope is made in seven strands. The central strand has forty-nine No. 11 wires, and the six strands enveloping this have nineteen wires each, of No. 4, 5, and 7 gauge, making 163 wires in all.

PAINT from steel scale is one of the latest additions to the many anti-all-sorts-of-things paints. The scales which fall from steel plates and bars, as these are passed through the rolls, are collected and finely ground. They are then mixed with oil and colouring matter, but without any extended experience of the paint so produced, there seems no reason for thinking it any more effectual than iron oxide and many other paints.

THE *Bootle Times* states that an interesting archæological discovery was made in Liverpool on the 5th inst. In the course of the excavations for extensive docks at the north end of the city the workmen discovered the half of a ship at a great depth from the surface. The timbers are in a good state of preservation. The beams to which the stays are fixed are of elm, fixed with oak pins, and the planking also appears to be of elm. The vessel is thought to have got into its present position at least two centuries ago. The build is of a very old type.

A NUMBER of Roman remains have been dug up outside the railway station at Metz. Among them are three skulls, which, according to Professor Schaffhausen, of Bonn, belonged to three different peoples. One is that of a civilised German, another that of a low German of the tribe of the Trisians, and the third is of Lappish origin. There were thirty-five vessels, four metallic objects, three coins, and two tombstones with inscriptions found. The spot on which all the objects were dug up was, it appears, the chief burial ground of Roman Metz.

IN a recent paper on "Electromotive Force and Chemical Affinity," Dr. C. R. Alder Wright described experiments, the chief result of which is the conclusion that the action of a current in electrolysis is to decompose the electrolyte into "nascent" products, which evolve heat in changing into ordinary products of electrolysis. These nascent products may be the ultimate atoms composing the molecules of the ordinary produets, and the heat is given out in these atoms coming together to produce molecules, say, of oxygen and hydrogen in the case of water.

ACCORDING to published results of a recent examination of Mallet's tables of corrosion of cast iron, wrought iron, and steel (British Association's Reports, 1839-43), the relative loss of weight due to corrosion of wrought iron and steel is as between 10·45 and 10·37 grains per year in foul sea water, 5·85 and 5·175 in clean sea water, 7·68 and 6·045 in foul river water, and 6·69 to 6·67 in city atmosphere. These experiments have been quoted by Mr. B. H. Thwaite, but Mallet's experiments, nor those of others to whom reference is made, have dealt with the very mild steels made for shipbuilding, nor do they give the effect of the contact or connection, even if that be only by the water itself, of different metals with this steel. Mallet's reports show the effect of contact of cast and wrought iron with gun metal and copper, the corrosion of best wrought iron and gun metal in contact and in sea water being 24·2 gr. per annum per square inch.

SOME interesting and useful information on the ignition temperature of gaseous mixtures was recently communicated to the Académie des Sciéncés by MM. Mallard and Le Chatelier. The explosive mixture of oxygen and hydrogen fired between 977 deg. and 1057 deg. Fah.; the temperature being only lowered about 85 deg. when the proportion of oxygen was increased one-half. The addition of nitrogen to the mixture made very little difference to the temperature of ignition, but carbonic acid slightly augmented it. An explosive mixture of carbonic oxide and oxygen took fire at about 1200 deg. Fah. Great variations in the relative proportions of carbonic oxide and oxygen only produced the slightest discernible differences in the temperature of ignition; but carbonic acid augmented it very remarkably. Nitrogen affected it but slightly. The slow combination of carbonic oxide is producible at temperatures much below that of its active combustion.

SOME experiments made by Mr. W. Crookes, F.R.S., show that the heat conduction of air at different states of rarefaction varies very considerably, although the transfer of heat through air of different densities above atmospheric pressure seems to be much the same. In Mr. Crookes' experiments an accurate thermometer was enclosed in a small glass globe, the bulb of the thermometer being in the centre of the stem enclosed in the tube from the globe to the pump. The globe under different stages of exhaustion was then dipped into hot water until the thermometer became stationary. It was then taken out, wiped dry, and allowed to cool in the air, the time occupied in every fall of 5 deg. being noted. The conductivity rapidly decreases as the pressure is lowered, and with a fall of pressure of from 5 millims. to 1 millim., the rate of fall in temperature is twice as much as in all the range of fall of 760 to 1 millim. The loss of heat in the high vacua in which planets are supposed to exist would thus only take place by radiation and be very slow.

A NEW method of treating paper, and printing such articles as cheques so has to prevent fraud, has been recently patented by Mr. A. Nesbit, F.C.S. In dissolving writing ink it is necessary to have the solution either slightly acid or slightly alkaline. He therefore makes his cheque by using a dye, which is affected both by acids and alkalis, but which is one colour in acids, and another colour in alkalis, and prints upon the document partly in an acid, and partly in an alkaline ink, so that the inscriptions are apparent only by virtue of their acidity or their alkalinity. When such a document is placed in dilute acid, the whole of the colour becomes of the acid tint and the printed inscription is lost; and if it is then placed in an alkaline solution the whole becomes alkaline, consequently the inscription is not regained. Again, if such a cheque is placed in dilute alkaline solution, the whole of the colour becomes of the alkaline tint and the printed inscription is lost; and if it is then placed in acid the whole becomes acid, consequently the inscription is not regained. All solutions must of necessity be either acid, alkaline or neutral, and, as against the last, it is only necessary to use either the alkaline or acid solution in the larger proportion.

A NEW optical milk test has been devised by Herr Mittelstrass, of Madgeburg. While in previous instruments of the kind the plan has been to add milk to water till a layer of given thickness becomes opaque, in this new instrument a given quantity of milk with a given quantity of water is examined by looking through different thicknesses of layer till opacity is reached. The vessel holding the liquid has a glass bottom, and in its cover a vertical graduated tube in a slide, with glass closing its lower end. Light is thrown up from below by means of an oblique mirror, or from the source direct. The tube, through which one looks, is moved in the slide till the light disappears, and at this point the scale is read off. Experiments made by Professor Maercker with this apparatus show it to be very accurate. The greatest difference between determinations of the fat in milk with it and by chemical analysis was 0·3 per cent.—average 0·1 per cent. It is only with fresh milk, however, that it succeeds; in the case of old milk, which has begun to form cream, the results obtained are too low. For skim milk Messrs. Mittelstrass prepare a special table. The chief advantage claimed for the instrument is its easy manipulation and the quickness with which results are arrived at.

MISCELLANEA.

THE Institution of Civil Engineers has just entered upon its sixty-fourth year.

IN our account which appeared last week of the Peterborough sewerage, it should have been stated that the 12in. centrifugal pumps were of the side opening type made by Mr. C. L. Hett. of Brigg.

THE English Watch Company, of Lozells, Birmingham, has, this year, the *Birmingham Post* says, carried off the contract for watches for the Indian State Railways, which has hitherto fallen to American manufacturers.

A PARLIAMENTARY paper has just been issued containing a declaration between Great Britain and the Swiss Confederation for the reciprocal protection of manufacturing and trade marks, signed at Berne, November 6th, 1880.

SOUTH London parishes, through which the pipes of the proposed Sea Water Supply Company will pass, should, the *Metropolitan* says, "look after their interests, so as to get cheap water for their roads." Rather a dear way of getting cheap water, bringing it seventy miles.

A NEW agricultural association is being formed in Edingburgh, The formation of so many new farmers societies in the past few years seems to indicate great change in the views of farmers as to the necessity, under modern competition, for making themselves acquainted with new-fangled notions and apparatus or machinery.

ACCORDING to the returns made by Mr. T. W. Keates, consulting chemist to the Metropolitan Board of Works, the gas supplied by the three gas companies under supervision was, on the whole, less in illuminating power during the week ending the 5th inst. than in the previous week. The sulphur was also less in quantity, but the ammonia was slightly in excess. Sulphuretted hydrogen continued to be entirely absent.

WE have received, among other sheet calendars, one of most original and tasteful design published by Sir J. Causton and Sons. The signs of the zodiac, or most of them, are arranged in a new manner, and treated in pleasing conventional style. Another is equally well got up by Mr. C. F. Kell, lithographer, London. It is a good sample of gold printing, and the choice of the few colours employed is illustrative of the change in taste in these matters in the past few years.

THE miners' conference sitting in Manchester this week has been discussing other matters relating to mining besides the Employers' Liability Act, and at the meeting on Wednesday a series of resolutions were passed with reference to the responsibilities and qualifications of chief managers, underground managers, and foremen, and the inspection of mines; also recommending the adoption of measures for exhausting the dangerous gases in new mines, and an increase in the number of shafts in large collieries.

Mr. J. CHARLES KING has published a pamphlet proposing to make an embankment road across the Irish Sea between the Mull of Cantyre and Tor Point. Mr. King simply proposes to fill this channel up with earth, &c. It is nineteen miles across 474ft. deep, and Mr. King says that there are no engineering difficulties in the way to prevent the immediate commencement of the undertaking. He notes the fact, however, that Gulf Stream currents flow at six knots an hour through its passage; it is true Mr. King says nothing of the completion but only the commencement of the project.

A VERY neat graphic history of the tin trade and copper trade in the past twenty years, has been published, the arrangement and colouring being similar to that of the iron trade's chart, issued last year by Messrs. Spon for Mr. W. G. Fossick. That before us is issued as a supplement of the *British Trade Journal*. It is very illustrative of the value of the graphic system of presenting statistical matter of this kind, and by the adoption of gold as the colour for the chief blocks, numerous clearly distinguishable shades illustrating quantity or value are obtainable with few colours. The scale divisions are not, however, fine enough to permit of accurate reading.

FROM the monthly returns published in connection with the Cleveland Ironmasters' Association it appears that there are now of the 167 blast furnaces in the district, 120 in blast. Some of the others are only damped down and not extinguished. Two furnaces were built during the past year—one by the Consett Iron Company, and one by Messrs. Samuelson and Co., Middlesbrough. The quantity of Cleveland pig iron made during the past year was 2,510,853 tons, which is greater than the production in any other year, the largest previous production being 2,138,378 in 1877. In 1879 the production was 1,781,443 tons, which is about the same as in 1871. The distress in the Cleveland district after 1875 was thus due to too greatly increased means of production rather than to decrease in the work to be done.

AT the monthly meeting of the Whitby Pier and Harbour Trustees, on the 5th instant, a report was read by Mr. Sandeman, engineer, stating that the foundations in the harbour are principally of shale, and that with little or no blasting a navigable channel may be dredged from between the pier ends to the fish quay above bridge, which will give an average increased depth of water of about six feet.—In reply to the Hon. Cecil Duncombe, the chairman said this increased depth of water would make all the difference between having a port fit for the purposes of trade and commerce and one that was fit for nothing, especially if the North-Eastern Railway constructed their projected new quay. In order that the Commissioners may be in a position to carry on dredging operations with their own plant, it was unanimously decided that the amount of loan to be applied for shall be increased from £40,000 to £45,000.

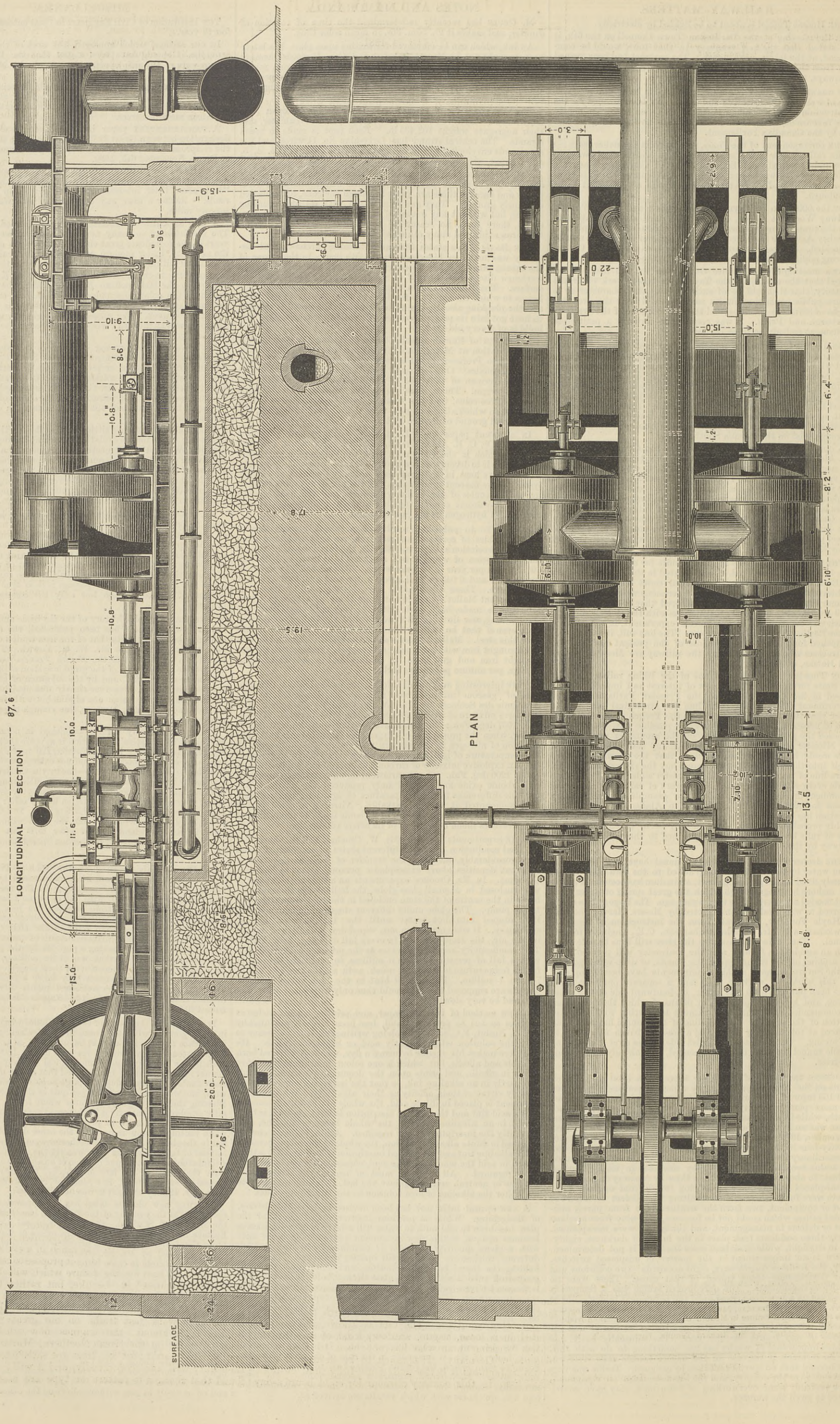
IT would seem that some of the work done by icebergs and glaciers in days gone by when they used to be busy hauling lumps of rock from place to place is likely to be utilised. A communication on boulder stones as gravestones was read at the last meeting of the Manchester Literary and Philosophical Society by Mr. E. W. Binney, the president. He observed that in the numerous excavations made in the drift deposits large boulder stones are often met with, and workmen are glad to get quit of them somehow or other. Blasting them or burying them near where found, have been generally employed. Latterly it has become the fashion to remove them to public parks in order to preserve them. He—the president—when visiting Ashton-under-Lyne the other day, observed another, but in the churchyard in the Manchester-road, a greenstone boulder, instead of being buried as was formerly the custom, is now used as a tombstone over the grave of a son of an alderman of that borough. Over the grave of the late Mr. Locke, the railway engineer, in Kensal-green cemetery, is a block of red granite, but although plain, Mr. Binney thought it was not a boulder.

ANOTHER new electric lamp has, it appears, been tried with success. On the evening of the 7th inst., the Duke of Sutherland, the Marquis of Stafford, Sir Arnold Kemball, Colonel Green, Sir Eustace Piers, and others, visited the offices of the British Electric Light Company, to witness a private exhibition of the new small lamps invented by Mr. St. George Lane Fox. These lamps are similar in principle to those being worked out by Mr. Edison. Mr. Lane Fox has been working at these lamps for two years, and there seems every reason to think that his labour has resulted in a practical success. The incandescent carbon filaments, which are enclosed in glass bulbs from which the air had been exhausted, had already burned from 50 to 100 hours, and it is believed by the inventor, that in ordinary average use they will last for years. Fifty hours is, however, it is stated, a sufficient length of time to make Mr. Fox's system much cheaper than gas, to say nothing of its other advantages. The lamps are made of various powers; those shown on Friday were giving a light of about 10 candles each. Seven lights were burning on a very small Gramme machine capable of working 20, and it was shown that each lamp could be turned on and off as easily as gas, without affecting the others.

HORIZONTAL BLOWING ENGINES, STAVELEY IRONWORKS.

MR. CHARLES MARKHAM, M.I.C.E., STAVELEY, ENGINEER.

(*For description see page 26.*)



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TO CORRESPONDENTS.

*** *In order to avoid trouble and confusion, we find it necessary to inform correspondents that letters of inquiry addressed to the public, and intended for insertion in this column, must, in all cases, be accompanied by a large envelope legibly directed by the writer to himself, and bearing a 2d. postage stamp, in order that answers received by us may be forwarded to their destination. No notice will be taken of communications which do not comply with these instructions.*

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

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

C. P. A.—*Almost all the principal iron and steel merchants in London will supply the different brands of iron mentioned. For names consult our advertising columns.*

W. H.—*To find the breaking weight for wood beams loaded in the middle, multiply the width in inches by the square of the depth in inches, and divide by the span in feet. Multiply the result by 3 for Riga fir, 4 for red pine, and 5 for English oak. The result is the breaking weight in hundred-weights. Knots weaken beams by an unknown quantity.*

H. P. T.—*For coating the end of the carbon rod you have simply to dip it into the acid solution and connect to the battery in the ordinary way. For the circle and hole in the plate of carbon, bed the latter on clay, and bed a small ring of clay on the top of the carbon. Pour into the hole and ring of clay some of the plating solution, and connect up the terminals in the ordinary way. Consult some work on electro-metallurgy. Gore's book, published by Longman, or the Electro-Metallurgy in Weale's Series, of Crosby Lockwood and Co.*

S. D.—*A rotary engine of the kind you describe with a heavy piston to cause rotation, was patented and made many years ago. It was a complete failure. When running at slow speeds it gave out no power worth having, and when run quickly the centrifugal force held the piston at the end of the cylinder. Nothing can be done with such an engine, unless means can be devised for returning the piston rapidly to the opposite end of the cylinder, which appears to be impossible without producing shocks which quickly break the machine to pieces.*

J. M. (Upperthorpe).—*There is nothing wrong about the rule, which is taken from Mr. Evan Leigh's "The Science of Cotton Spinning." The rule has been derived from actual practice, and you will find, if you make the calculation, that a belt* 11*in. wide and running at* 1800*ft. per minute, will have a pull of* 1375 *lb., or* 144 *lb. per inch of width to sustain. A belt half an inch thick will readily work under these conditions. Your pulley would probably be quite* 10*ft. in diameter to get a lap of* 120*in., and its speed at* 1800*ft. per minute would be only about* 60 *revolutions in the same time. The conditions are therefore rather unusual. By the rule, single belts are supposed to do twice the duty of double belts.*

H. P. T.—(1) *There is no difficulty in calculating the strength of a punching bear, but we have some difficulty in giving you a really approximate rule. You must measure the distance from the centre of effort in the jaws to the centre of the width of the bar. If the bar be of uniform section, then the strain, supposed to be all concentrated at the inner edge of the frame, may be got by dividing half the width of the bar into the length from the centre of effort in the jaws to the middle of the bar. If the quotient be say ten, then* 1 *ton at the jaws will be* 10 *tons on the bar. All the iron is, however, not concentrated at the edge of the frame, and it is the practice to make the inner edge of the bar about three times as wide as the outer edge, just as the bottom flange of a girder is sometimes made of a greater section than the top. As a rough-and-ready rule you may regard the whole strain as one of tension at the place "A" in your sketch, and as concentrated at a point one inch in from the inner edge. The iron should not be submitted to a strain of more than* 7 *tons per square inch under the conditions stated.*

PAINTING CASTINGS.

(To the Editor of The Engineer.)

SIR,—Can any one tell me of a cheap process for covering small castings to save painting? Galvanising leaves such ugly lumps all over them.

Manchester, January 5th. ZETA.

POSTAGE STAMP MACHINES.

(To the Editor of The Engineer.)

SIR,—Will any reader kindly tell me whose machines are now used by the Government contractors in the manufacture of postage stamps, and what are the dates of the patents? B. B.

Halifax, January 10th.

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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.

THE INSTITUTION OF CIVIL ENGINEERS.—Tuesday, Jan. 18th, at 8 p.m.: "Deep Winning of Coal in South Wales," by Messrs. T. F. Brown and G. F. Adams, M. M. Inst. C.E.

THE METEOROLOGICAL SOCIETY.—Wednesday, Jan. 19th, at 7 p.m.: Annual general meeting, when the report of the council will be read, the election of officers and council for the ensuing year will take place, and the president will deliver his address.

SOCIETY OF ARTS.—Wednesday, Jan. 19th, at 8 p.m.: Ordinary meeting, "Causes of Success and Failure in Modern Gold Mining," by Mr. Alfred G. Lock, F.R.G.S. Friday, Jan. 21st, at 8 p.m.: Indian Section, "Forest Conservancy in India," by Sir Richard Temple, Bart., G.C.S.I. Mr. Andrew Cassels will preside.

DEATH.

On the 2nd ult., at sea, off Colombo, Mr. CHARLES HENRY RINGWOOD, C.E., Rungpore, Bengal, aged 39.

THE ENGINEER.

JANUARY 14, 1881.

FACTORY AND WORKSHOP INSPECTION.

ON Saturday afternoon the Home Secretary received a deputation at the Home-office, charged with the expression of the sentiments of a large number of working men who are dissatisfied with the existing arrangements for the Government inspection of workshops and factories. The deputation was introduced to Sir William Harcourt by Mr. Broadhurst, M.P. Its members advocated the appointment of an increased number of inspectors, and that inspectors should be drawn to some considerable extent from the artisan class. Mr. Burt, M.P., and Mr. Macdonald, M.P., supported the deputation by their presence. We note with pleasure that Sir William Harcourt gave a very temperate and statesmanlike reply to the request of the deputation. He pointed out that in the first place more inspectors meant more outlay and expense; and in the second place he warned his hearers against doing anything to augment what may be termed trade friction, or the difficulties against which trade has to struggle in this country; and he concluded by saying that he thought the great artisan class should have its fair number of places in the civil service of the country. He gave no pledge, but he succeeded in dismissing his visitors fairly well pleased with him and with themselves. The latter portion of his reply apparently means nothing. Appointments of all kinds in the Civil Service are now made according to the number of marks obtained by the competing candidates when being examined to ascertain their fitness for the posts they wish to fill; and if artisans, or their children, being of suitable age, can pass the examinations nothing more is required to get into the Civil Service. In a word, Civil Service appointments are as open now to the artisans' children as they are to a duke's progeny, and we fail to see what more Sir William Harcourt or any one else can do; unless indeed a certain number of places are to be filled up from the artisan class without regard to qualifications. If the working man is not now represented in the Civil Service it is simply because his class contains no members who are at once qualified for places in its ranks and willing to join them. It is a pity that Sir William Harcourt did not make this point quite clear, as what he said may raise hopes which can of course never be fulfilled.

The deputation will, however, have done good service in a way not intended, if it directs the attention of employers of labour generally to the whole question; and stimulates them to get rid of some of the burdens with which the present system of Factory Acts and inspection has laden them. It is indisputable that Government inspection has done a great deal of good; but it is well known to dispassionate men that it is in many cases arbitrary in its action, unequal in its incidence, and oppressive in its operation. The great mistake which lies at its root is that it overdoes some things while it leaves others undone. Thus, it permits work to be carried on in low, ill-ventilated, unhealthy workshops, while it prevents a stout healthy lad from working an hour extra a few nights in the month. It prevents women who are old enough to take care of themselves from doing certain classes of work, which are accordingly performed by men, and the women are thus deprived of the chance of earning their own living. But the defects of the Factory Acts and several other enactments of a kindred character are too well known by both artisans and employers to render it necessary that we should cite particular instances of their defects. The law might be rendered intolerable in its operation by lack of judgment on the part of the inspectors. What injudicious or officious Government inspectors may do is well illustrated by the action of the marine department of the Board of Trade in many instances which will suggest themselves to our readers. But on the other hand, most employers of labour know how much they owe to the tact, courtesy, and skill of experienced inspectors, who take enormous trouble to avoid increasing that "friction in the working of the Act" against which Sir William Harcourt warned the deputation. We hold that for the most successful carrying out of the system of Government inspection of all kinds, the inspectors should be carefully selected from classes which have no interests either with employers or employed. Such men are likely to do their duty, which is simply to see the law put in force as pleasantly as possible for all parties. If artisan inspectors were appointed, they could easily bring an amount of oppression to bear on the masters which would render life a burthen; and if artisan inspectors did not do this as a rule, then their mere transfer to a Government office would work a miracle. We feel confident, indeed, that any considerable augmentation of the strain now put on manufacturers would do very great harm, and tend in the long run to injure the artisan as much as the master. Sir William Harcourt's scheme for making the existing inspectors do more work than they do now has at least its plain common sense to recommend it. If the artisans have complaints to make, let them complain to the heads of the trades unions, who will in turn direct the attention of the inspectors to the black spot they have failed to discover; and all this could be done so secretly that the employer must fail to detect the original informer. It is remarkable if this plan has not been extensively acted upon already. We know that in some districts the manufacturer always hears from the Union if he makes a mistake, or breaks the law when his hands do not wish it broken.

In dealing with this question, the men would do well to bear in mind that circumstances are at present adverse to the earning of money with extreme ease. The working men of this country have to compete with the working men of other countries. The fact is known and comprehended in a loose, vague, shadowy kind of way by the British working man who has not been to France, or Belgium, or Germany. It is much to be desired that he should understand it better and more fully than he does. While men in this country clamour for eight hours a-day of work, those with whom they have to compete work contentedly for eleven, twelve, and even fourteen hours a-day, and that at a rate of remuneration which would not half satisfy the English artisan. We recently heard it stated by an engineer, who has gasworks abroad under his control, that the regular pay for gas stokers, skilled men was 4d. per day. We might cite other instances of work done for a franc or a franc and a-half per day in France, and in Germany and Austria for equivalent sums, which would make English fitters and erectors open their eyes. The reply always ready is, "It is quite true that these men get low wages, but they get all they are worth. An Englishmen can do three times as much." This was at one time an excellent argument. It was, moreover, practically true. It was just because one Englishman could do as much work as three Frenchmen that England attained the high position she did. But foreigners have changed all that. Artisans in factories and workshops do comparatively little with their hands now-a-days; and other things being equal, the efficiency of a workshop is measured not by that of its men, but by that of its machine tools, no matter whether those tools are making calico, or cloth, or steam engines. Thus it is that one Englishman has ceased to be a match for more than one Frenchman or German; and as regards skill, it is only necessary to look at the contents of any recent exhibition, as for instance, that of Paris in 1878, to become aware that on this point we have no superlative excellence to boast of. Under these conditions the working man cannot afford to be too particular. He cannot have life made quite smooth for him, and it is very possible that the influence of a paternal Government might operate to take all the bread out of his mouth. We hear even now only too much concerning starving folks who are hungry just because the law will not let them work. We have no doubt whatever that the artisans of Great Britain would hail with delight a Factory Act which should limit the hours of labour to four per day; but they would not be pleased if wages were also reduced one-half. It is very plain, however, that if manufacturers were still to pay full wages and get half-time in return, they must collapse, and with them the whole trade of the nation. Of course we shall be told that so preposterous a state of affairs could never come about. This may be quite true; but we have not the artisan to thank. We do not advocate long hours of labour. It would probably be a good thing if every man could earn as much money as would keep himself and his family in great comfort by working for four hours only per day. But the thing cannot be done, and all attempts on the part of Government to force the practice of trade into grooves which it cannot fit, by mere force of law must end in disappointment. The artisan cannot have his loaf and eat it. He cannot have short hours and divers other delights, and high pay at the same time, simply because other working men in other countries will not let him. A direct and forcible proof of the helplessness of legislation to operate against economic laws is afforded by the Employers' Liability Act, which promises to be in a large number of cases a dead letter. As regards miners especially we find them contracting themselves out of the Act by the thousand. They incur a certain risk; this risk is reduced by the operation of the Act, and the immediate tendency is to reduce wages. But the men favour the high wages and the risk. Again, it is well-known that dry-grinding is one of the most unhealthy trades in existence. The particles of grit from the stone are inhaled, and "grinders' asthma" carries off its victims at early ages by the score. Several years ago a fan was introduced in some Sheffield grinderies to carry off the dust; grinding was rendered more healthy, and wages at once fell. The grinders all struck and the fans had to be taken away. What we wish to enforce from such facts is, that the more the British working man is protected and coddled by Government, the less will be the wages which the employer can afford to pay him. The appointment of a large number of inspectors drawn from the artisan class would, we have no doubt, lead at once to the setting up of a great deal of attrition, and would so hamper the manufacturers in various branches of trade, that they could no longer carry on their business with profit. We agree with the Home Secretary in thinking we have inspectors enough. They are, taken as a body, gentlemen of intelligence, tact, education, and experience. They have discharged very difficult functions wisely and well, and at the present moment, if there be any ground for complaint, it is that factories and workshops are rather too much than too little inspected. The deputation to Sir William Harcourt admitted that with large establishments they had little fault to find. We advise those whose desires the deputation advocated, to act on the Home Secretary's advice, and inspect for themselves. Let the Unions be told of all cases of wrong-doing, and instruct the Government inspector accordingly. Is it too much to expect this from a Union?

THE LOCOMOTIVE OF THE FUTURE.

WE publish this week two letters, neither of them written by Englishmen, which deserve attention. One takes an American view of the matter, the other expresses what may be regarded as peculiarly French notions on the points discussed. From each something may be learned. Neither of our correspondents is quite contented with locomotives as they are; each wishes to see improvements adopted. No doubt this very accurately expresses the sentiments of English locomotive superintendents, and the locomotive engine is possibly as much in a state of change now as it has ever been. We do not propose to consider here what the locomotive of the future which will be built to work steep inclines may be like, but rather to consider what changes and alterations in construction time may work in the design and construction of locomotives intended to work fast traffic on our great main lines. So far as is known, the engines now working every class of traffic on the Great Northern, Midland, London and North-Western, &c. &c., lines are satisfactory, and do their duty well and economically, and it will generally be found that changes in pattern or type are made more to

meet changes in the character of the traffic to be worked than for any other reason.

To make this point clear—and it is highly desirable that it should be very clear—let us assume that all the demands made on a railway by a certain district can be accommodated by trains of ten carriages. The line we shall suppose is fairly laid, and the speed is to be pretty high. Engines with 16in. cylinders, 22in. stroke, and four-coupled 6ft. wheels are employed, and do their work very well indeed. By degrees the district grows in importance, and coach after coach is added to the trains, until at last the ten carriages have become fifteen or sixteen. Then the engines begin to stagger under loads too great for them; time is maintained with difficulty; it puzzles the firemen to keep steam; complaints are heard from the public; the strain begins to tell on the constitutions of the engines; and it is clear that something bigger must be put on the road. At this point we encounter the idiosyncracy of locomotive superintendents. One man will believe that there can be no further increase in the weight of trains, and builds engines with a little more boiler power, and 17 by 22 cylinders, and 6ft. 6in. wheels. These engines grapple with the sixteen-coach trains, and keep time successfully. If no further augmentation in the weight of the trains takes place, there is no room for complaint. Another superintendent determines in his own mind that the traffic must increase, and that it must be met in advance. So he jumps at once from 16in. to 18in. cylinders, and adopts a 7ft. wheel and a 26in. stroke, and a big boiler. Such an engine well designed means twenty coaches and sixty miles an hour. If the traffic does not develope enough to require trains of twenty coaches, to be run at sixty miles an hour, then a mistake has been made, and too big an engine has been built. Such mistakes are no doubt made now and then; but whether or not, the fact remains that the existing or anticipated growth of traffic is responsible for most of the changes made in locomotive design from year to year.

Before we can attempt, therefore, to indicate what the locomotive of the future will be, we must know what the conditions of traffic on our great lines are likely to be, and on this point it is very difficult to speak with certainty. We have no hesitation in saying that the desire of the public is, on the whole, for faster trains than are run now. It is true that from time to time protests appear in the columns of the daily press against quick trains; but it is well known that of two rival lines that which runs the fastest trains gets the most traffic. The general public refuse, and properly refuse, to believe that fast trains must be more dangerous than slow, and so they travel as fast as they can. Up to the present time quick travelling means long continuous runs, and it is by no means impossible that at some future period trains will be run from York, or Leeds, to London without a stop. There is nothing impossible in making such a run at an average velocity of fifty-five miles an hour, and this would bring Leeds within about three and a-half hours of London, while the time from York to London would be a little more. It is quite practicable to do this work now with many engines on either the Midland or the Great Northern lines, but not with the existing tenders. At such speeds, and with heavy trains, the consumption of water cannot be less than twenty-five gallons a mile, or thereabouts. For a run of 180 miles this represents 4500 gallons, and for a run of 200 miles 5000 gallons, weighing over 22 tons. Coal at 30 lb. a mile will weigh, say, 3 tons, allowing a little for contingencies. Together then we have 25 tons of water and coal. The tender to carry this will weigh at least 20 tons empty. Here, then, we have a 45-ton tender and, say, a 35-ton engine. It would, we think, hardly be found desirable to adopt this system. At the present moment it is pretty certain that we have reached a maximum beyond which it is not advisable to go in the 32 or 33-ton tenders used by Mr. Johnson on the Midland Railway. It may be asked, what has all this about tenders to do with engines? We shall show presently that it has a great deal to do with them.

We quite agree with our correspondents that a large fire-box is essential to a powerful locomotive, and it is also certain that very great difficulties are met with in getting in this big box when coupled drivers and inside cylinders are combined. A fire-box may be made large either by augmenting its length or by increasing its width. The latter expedient can only be adopted by putting the grate over the trailing wheels, as in the Wootten box. If, however, we increase the length of the fire-box we must increase the length of the side coupling rods, or else put the trailing axle under the grate. This last is a very favourite device with French engineers. To get a grate with 22 square feet of surface into a locomotive with four coupled drivers is no joke. The maximum width of the grate will be 3ft. 3in., and its length must therefore be about 6ft. 10in.; but this will throw the axles apart by a distance of 9ft. 6in. at the very least, and this represents a very long coupling rod. The difficulty may perhaps be solved in a different way. With English or Welsh coal a large grate is not absolutely essential. What is wanted is a large fire-box. A grate with an area of say 10 square feet might be provided, which grate shall be perfectly horizontal. From that will slope up to the rear a water-space, say 4in. deep. This may be carried over the rear axle without any difficulty, and may be made on two different inclines, which a grate cannot well be. A flooring of fire-tiles may be laid on the upper plate of this water-space to protect it from the fire if necessary. The coal charged down this plate on to the grate below would be very much as though in a gas furnace, and the brick arch above, and the deflector in the fire-door, in the usual way, would render the combustion of the gas evolved very complete. It will be seen at a glance that this scheme is only a development of the water-bottom fire-box used by Mr. Webb in his new engines. As with this arrangement all the depth which is now occupied by the grate-bars and ash-pan would be saved, and we should have in their place only a water bottom 4in. deep or so, there would be no difficulty in getting a very large fire-box, combined with driving wheels of moderate diameter—say 6ft. 6in.—short coupling rods, and inside cylinders. The leading end of this engine may be carried on a four-wheeled bogie or not, according to the character of the road. Retaining the general features of the gas furnace fire-box, four coupled wheels, and inside cylinders, we have now two alternative designs to consider. We have seen that it is out of the question to try to carry water enough for a 200 mile run in a tender. But there is ready to every one's hand a simple, satisfactory, and cheap way out of the difficulty. Let Ramsbottom's troughs be laid down, and let the engines pick up water as they run. It is unnecessary to say a word in praise of these troughs. Their use is rapidly extending over the whole London and North-Western system. All the patents connected with them have, we believe, long since expired, and their use is open to the whole world. If this plan be adopted then the tender may be a very small one; a tender with four wheels, and capable of carrying 1000 gallons of water and 3 tons of coal would suffice, and the engine would thus be relieved at once of a very heavy unpaying load. But the other alternative may be found better still. Let the engine be carried on eight wheels, the first or leading pair to be fitted in the usual way. Next would come four coupled drivers, and lastly a pair of trailing wheels with, say, Bridges Adams' patent axle boxes or a Bissel truck. We should thus have an eight-wheeled tank engine, and there is no good reason to doubt that it would run very steadily at high speeds—possibly more steadily than any tender engine.

Much more may be said concerning the locomotive of the future. It is impossible, indeed, within the limits of a single article to do more than throw out certain hints concerning its design. Indeed our principal object in writing on a subject which we hope to see well discussed by our correspondents, is to enforce the doctrine that the designing of the locomotive of the future must be mainly determined by the nature of the work which it will be expected to perform, a fact which we fear our readers may overlook. Nothing is more easily met with among young mechanical engineers than designs for locomotive engines, which are intended to secure this, that, or the other object, a total disregard being paid the while for the conditions under which the engine will live. At one time engineers were content to design "good all round" engines, but this practice has long been given up, and the most eminent men, both in this country and abroad, always design each type of locomotive with special regard for the conditions under which it will work. Our younger readers, to whom the designing of locomotives is a tempting exercise, will do well to bear this fact in mind.

APPOINTMENT OF CITY ENGINEER IN CORK.

Some weeks ago an advertisement appeared in the principal newspapers and engineering journals in the kingdom, intimating that the Corporation of Cork required an engineer, and announcing its intention of having an examination held, for the purpose of testing the relative merits of the different candidates. The names of the gentlemen appointed to examine, viz.: Alexander Jack, M.A., Professor of Engineering, Queen's College, Cork; Phillip Barry, C.E., Harbour Engineer, Cork; and S. A. Kerkley, M.A. Cantab, county surveyor, Cork, were given and appeared to be a sort of guarantee that everything would be fair and above board. The general impression was, that the Corporation of Cork had determined to adopt the recommendations of the recent Royal Commission, appointed to inquire into Municipal Government in Ireland, and having, by examination obtained the best man, appoint him to this important office. On the 5th and 6th November, the days appointed, eleven candidates presented themselves for examination, and on the 10th November, the examiners' report was published and stated that seven of the candidates had qualified, and that the first three, viz.: Messrs. Horan, Lynam, and Moynan were specially fit on account of superior ability and extended knowledge. It will be thought that the Corporation chose one of the first three, but it did nothing of the kind. Several members publicly announced that they did not intend to be influenced by the report but intended to elect a local man who stood last but one on the list; thinking, however, to justify their action in the eyes of the citizens of Cork, they passed a resolution asking for a detailed list of the marks of each candidate, in the hopes, as was publicly stated by members in the Council, that the local man would show out favourably in the more important subjects of examination, *i.e.*, architecture, roads, bridge construction, materials, waterworks, and sewerage. Accordingly on the 20th November the examiners published a supplemental report giving the names of the candidates in order of merit as follows:—J. O. Moynan, 275½; P. Lynam, 253; J. Horan, 236; No. 4, No. 5, No. 6, and M. J. McMullen, 155. Notwithstanding this report, and editorial admonitions from papers of every phase of politics, when the matter came to a division, twenty-three members of Council voted for Mr. Moynan, and twenty-three for Mr. McMullen, the Mayor then gave his casting vote to the last-named gentleman, and the friends of the local man had the satisfaction of seeing him elected, though he stood last on the list, and over 120 marks below the first. This election has raised a perfect storm of indignation in Cork, having been carried out in opposition to the opinion of the majority of the ratepayers. Two memorials have already been presented to the Lord-Lieutenant, asking him to withhold his sanction to the appointment, and to grant an inquiry into the whole transaction. Meetings of the ratepayers have also been held protesting against it in the most emphatic manner, both on account of the presumptive injury to the inhabitants of Cork, and the great hardship and injustice of bringing men from all parts of the kingdom, to remain some time in Cork undergoing a severe examination, and having their names and relative inferiorities paraded before the public day after day, when all along the result was a foregone conclusion. The following is the exact report of the examiners: "We beg to report that we have, in compliance with the instructions of the Council, held an examination of the Candidates for the office of City Engineer and Surveyor, on Friday and Saturday, 5th and 6th inst., in the Court-house. The examination occupied six hours each day. Eleven Candidates presented themselves for examination on Friday morning. One of these subsequently requested that his name be withdrawn, and the remaining ten completed the examination. We have also carefully scrutinised the testimonials submitted by them. Of the ten candidates examined, we consider the following seven, namely, John Horan, P. Lynam, J. O. B. Moynam, equal; W. H. Warren, W. Atkins, M. J. McMullen, and F. J. Joyce, are fairly qualified for the office with regard to their professional knowledge, past experience, and general competence and efficiency, and that of these the first three on the list have given evidence of superior ability and extended knowledge."

THE NEW FORTY-THREE TON BREECH-LOADING GUN.

The heavy breech-loading gun now in course of its departmental trials in the Royal Gun Factories naturally excites much interest, being the first breech-loader in our service larger than the old Armstrong 7in. guns, which fired shot weighing 110 lb. with considerable difficulty, and were eventually supplied with shells under 100 lb. in weight. The new gun weighs about 43 tons. Its calibre is 12in., and its length of bore about 26 calibres—the whole gun being about 29ft. long. The method of closing the breech is the same as that adopted in the new field breech-loading guns, except that lever and screw power is applied to the closing and locking of the breech. In general appearance, proportions, and character, the gun closely resembles the 9·2in. breech-loading Woolwich gun depicted in The Engineer of June 25, 1880. The new armour-clad vessels Colossus and Majestic will each, we believe, carry four of this description of gun, mounted in two turrets, arranged similarly to those of the Inflexible, which vessel they will closely resemble. They are to be 5ft. longer and 7ft. narrower, and are to be made of steel, with compound armour 16in. thick. For a full description the reader is referred to King's "War Ships," new edition. Up to the present time the gun in question has not been the subject of any public trial, being, as we have said, in the course of undergoing its early proofs in the hands of Colonel Maitland, the Superintendent of the Gun Factories. In this stage it is impossible to give full detailed information. We think, however, that we can supply what is sufficiently near for all practical purposes. The gun was fired on Thursday, January 6th, with about 280 lb. of prismatic powder, which, with a projectile weighing 703 lb., gave an initial velocity of about 1830ft. per second. The charge is being gradually increased — the pressure in the bore being as yet only about 16 tons on the square inch. Taking it in its present condition, however, the gun is a very powerful weapon, having about 16,330 foot-tons stored-up work, or 435 foot-tons per inch circumference, which means a penetration of from 22in. to 23in.—on the service system of calculation, nearly 25in. This is the class of gun we have before commended as likely to be useful in future times. It is capable of piercing wrought iron of the thickness of the armour employed on the Duilio. As a matter of fact, the plates of that ship are steel, so that they could not be penetrated, but must be destroyed by racking. For its size, the racking power of the 43-ton gun is very great. The 35 ton was of the same calibre, it had 8203 foot-tons stored-up work, a penetrating figure of 219·06 foot-tons, and about 16in. penetration. Thus, for 8 tons increased weight the new gun nearly doubles the quantity of stored-up work and the penetrating figure. We must not blink the fact that 29ft. is a length of gun involving special allowance in the turret and deck. The maximum width of both the Colossus and Majestic is 68ft. The power of this piece then is very great, and we have not yet reached the maximum development. On the most recent trials a velocity of 1930ft. was obtained with 300 lb. of powder, and a pressure of 19 tons on the square inch.

CLEVELAND IRON SLIDING SCALE.

The returns of the accountant employed to ascertain the realised price of Cleveland pig iron have been published for the quarter ending with December last. They show that that price was 4065·52d. per ton, a fall from 40610·95d. per ton in the previous quarter. It is evident in the first place that the realised price has only slowly followed the descent of the market prices, for since June there has only been a declension of about 2d. per ton from the comparatively high realised rate that was then declared. In the time of the rise caused by the demand for iron for the United States, the realised price lagged behind the rising market price and the workmen failed to receive any large proportion of that apparent increase in prices. But in the latter part of last year when the market price had rapidly fallen, it is shown that the realised price lagged behind also, and thus the benefit the workmen are now receiving—a benefit in the maintenance of comparatively high wages—is that which was postponed from last year by the fact that the realised rate follows rather than accompanies the market price, and there is the further testimony that whilst on the one hand the realised prices did not show that makers were receiving many orders at the high prices that prevailed in the market a year ago, so now it is evident that the average price they have been receiving for the past quarter has been above the low rate that prevailed in the market during the greater part of the three months. Remembering that the sliding scale turns on the realised price for one of the lower qualities of pig iron, and that not only is there a proportion of higher priced Cleveland pig made, but also that some of the makers are producing hematite iron in some degree, it may be said that the pig iron trade in the Cleveland and Durham district has shown a greater tendency towards profitable working in the past few months than could at one time have been supposed probable from the low prices that were quoted in the market during a considerable part of that time. This is the more important, inasmuch as the ultimate determination of a healthy state of trade is not the extent of the production nor even the price obtained; but whether or not that production is at a profit when the iron is sold. In the crude iron trade, for a long time there was a production of crude iron at a loss, and it was to this that we have to attribute the serious calamities that befel the pig iron trade in the north. It is gratifying to notice that there are in these authentic returns the signs that a more healthy state of things has been brought about. It is true that the price that has been named as that for the past quarter is a low one—by itself it would not allow of a profit to the producer of Cleveland pig iron, except in cases where unusual advantages were enjoyed. But with the qualifications that have been referred to, and bearing in mind the low prices of materials and the low rates of wages that still prevail, there is ground to believe that the vast output of pig iron in the Cleveland and Durham district is produced without loss and in the majority of instances probably with a small but increasing profit to the producer.

THE COLLIERY RIOTS IN LANCASHIRE.

Is the British workman to be permitted to work, or is he not? This seems to be the question at issue in the Lancashire colliery districts. In the Ashton district the miners want an advance of 12½ per cent.; in the Oldham district an increase of 2d. in the shilling. A refusal to comply with these demands led to a strike of 14,000 miners, who immediately took to holding public meetings and passing resolutions declining to contract themselves out of the Employers' Liability Act. Had they confined themselves to meetings *en masse* and moving motions, nobody could have objected; but the meeting was followed by marching to the pits of Messrs. A. Knowles and Sons, Limited, where, it seems, the men had the bad taste to prefer labour to laziness. Messrs. Knowles's men, it appears, have

formed an Accident Relief Society among themselves; and their free and dependent brethren, resenting this liberty of action, took the first opportunity of expressing their resentment in a most practical fashion. Assembling to the number of 15,000 men and boys, they formed a procession a mile and a-half long, and proceeded to the pits where the offending colliers were at work. Agecroft Colliery, Pendleton, was first visited. There the men were imperiously required to come up out of the pit. Their summons being disregarded, they overturned wagons, pulled up rails, broke all the tools and implements they could lay their hands on, and the ringleaders finished by threatening to cut the winding-ropes if their orders were not obeyed. Inspector Kelly and a staff of police arrived in time to prevent this threat being carried out. Visits were made to other collieries, and a very successful effort made to establish an industrial reign of terror. Lancashire and other colliers should be considerate. We have Ireland on our hands at present, and cannot well spare attention to a wave of outrage in England also.

LITERATURE.

Aid to Survey Practice, for Reference in Surveying, Levelling, and Setting Out; and in Route Surveys of Travellers by Land and Sea. With tables, illustrations, and records. By LOWIS D'A. JACKSON., A.M.I.C.E. London: Crosby Lockwood and Co. 1880.

IF we were to say that this book is what its title indicates we should reduce to the shortest form a notice of a book that is satisfactory throughout. The object of the author has been to give in one volume that which could previously only be found in several. He does not make the book a catalogue of measuring instruments by illustrating and describing these. He is thus able to give in the space that would be so occupied, more minute attention to the careful discussion of various methods of surveying, levelling, and setting out. The methods of adjustment of instruments are described, but those descriptions which are chiefly useful rather to the designer of instruments than the surveyor are avoided. Those are intend to practice the arts with which the book deals must have instruments and generally the assistance at first of an instructor, and may thus learn in an hour or two all that can be taught by long descriptions. These descriptions are thus advisedly omitted. The book is necessarily to a considerable extent a compilation; but it has a freshness which shows that, though an account of known methods, it is not a simple reprint of these. They are clearly described, and modern modifications and new formulæ applicable in practice systematically set forth. The book, it must be remarked, is not suitable for the beginner who has no knowledge of the rudimentary principles which underlie the work of surveying and levelling. Having acquired these, however, he will find Mr. Jackson's book an efficient aid, not only from the commencement of field practice, but afterwards when engaged on different branches of survey practice. The several methods of setting out curves commonly known are supplemented by the author's polygonal systems, by which a circular curve is obtained, and by which the long offsetts occasionally involved in the use of Baker's and Kroehnke's tangential systems are avoided. The Baker system has the advantage of great simplicity, and requires but few figures for use in the field. Both these systems, however, produce a parabolic curve, which is sometimes not desired; but on curves of small versine the departure from a true circular curve is so small that it is not often of any practical importance. For railway curves there are, moreover, several reasons for preferring the parabolic curve, although in this country circular curves are generally considered best and intended to be used, though in practice they are not, perhaps, always truly set out. The equi-distant polygonal system devised by the author is not less, or very little less, simple than the others in the mechanical work, but a table of constants for second and succeeding tangents is necessary.

A large number of plates illustrative of field records accompanies the volume, and other plates illustrating chain surveying in town and country, theodolite triangulation, and traverse surveys; catchment areas, hill contouring and sketching, eight days' course at sea, and hypsometrical observations. As a book for reference it is in every way satisfactory except in the paper it is printed upon, and this is much too thick and stiff. The paper should have been much thinner, which it might be without sacrificing strength, and the book might have occupied much less space and been more convenient to use. The use of thick stiff paper for small books has become far too common. Surely publishers do not think purchasers estimate the real value of a book by its thickness or weight.

BOOKS RECEIVED.

Journal Iron and Steel Institute. 1880. No. 2. London: E. and F. N. Spon.

Proceedings of the Mechanical Engineers. 1880. No. 3. Published by the Institution.

A Treatise on the Locomotive in Theory, History, and Practice, for the Use of the Marathia Speaking employés in the India Railway Department. By Vishnu Chimnaji Karve. New Edition. Bombay: At the *Indu Prakesh* Press.

The Scientific English Reader. Englisches Naturwissen-schaftlich-technisches Lesebuch. Von Dr. F. J. Wershoven, 11, Teil Maschinentechnick und Mechanische Technologie. Leipzig: F. A. Brockhaus.

The Stock Exchange Year-Book for 1881. A digest of information relating to the origin, history, and present position of each of the Joint Stock Companies and Public Securities known to the markets of the United Kingdom, to which is added a variety of miscellaneous matter. By Thomas Skinner. Seventh year. London: Cassell, Petter, and Galpin.

Dickens' Dictionary of Days. An everyday record of 1880, with calendar and useful information for 1881. London: Charles Dickens.

Street's Indian and Colonial Mercantile Directory for 1880-1. London: G. Street and Co., Cornhill.

The Gas Engineers' Diary and Text Book for 1881. Comprising a complete Business Diary for the year, together with a Directory of Gas Companies of Great Britain and Ireland, and a Directory of Foreign Gas Companies, and original articles on Gas Manufacture and Apparatus. Edited by G. E. Wright and W. S. Mason. Second year. Birmingham: Offices of the *Gas Engineer.*

How to Manage a Steam Engine. By M. Powis Bale, M.I.M.E. London: Wyman and Sons.

Rules for Engine Drivers. Mounted sheet. By M. Powis Bale. London: Wyman and Sons.

Ward and Lock's Self-culture for All. Part 3. Illustrated. London: Ward and Lock.

BOILER INSURANCE AND INSPECTION.

AT the usual monthly meeting of the Board of Directors of the Boiler Insurance and Steam Power Company, Manchester, the chief engineer, Mr. M'Dougall, reported that the past year, like the preceding one, had been remarkable for the absence of explosions among the boilers insured and inspected by the company. It appeared from the records that up to the end of 1878 the average annual rate of explosions among the boilers insured had amounted to one in 5197. Last year, however, although over 20,000 boilers had been under the supervision of the company, being about one-fifth of the estimated number of stationary boilers in use in the whole of the United Kingdom, only one serious collapse of flue had occurred, and not one explosion, fatal or non-fatal, for which the company were liable had taken place. An experiment which had been made since the board last met had thrown considerable light upon the cause of the explosion of a Rastrick boiler which had been accepted for insurance for £1000, but which had exploded before the owners had conformed to the conditions imposed by the company, and before the policy of insurance had been delivered. It was conclusively proved at the inquiry that the boiler was being worked at from 40 to 50 per cent. above the stipulated pressure, the estimated factor of safety being thus reduced from 4 to about 2·7. An old and patched boiler of this type could not be worked with safety with so low a margin of strength, and the overloading of the safety valves had, without doubt, materially contributed to the explosion. The acceptance of the insurance was also thus rendered void. The immediate cause of the accident being, however, not clear, and there having been evidence that the strength and ductility of the plates had been reduced at the moment of explosion by overheating, a donation of £500 was made to the owners of the boiler after the conclusion of the inquiry in order partly to cover the expense of experimenting upon a boiler of like age and dimensions to the exploded one, and which in the most praiseworthy spirit the firm, notwithstanding the heavy losses to which the explosion had put them, decided to burst by hydraulic pressure with a view of throwing light upon the cause of the explosion. The result of the final experiment, which took place on the 14th ult., was that the shell gave way at a part which had been injured in removing the boiler from its seating, the pressure sustained being between 115 lb. and 120 lb. The working pressure stipulated by the company had been 30 lb., and this experiment, with other facts which have transpired since the inquiry, and which will be detailed in due course in the chief engineer's annual report, had gone far to establish the accuracy of the view that the strength of the plates of the boiler had become reduced from overheating at the time the accident occurred. Mr. M'Dougall further reported that he had paid special attention during the past year to obtaining thorough examination of the boilers insured or under inspection, more especially of those which had been allowed to remain for considerable periods without such an examination being made by the company's officers. He had thus succeeded in obtaining 11,503 thorough inspections and 1421 internal examinations, being by far a greater number than obtained in any previous year. Following also the Admiralty practice, he had begun to substitute hydraulic tests for the manual examinations in the case of boilers which were not properly accessible for thorough inspection, and 147 tests had been made in addition to the thorough and internal inspections. The following is a summary of the principal defects discovered in the course of these examinations:—Corrosion of plates and angle irons, 1769; fracture of plates and angle irons, 397; safety valves out of order or overloaded, 1279; pressure gauges out of order, 588; water gauges out of order or fixed too low, 327; boilers damaged by overheating in consequence of deposit, 34; boilers damaged by overheating in consequence of deficiency of water, 65. A large number of the above defects were of a decidedly dangerous character, and would without doubt have led to serious and possibly fatal accidents if they had remained undiscovered. Improvements in dealing with so vast a business must necessarily be gradual, but he hoped to be able soon to report further progress both in regard to thorough examinations and other matters which had been receiving his anxious attention. That the value of boiler insurance and independent inspection was increasing in public estimation, so far at all events as this company was concerned, was evident from the fact that the number of proposals for insurance this year had considerably exceeded the number obtained in any previous year since the origination of the company. The number of boilers proposed for insurance had amounted to 2985, being an advance of 840 over the previous year, and 1015 over 1878. These figures are very striking in view of the fact that three new boiler insurance companies had recently commenced operations, the competition during the year having thus been exceptionally keen.

BREWING IN ENGLAND.

No. I.

WE have explained pretty fully the practice of a very important branch of the brewing trade of the world. We now propose to notice at some length the practice of modern English brewing, with special regard for the plant employed. The light beers, which are the chief productions of the Austrian brewers, whose methods and plant we have recently described, have not yet found much support from English brewers, though a not inconsiderable quantity of such beer is imported into this country. Modern improvements, changes, and necessities may, however alter this. We do not propose to dwell on the means of making these beers with existing arrangement and plant, but to describe some modern practice in design, and some of the changes in plant which are proposed to meet new laws and regulations.

We give this month some illustrations that will prove of interest, we believe, to many of our readers. The late alteration in fiscal law has practically facilitated the use of raw in place of malted grain in the production of beer, and the sketch of new mashing plant we publish will enable our readers to see, after perusal of what follows, that the employment of raw grain within certain limits presents no difficulties to the practical brewer. We understand that this special arrangement has been suggested by Mr. Frank Faulkner, the author of several works in connection with brewing, and who has also had a good deal of continental experience in so far as the use of raw material is concerned. The design of the brewery we illustrate on page 34 is based upon the following amongst other considerations. Malted grain contains an excess of diastatic power, that is a capacity of causing starch under certain conditions of temperature and fluidity to split up into malt sugar and dextrine, and as a consequence a proportion of raw material in the shape of maize, rice, or barley flour can be employed with malted grain, with the certainty of arriving at complete conversion of the starch of the raw meal, so long as such starch be first brought into a soluble condition. This process is carried on in the saccharification vessel, which is practically a cylindrical steam jacketted boiler, the interior surface perfectly smooth, the vessel itself being capable of withstanding considerable pressure. We say this since it is well known that pressure is a most influential factor in diastatic changes, and has an influence we cannot now, however, enlarge upon. Into this vessel the meal, mixed with an equal weight of malted grain, is run with sufficient water at a temperature capable of giving initially a mixture at 140 deg. After standing forty-five minutes the steam is put on while the internal rake machinery is put in motion, so that the whole mass is gradually raised to the boiling point, below which temperature, however, the starch becomes entirely soluble. It will be seen that during the first hour the proportion of malted grain acts as energetically as possible on the starch of the meal; after this the unaltered starch is rendered soluble by the rise of temperature. In this way the raw grain is fitted for admixture with the larger proportion of malted grain in the mash tun below, and we are assured that the conversion that results is perfectly satisfactory. When we say that fine maize meal free from husks can be bought for 8s. or 9s. per cwt., while 320 lb. of malt costs about 45s., the advantage of using a portion of raw material is at once apparent, and we are assured that if properly prepared for admixture with malted grain mashed under ordinary conditions, a wort is obtained from the entire mixture differing but slightly from the malt wort of the past. In the illustration we see the saccharification vessel, commanded by the meal and malt hoppers, in connection with the mixing machine, through which the mash of raw meal and malt passes to so-called converter. In this, submitted to certain ranges of temperature, with constant stirring to prevent any settlement and consequent burning, the partial modification and complete solution of starch results, and the meal mixture then passes to the ordinary mash tun below to be intermingled with the malt mash at a converting temperature. This cylindrical saccharification vessel answers also most admirably for the treatment of matters that are of stubborn and sticky character—grain, indeed, that has to be stewed and cooked before it will yield its extract in perfect form.

In connection with this new mash tun room arrangement, the illustration shows a sugar inversion vessel, used as follows. Cane sugar itself is incapable of undergoing fermentation. If used in brewing it undergoes inversion, that is, change into a fermentable variety at the expense of the yeast plant. A similar inversion takes place when an acidulated solution of the cane sugar is boiled for an hour or so. This is accomplished in a wooden vessel lined with sheet copper and fitted with copper steam coil. When the inversion is complete, the acidity of solution is neutralised, the insoluble salt formed filtered off, and the clear syrup mixed with the worts from the mash tun. This is, of course, but a mere outline of the process, for there are many practical details in connection with the necessary filtration that we cannot do more than refer to at the present moment, but we are convinced that brewers will only be consulting their own interests in giving attention to the suggestions made by Mr. Faulkner, whose writings on the subject are exemplified in the present illustrations of Messrs. Wilson's plant.

In the elevation on page 34 a position is shown, marked 25, for a machine for producing a supply of cold air, the working principle of which is that of compressing, cooling, and expanding air by which, as is known, intense cold is produced. Messrs. Wilson suggest that this cold air may with advantage be passed into store rooms of breweries, so as to render the storage of stock beer during the summer months less trying to a fluid which from its constitution is naturally somewhat unstable. The cooled air may also be used with great advantage in fermenting and settling tank rooms. The machine is simple, and, comparatively speaking, inexpensive.

In the longitudinal sectional elevation of the brewery on page 34, the principal details of the plant and building are numbered:—1, is the granary; 2, the screw for conveying grain to the hoppers; 3, mills for grinding grain; 4, screw conveying meal to elevator; 5, meal elevator; 6, screw conveying meal to mixing floor; 7, malt mill and elevator to grist case; 8, mash tun and steel masher with rake machine; 9, outside masher for raw grain; 10, saccharification vessel; 11, sugar inversion vessel with block tin coil; 12, cold liquor back; 12a, hot liquor back; 13, underback back; 14, copper; 15, hop back; 16, compound steam engine; 17, steam boilers; 18, hot liquor back; 19, wort receiver; 20, refrigerator; 21, fermenting rounds; 22, settlers; 23, travelling crane for stacking casks in cellar; 24, cask lifting and lowering machine; 25, air refrigerating machine for cellars.

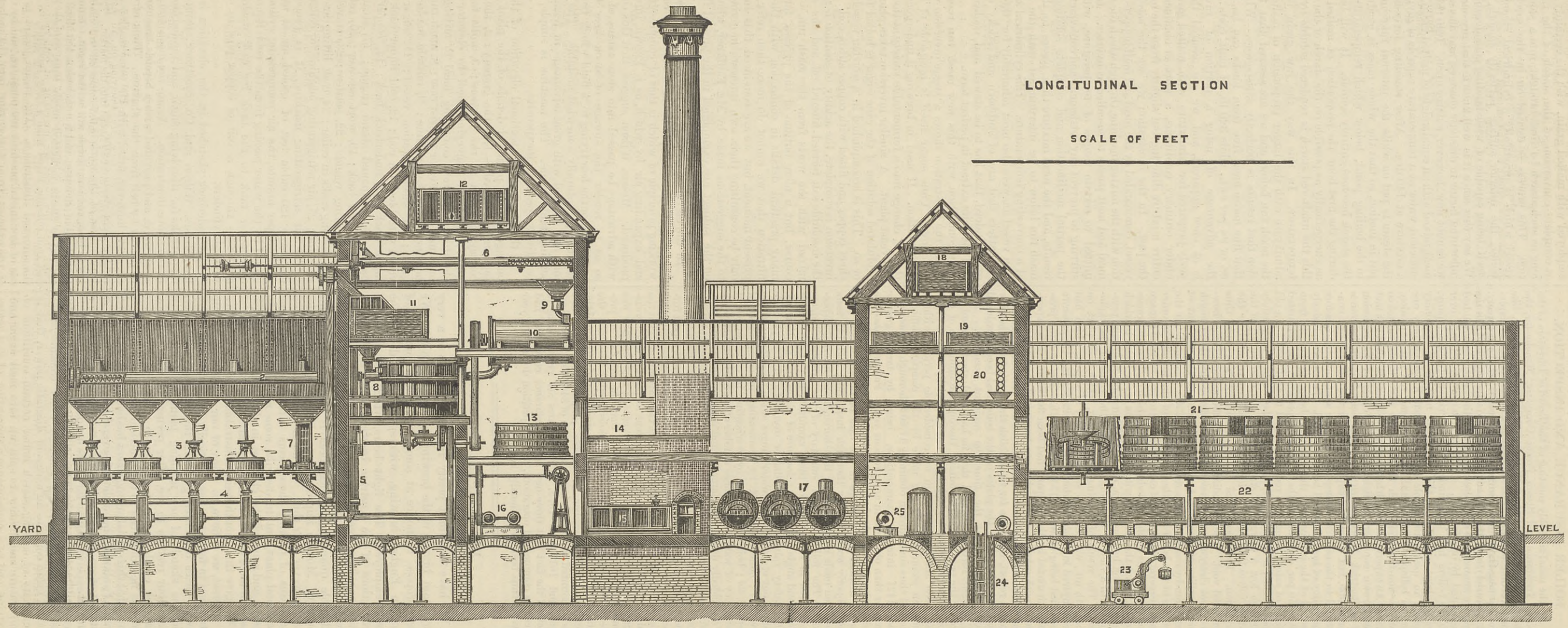
The air refrigerating machine, it is proposed, shall discharge 120 cubic feet of cooled air at atmospheric pressure per minute, the air compressing cylinders being cooled by the water passing from the cold liquor back or cold water tank to the tank for cask washing. The air passes through a coil of copper pipe in one of the vertical cylinders.

The underback sketched in the elevation is of wood, but Messrs. Wilson and Co. construct steam jacketted underbacks for dissolving sugar and saccharum as shown in the above illustration. Again, the mash tun is shown as of wood, and provided with a Steele's masher fitted to be driven by belt from the shafting. Tuns of this same class are, however, fitted with the same masher driven by independent steam engine, as shown above. In breweries where most of the work is done by steam, or where shafting is inconvenient, there are advantages connected with this mode of driving, and for this reason it has also been applied to steam jacketted mash tuns, copper inside and cast iron outside, fitted with a rake machine, as shown in the annexed illustration. The steam jacket permits the use of low initial mashing temperature, and by circulation of the exhaust from the engine into the jacket the temperature is gradually raised. A steam pipe is also fitted

PROPOSED ARRANGEMENT OF BREWERY WITH RAW GRAIN PLANT.

MESSRS. WILSON AND CO., FROME, ENGINEERS.

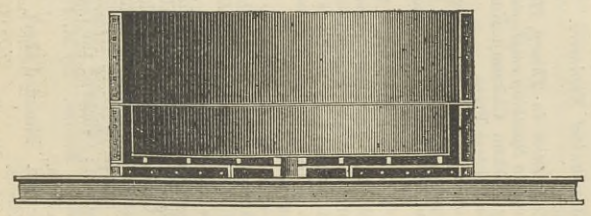
(*For description see next page.*)



direct to jacket. The wood hot liquor backs are sometimes fitted with a rouser, as shown in the annexed Fig. 5 to insure an even temperature of mashing liquor, when it is difficult, owing to position to rouse it in the ordinary manner.

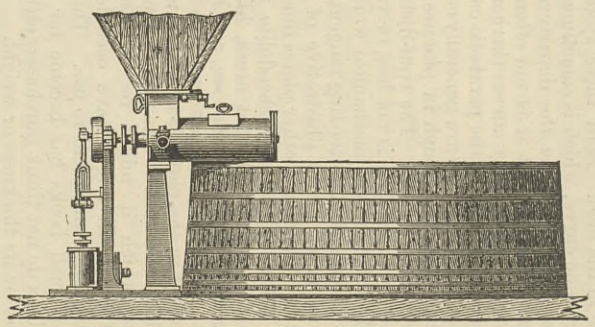
The woodcut Fig. 6 shows a combined rouser and attemperator. This machine is based upon Faulkner's system of

Fig. 2.



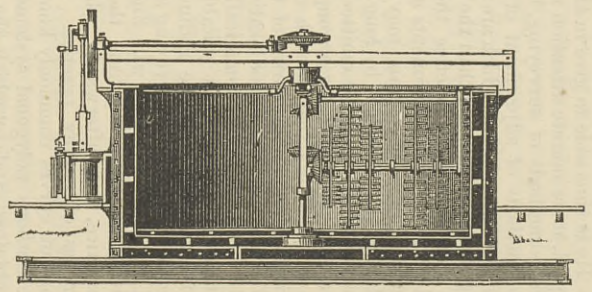
rousing during fermentation. The attemperator is made to vibrate upon a rocking shaft by means of an excentric or small crank. It can be worked either by hand or steam power. The attemperator is made in the form of an upright refrigerator, and being submerged in the middle of the mass of beer, is very powerful in regulating the fermentation. The sides of the rounds or squares are free from all stays or other obstructions to cleaning, presenting a smooth surface. Into the advantages of rousing during fermentation, or the circumstances of its most useful application, we may enter in a future impression.

Fig. 3.



At the recent brewery exhibition Messrs. Wilson also showed a skimmer fitted with adjustable skimming board. The vessel is made in the form of a long "square," fitted with a parachute whose dish or trough extends across one end of the vessel. The parachute can be adjusted to any required level. The skimming apparatus consists of a railway having one rail on

Fig. 4.



each long side of the vessel. This railway is traversed by a frame mounted on two axles, with flanged wheels carrying a skimming board which can be raised or lowered to any level. Movement is given by a man turning a handle fixed to the end

Fig. 5.

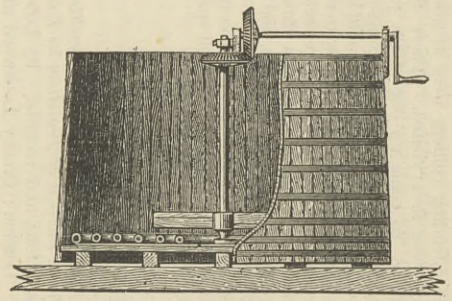
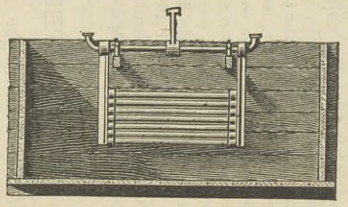


Fig. 6.



of one of the axles. The yeast is thus all swept into the parachute.

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

(*From our own Correspondent.*)

THE ironmasters' quarterly meetings were held to-day—Thursday—in Birmingham, and yesterday in Wolverhampton.

In Wolverhampton prices were re-declared upon the basis of last quarter, namely, £7 10s. for marked bars and £3 5s. for all-mine pigs. These are the rates which prevailed throughout last quarter. Yet the net average price of bars in the three months ending November last having been £6 15s. 6½d., abundantly testifies to the small proportion of the business that was done in the past quarter at the £7 10s. quotation. Earl Dudley's quotation yesterday was as usual, plus the 12s. 6d. upon the general marked bar quotation. Thus, Round Oak bars were £8 2s. 6d. Between this price and £5 12s. 6d. the rates at which bars could be bought were numerous. No difficulty was experienced either to-day or yesterday in buying bars at £5 15s. ; and an excellent bar was to be had at £6 10s. The vendors of South Wales bars were unable to do business to any appreciable extent. They quoted £5 2s. 6d. at Cardiff ; with 10s. on for delivery in Liverpool, London, or in this district. When Welsh and Staffordshire iron is at the same price in this district, the local brands are preferred.

Comparatively cheaper than bars of three-eighths and five-sixteenths and the other merchant bar gauges at £5 15s., was bucket handle iron at £6 2s. 6d. Yet this was the price of a good firm upon both exchanges. The price was a surprise to some buyers, who a twelvemonth ago did not hesitate to give for the same description more money by £2 per ton.

Hoops and strips were almost equally depreciated. There was much competition for the orders which were held by the representatives of London and Liverpool houses. The United States demand for this commodity is just now scarcely appreciable, and buying by the local iron tube firms is becoming dilatory. Coopers' hoops and bedstead strips are now being mostly turned out, and the mills are getting short of work. Representatives of Warrington firms were ready to-day and yesterday to cite terms with which Staffordshire makers had to compete. Consequently, £6 5s. per ton was not the lowest rate at which it might have been possible to buy hoops either in Birmingham or Wolverhampton.

The sheet firms, who before Christmas had declined to book into the new year, were to-day prepared to accept, from good customers, 5s., and in a few instances even 10s. per ton less money than that at which they were completing deliveries when the year went out. The general quotation was £7 10s. for singles, £8 10s. for doubles, and £10 for trebles. These prices were for corrugating and galvanising iron. But very few galvanisers would give them, protesting their ability to obtain supplies even within the passing drop I have cited. Ironmasters, who had allowed their customers to place orders to the close of February, were firm in their quotations yesterday and to-day, and altogether uninfluenced by the prices which their over-cautious neighbours were obliged to accept. Yet they were unable to establish a rise which they sought to obtain and which the condition of their own books would have justified. Stamping sheets sold better both in Wolverhampton and Birmingham than for some weeks past. Prices remained on the basis of makers' circulars ; and those which distinguished actual sales showed a nearer approach to those lists. Hence stamping sheets must be quoted more than strong. Sales to United States' consumers are slowly but steadily increasing. More business than upon any previous similar occasion was done in steel slabs for rolling down into sheets. The Landore Company are now represented in this district by the former manager of the works. Most of the other Siemens-Martin and Bessemer firms who have laid themselves out to produce the article are now commissioning local agents to represent them. Familiarity with the uses to which rolled as well as partially manufactured steel can be applied in the yards and factories of Birmingham and the Black Country, to the supplanting of high-class iron, which results from the activity of the local agents, is quietly but surely increasing the business which steel makers are doing hereabouts. The plate orders were difficult to secure to-day and yesterday at prices which would yield a paying profit. Liverpool merchants were ready to buy, but only on terms at which few but South Wales firms would begin to negotiate.

The leading galvanising firms reported themselves well supplied with orders for more than two months ahead. Such firms sought to secure a rise of 10s. per ton, quoting 24 w.g. at £15 10s. per ton. Inasmuch as all the firms were not in an equally good position, the effort was not successful, though prices must be reported as strong, in sympathy with spelter, which is again moving upwards. More spelter has been bought by the galvanisers in this part of the kingdom during the past week than in any similar period within the recent few months.

A statement just published in Birmingham shows that the galvanising trade has doubled itself during the last eight years in this country, and more than quadrupled itself on the Continent and in America. Notwithstanding the increase in the production of spelter, the imports into this country have fallen off. In 1876 the total imports of foreign spelter amounted to 29,466 tons ; in 1877, 35,094 tons ; 1878, 32,750 tons ; 1879, 34,180 tons ; and 1880, 28,703 tons.

Plate orders were difficult to book, whether for bridge and girder, or for boiler-making uses. A little was done in tank plates, but at prices which showed a decline upon the quarter of from 2s. 6d. to 5s. per ton.

Only few inquiries for quotations on account of new engineering work have reached local engineers thus far this year. A little new railway roofing will soon be begun here and there ; but beyond that the new year has, in constructive engineering, been scarcely more than a blank. Still arrangements for meeting what it is believed will prove a larger demand for roofing as the year goes on are being made in several directions.

A tolerably firm stand was made to-day and yesterday by the different pig iron firms, whether local or foreign, to secure prices based upon open market quotations ; and there were some who sought a rise upon the quarter of 2s. 6d. per ton. But all advanced prices checked business. The sales were mostly regulated by those which have prevailed throughout the quarter.

At close of 'Change ruling quotations were :—£7 10s. for bars, £12 to £12 10s. for stamping sheets, £7 10s. to £8 for tank plates, £5 15s. for fencing bars ; Staffordshire all-mine pigs, £3 5s.; for hydrans, £3 2s. 6d.; part-mine, £2 12s. 6d.; common, £2 2s. 6d.; Barrow gray forge, £3 15s. to £3 12s.; and Blaenavon, £3 15s.

Coal and coke were much offered at firm prices for coal, but at weak prices for coke. Most descriptions of coke are down upon the quarter at from 1s. to 1s. 6d. Derbyshire, South Wales, and Wigan sorts may all alike be bought readily at 15s. per ton. Furnace coal was quoted at from 8s. to 10s., and forge coal at from 6s. to 7s. 6d.

The vice-chairman of the South Staffordshire Mill and Forge Wages Board has given notice that at the forthcoming annual meeting he shall call for a list of all employers who are allowing their operatives to contribute to the Wages Board, but who do not themselves contribute. It is also proposed to add a list of the works where neither employers nor operatives subscribe.

The ironworkers have all returned to work at the drop awarded by the Wages Board, but they are uneasy, and on Monday there will be an influential representative meeting to determine their future action in respect of the Wages Board.

An application for a rise in wages by a deputation of workmen at the recent quarterly meeting of the North Staffordshire Ironmasters' Association, at Hanley, was refused on the ground that the selling prices of iron are now lower than they have been for some time past.

The well-known Shropshire concern, the Lilleshall Coal and Iron and Engineering Company, is to be converted into a limited liability company, with a capital of £600,000 in £300 shares. The Earl of Granville is appointed first and sole director of the company, and his lordship is to retain that position so long as he holds one-third of the paid-up capital. This arrangement is due to the desire of certain trustees among the representative proprietary to limit their individual responsibility. The proprietary will in no respect be altered, nor will any change take place in the method of doing business at Lilleshall, or in the managerial or any other portion of the staff.

The Australian mail which has been delivered this week is reported by merchants to have brought a fair amount of business. But now the steam communication has been so much improved with the Antipodes that we get three deliveries of letters monthly, the several arrivals do not appear of the importance which attached to them when the mails were less frequent. The Australians advices, unfortunately, do not speak of much improvement in prices ; and there is fear that no improvement will take place if, led astray by the better prospects which the market undoubtedly shows, exporters should make shipments beyond immediate demand.

Prospects of an enlarged business with the south-east and south-west coast of South America are bright. There is also every reason to believe that the markets in that part of the world might be rendered much more valuable to our manufacturers if they would only send representatives there. French and United States enterprise in this direction is wonderfully benefiting those competitors, particularly in the matter of rolling stock and permanent way materials.

The arbitrators under the South Staffordshire Mines Drainage Acts have intimated their intention of holding a Court in Wolverhampton on the 29th inst., to hear objections to the proposed amalgamation of the Bilston and Tipton mines drainage districts.

The work of placing concrete between the iron tubbing and the side of No. 1 shaft in the Cannock and Huntingdon Colliery is now completed. It is expected that the water will be drawn out of the pit, and the buoy that supports the column of the tubbing removed by the 15th inst., when the sinking of the shaft by the ordinary method will be at once proceeded with.

The Wednesbury Local Board have sanctioned the construction of the South Staffordshire tramways, as also the Walsall, Wednesbury, and West Bromwich Extension Tramways. In default of completion within the statutory period, the companies are each to forfeit £500 to the board as liquidated damages.

The Birmingham, Tame, and Rea District Drainage Board have agreed to purchase 850 acres of land near to the existing works at Saltley for the more effectual treatment and purification of the sewage of the united drainage district. The cost of the land and the buildings thereon, which will have to be pulled down, is estimated at about £85,000. With the exception of about 100 acres, it is stated that the level admits of the whole area being irrigated from the main conduit by gravitation.

NOTES FROM LANCASHIRE.

(*From our own Correspondent.*)

Manchester.—The important manufacturing industries of this district are threatened with a serious difficulty in the shape of obtaining supplies of fuel, as a consequence of the action which has been taken by the miners throughout Lancashire with reference to the adoption of the Employers' Liability Act, and the agitation now going on in several important districts for an advance of wages. In my last report I referred to the serious interference with work which then existed as the result of the dispute between the masters and the men as to whether the pits should be worked under a system of mutual insurance through the medium of the permanent relief funds, and thus supersede the operation of the Employers' Liability Act, or whether the men should work only under the provisions of the Act, as they were strongly urged to do by nearly all the leaders connected with the miners' unions, and especially more recently by the emphatic resolution passed at the Miners' National Conference sitting this week in Manchester. Since then the matter has become still further complicated by the demand for an advance of wages in the West Lancashire districts, and the result has been that nearly the whole of the collieries throughout Lancashire are now stopped. At some of the pits the men had virtually agreed to the arrangement for contracting out of the Act proposed by the masters, and the collieries owned by Messrs. Andrew Knowles and Sons, Limited, Manchester, one of the largest firms in the district, were working this week, whilst at other large collieries in the neighbourhood the employers had got their men back again by consenting to work under the provisions of the Act. So determined, however, are the miners to carry their point with regard both to the Employers' Liability Act and the wages question by a general cessation of work, that within the last couple of days the whole of these men have been compelled to come out, in some cases by demonstrations of violence. It is estimated that throughout Lancashire there are now between 40,000 and 50,000 men practically out on strike ; such a general stoppage of work has probably scarcely ever before been known in Lancashire, and this sudden withdrawal of the usual local supplies of coal from the market is already making itself inconveniently felt. I do not hear of many works having as yet been actually stopped for want of fuel, but there is very great difficulty in obtaining supplies, especially for steam and engine purposes, and there was a very excited coal market at Manchester on Tuesday. Enhanced prices had to be paid by consumers to obtain temporary supplies, and although the pressure to some extent is being met by large quantities of coal which are coming into the district from Yorkshire and other outside coalfields, the continuance of this source of supply is not a matter of certainty, and under any circumstances consumers will have to pay higher rates than hitherto.

To-day, Thursday, there is no material change in the position of affairs in the Lancashire coal trade. There is no diminution in the number of men who have either struck or ceased work, and nearly the whole of the Lancashire collieries continue idle. This general stoppage of work is making itself more severely felt—a few mills and other works in the district have been stopped for want of fuel,. The leading Manchester firms have so far been able to meet the requirements of their regular customers from stock, but to-day a meeting has been held to consider the question of prices, and it was resolved that an advance of 10d. per ton should be made on all classes of fuel, to commence on Monday next. This advance applies to all the outside districts of Manchester, and in some cases house coals, if delivered to consumers, have been put up 1s. 8d. per ton.

In the iron trade the market maintains the firm tone by which it has been characterised since the commencement of the year, but there is not as yet any largely increased amount of business doing. Consumers are mostly well covered for the present, and the enquiries in the market are chiefly for forward delivery. Where sales over extended periods are made, an advance upon late rates is generally obtained, but makers, as a rule, do not much care about committing themselves very far forward. The continued firmness of the market is bringing out work in which iron for constructive purposes is required, and the most noticeable feature in the trade is the strong feeling of confidence which everywhere prevails with regard to the future.

Lancashire makers of pig iron who still decline to sell for forward delivery have been doing only a limited amount of business during the week, but they are very firm at 47s. 6d. for No. 3 foundry, and 46s. 6d. for No. 4 forge less 2½, delivered into the Manchester district.

Small transactions for forward delivery are reported in Lincolnshire and Derbyshire irons at slightly advanced prices, Lincolnshire being quoted at 48s. to 48s. 6d., and some brands of Derbyshire at about 49s. 6d. per ton, less 2½ delivered equal to Manchester. Middlesbrough iron, however, is still out of this market.

The local finished iron-makers are still only moderately employed, and there are complaints that specifications on account of iron sold are not coming in very freely. Prices, however, are firmer, and for local bars there are not now many quotations under £6 per ton, delivered equal to Manchester. Hoop makers are not very busy, the work in hand being almost entirely on home account, and prices average about £6 5s. to £6 10s. per ton. For boiler plates there is fair inquiry, and good marked brands are being sold in this district at about £9 10s. per ton. I hear that a fair number of inquiries are coming to hand amongst machinists in this district.

Barrow.—With the opening of the new year a very healthy tone is manifested in the hematite pig iron market, and there is quite an improvement in the demand. The inquiry coming from all quarters is showing itself to be much better, and users seem more disposed than for some time past to place their orders with producers, anticipating a rise in prices ere long. Buyers seem to be of opinion that with the spring quotations will show a much larger figure than at present, and for this reason they are anxious to give orders, though in some instances makers are not over anxious to do business just now. For Bessemer pig iron 67s. 6d. to 70s. per ton is quoted, and forge quality, No. 3, from 2s. to 2s. 6d. less than these figures. There is a very large output of metal from the furnaces, but this will be increased very considerably by the blowing in of the furnaces at Askham. At Carnforth and Ulverston preparations are being made to increase the output. The prospects of trade are exceedingly promising, and a cheerful feeling prevails. Steel producers have their hands full of work. Bessemer samples in good demand, together with Siemens steel. Good orders are held, and the prospects of good trade for the year 1881 are more promising than for a long period. Iron ore in request. Shipbuilders very busy, and good orders held. Other industries briskly employed.

THE SHEFFIELD DISTRICT.

(*From our own Correspondent.*)

THE principal item of the week's news is the proposed issue of new stock by the Sheepbridge Coal and Iron Company. This increase of the capital has been rendered necessary, the directors say, by the entering upon the Grapwell coalfield, the development of recently acquired ironstone fields, and the increased expenditure of more money to complete the works at Langwith and Newstead. Beyond this the directors think they should be placed in a position to reduce the large amount of borrowed capital employed in the company's business. It is proposed to increase the nominal capital of the company by £245,300, divided into 9812 shares of £25 each, which, with the 188 new preference shares of £25 each, created by the special resolutions of 1871, are consolidated into one class of 10,000 shares called the guaranteed preference shares, the holders of which are to be entitled to a dividend of £5 per cent. in each year in priority to the payment of any dividend to the ordinary shareholders. The directors have also thought it desirable to change the form of the original £100 shares by sub-dividing them into shares of £25 each, with £20 paid thereon, being the equivalent of £100, with £80 paid. There are 5000 of these shares. The object of this subdivision is to render the shares more easily negotiable, and the directors think that by so doing they will add to their stability. "As a considerable portion of the additional capital," say the directors, "will be devoted to paying off existing loans, it will to that extent make no additions to the first charges on the earnings of the company, and as regards whatever is expended on the various works specified—Langwith, Newstead, &c.—the directors believe they will all be highly profitable at early dates." The immediate effect on 'Change has been to give the shares a drop, the £100—£80 paid up—which stood at 17 discount prior to the commencement, being now—Wednesday—at 23 discount.

I stated last week that the order for steel rails taken by Messrs. Wilson, Cammell, and Co., Dronfield Steel Works, for an Indian railway, was at the price of £6 6s., delivered in London. The price should have been £6 16s.

The shareholders' meeting in the affairs of Messrs. Brown, Bayley, and Dixon, Limited—which occurred too late to have the result reported in my last letter, confirmed and adopted the resolution carried by the creditors in favour of voluntary liquidation with Mr. J. H. Barber, the secretary, and Mr. W. B. Peat, of Middlesbrough and London, as liquidators. The directors stated that they had a scheme for the resuscitation of the company, but they thought it advisable to defer giving the details. The petitions filed against the company are appointed to be heard in Chancery on the 14th inst. The shares of the company were quoted on Sheffield Stock Exchange, on Wednesday, at 44¼—43¾—*i.e.*, the shares being £50—£40 paid-up—certain holders will give anybody £3 15s. to take them, while some outsiders appear disposed not to take them under a bonus of £4 5s. As the assets show 9s. in the pound, even if the concern is broken up, the proprietors do not seem wise to part with the scrip at this price.

A good deal of business is again doing in shares, and several local companies appear to be improving pretty rapidly. More attention in now being given to American securities, in which only a short time ago very little confidence was expressed. Cutlery and general hardware remain as noted last week. Railway material is also in brisk demand, and there is an expectation of better prices for rails this spring.

At the district collieries the agitation for 10 per cent. advance increases ; but nothing definite will be done on the notices handed in till after the conference at Manchester. All the employers I have met with state most positively that they will not agree to any advance at present, and will prefer to close their collieries. Many miners tell me they are anxious to settle this matter amicably with their masters ; that they think they should have an advance of 5 per cent., and would accept that in the meantime.

THE NORTH OF ENGLAND.

(*From our own Correspondent.*)

MIDDLESBROUGH Exchange had a more than usually animated appearance on Tuesday, it being the quarterly meeting. There were present many merchants and manufacturers from a distance. The appearance of the hall was enlivened by various exhibits, which included samples of Spanish ore, specimens of nickel plating, petroleum gas lamps, slag bricks, and other articles of interest to the iron trade. The tone of the market was cheerful for the present, and hopeful and even sanguine as regards the future. The news from Glasgow, being to the effect that that market was inclining towards lower prices, tended to stop business. Buyers mostly held back for a similar reaction in Middlesbrough, and sellers could not make up their minds to a substantial reduction. The market price of No. 3 g.m.b. was at the opening about 41s. 6d., but at the close transactions had taken place at 41s. 3d. and 41s. Makers, however, remained firm at 42s. throughout. Warrants were firm at 42s. 6d. Connal's Middlesbrough stores have received an addition during the week of nearly 2900 tons, raising the total to 130,774 tons.

Finished iron remained steady at previous prices. Plate and angle makers are mostly fully sold for the first half of the year ; and for the second half they prefer not to sell until they can see how the pig iron market tends. No smelter or merchant will at present sell for delivery beyond June 30th, as they believe in and expect higher prices. This general consensus of opinion is very likely to prevent the very objects they hope for, because they are reserving on all hands produce which eventually must be forced into the market. Probably when the time for a change of mind comes all will change about the same time, and lower prices will be the result. Indeed, considering that the production of pig iron, both in the Middlesbrough and Glasgow districts, is now considerably in excess of the consumption, and that the stocks are increasing at both centres, it is quite certain that prices will tend downwards rather than upwards, unless some extraordinary demand sets in, and that pretty soon. It is one thing to hope for better things, and another thing to act on the assumption that they must occur. This latter is what is

being done by those investors who are now competing for warrants so keenly as to keep up the price 1s. 6d. per ton over and above the price of iron for consumption. Every warrant purchaser pays this 1s. 6d. per ton premium, and incurs also 6d. per ton per annum rent, and 2s. per annum interest. Thus, every ton of iron he holds for a twelvemonth must be then sold at 4s. per ton more for him to end the transaction without loss. It is clear, therefore, that purchasers of warrants must believe in a greater rise than 1s. per ton per quarter, or they could not purchase. Recent and current statistics as to production and distribution are all against the wisdom of such a policy. Hopefulness is therefore alone producing it. And nothing but a large and indeed quite unprecedented demand simultaneously from all the principal centres of consumption can eventually justify it. That the demand has wonderfully increased is true, and that it is likely to continue largely to increase is pretty certain. But that it will increase sufficiently to take up all the preparations which are being made to satisfy it is extremely doubtful. Shipbuilders on the north-east coast are still booking additional orders, and are betraying anxiety to buy for delivery to the end of the year. Manufacturers are, however, in very few cases willing to sell for the second half, except at an advance of from 7s. 6d. to 10s. per ton over present prices.

Considerable local interest has been excited in an inquiry which has just been held before Mr. Coleman, the Middlesbrough stipendiary, as to damage sustained by the steamship Muriel during a recent voyage across the Atlantic. The Muriel was built at Middlesbrough, and of Middlesbrough iron. It was of the type known as a "well decked" ship. It left Philadelphia recently, bound for Hull, and laden with maize. In mid-Atlantic a storm arose, and the vessel was repeatedly struck by heavy seas, which broke over her, and fell into the well, which, when full, was capable of holding 160 tons of water. One of the bulkheads forming the after boundary of the well gave way under this strain, and the vessel was, without doubt, in great jeopardy. Fortunately the other bulkhead, which inclosed the engine-room, remained intact, and the weather moderating, the vessel arrived safely at Hull. When there, she was inspected by Mr. J. N. Armitt, Board of Trade surveyor, and it was upon his evidence at the inquiry and the counter evidence produced in refutation of it that the chief interest centred. Mr. Armitt said, after describing the condition of the vessel on her return, that he thought the iron plating of the bulkhead was very poor stuff, and not up to the mark of shipbuilding iron. His worship considering this a serious reflection on the builders, adjourned the inquiry to give an opportunity for them to appear if they thought fit. Accordingly they did appear the following day by Mr. Roche. Meanwhile pieces of the iron had been tested by Mr. W. Richards, an independent engineer, who after testing cold in bending rolls, said it was a very good quality of shipbuilding iron. Under examination and cross-examination he said "It would not be fair to say it was a "wretched lot," nor that it was "poor stuff." On the contrary it was of first-class quality. It was not possible to give an opinion without testing. He considered it ought and easily would stand twenty tons per square inch. The piece produced was a piece of fibrous iron. By the Court: "As a practical man he should pass the iron as first-class shipbuilding iron, and of strong resisting power. Mr. S. P. Gladstone, Lloyd's surveyor, considered the mode of testing described by Mr. Richards was correct; the iron was very good stuff and he hoped they would always get as good." Mr. Armitt, recalled, said the fault be found with the iron on examination was that crystallisation showed itself at the broken edge. He "thought" it would give fifteen tons to the square inch, whereas ship's iron should run from eighteen to twenty. By the Court: He had arrived at that conclusion "merely by vision." (!) Mr. T. W. Bonniwell, Lloyd's surveyor, who had personally superintended the construction of the Muriel, considered she was constructed of very good material and strictly up to the requirements of Lloyd's. He considered it was quite equal if not superior to the required standard for shipbuilding purposes. After hearing the above and other evidence his worship said the Court had arrived at the conclusion that the iron was thoroughly fit for the purposes for which it was used. The builders of the ship were Messrs. Raylton, Dixon, and Co., and the manufacturers of the plates were Messrs. Fox, Head, and Co.

NOTES FROM SCOTLAND.

(From our own Correspondent.)

THE course of the iron market has not been quite so satisfactory or promising this week. In the warrant market less business has been doing, and although prices are better than they were at the close of the year, there has been a general feeling of slackness about the transactions. Except for Gartsherrie iron the demand on the part of the United States continues rather backward. The heavy and rapidly-increasing stocks act as a dead weight upon the market at a time when the production is maintained at a high rate. In the speculative circle of the warrant market the "bulls" and "bears" alike profess faith in a coming period of genuine good trade; but not a little impatience is being shown that a more pronounced upward movement in prices and an improved business has not already begun. Probably, the merchants' Christmas circulars were a little too sanguine as to the early date of expected revival. At any rate, the market, as I have said, is flat, and any incident, however trifling, that could help to impart to it some more animation, would be eagerly welcomed. At the time of writing, there are about 505,000 tons of pig iron in Messrs. Connal and Co.'s stores, and, altogether close upon 20,000 tons have been added to stock since Christmas Day. Of course, some allowance must be made for the partial stoppage of consumption and export during the holidays, but still the increase, taking this into account, does not appear to indicate sufficient activity in the trade.

Business was done in the warrant market on Friday morning at from 53s. 3d. to 53s. 4½d. cash and 53s. 5d. to 53s. 6d. one month; the afternoon quotations being from 53s. 4d. to 53s. 5d. cash and 53s. 6d. to 53s. 7d. one month. A fair business was done on Monday, the prices in the morning being 53s. 6d. to 53s. 8d. cash and 53s. 9d. ten days, and 53s. 8d. to 53s. 10½d. one month. In the afternoon business was done at from 53s. 7½d. to 53s. 6d. cash and 53s. 9d. to 53s. 8½d. one month. On Tuesday the market was flat, with business at 53s. 7½d. one month and 53s. 5d. cash, to 53s. 3d. one month and 53s. 1½d. cash.

The tone of the market was slightly firmer on Wednesday, and to-day—Thursday—a moderate business was done up to 53s. 2d. cash, and 53s. 5d. one month. Mr. Barlow, engineer of the Tay Bridge, accompanied by Sir John Hawkshaw and Mr. Cochrane, engineers, London, were to-day—Thursday—engaged examining the damaged structure and the site of the proposed new bridge at Dundee.

Advances have been intimated in the prices of some of the better known special brands, such as Gartsherrie, Eglinton and Coltness, and merchants quote makers' prices generally 6d. to 1s. higher in sympathy with last week's advance in warrants. There is in reality, however, little change in prices.

All the malleable and manufactured ironworks are now again in operation, after the new year holidays, and they have the prospect of a long run of good business, mostly induced, either directly or indirectly, by the prosperity of the shipbuilding trade. There is no quotable alteration in prices. Operations at the steel works are also resumed with much animation. Marine engineers are busy as a rule, and the locomotive works are still engaged upon extensive contracts. Makers of cast iron pipes are not quite so busy.

Last week's shipments of iron manufactures from the Clyde included £12,500 worth of machinery, of which £10,470 were locomotives for Kurrachee, and £1427 for Spain; £9600 other articles, of which £6067 were sent to Kurrachee, £1350 to the Mediterranean, and £905 to Marseilles; £8000 sewing machines, of which £3740 went to Valencia, £2380 to Mediterranean ports, and £1467 to Antwerp.

Considerable quantities of manufactured iron articles are weekly received from Antwerp and other continental ports, and heavy imports of iron ore are arriving from Spain.

There is little change in the coal trade, but the demand for home consumption is good and is improving since the holidays. The export trade has been somewhat backward, but a rather better inquiry may now be anticipated, particularly if the weather should become more settled. Prices are nominally without alteration. These remarks are applicable to the present state of the coal trade all over the country.

In some cases the colliers in the Western districts have been approaching their employers again for an advance of wages, but it is very doubtful whether they will succeed. The competition is so keen among the colliery owners for business that abundant supplies of coals are readily obtained for all purposes at present rates; and there is a danger that if an advance were made it might be dangerous to the shipping trade, as it proved last year. Then as regards the ironmasters, the prices of iron, although slightly advanced in the warrant market, owing to speculation, are in reality not so much better as to warrant the extra cost of production that would be entailed by advancing the miners' wages. The leaders of the men themselves seem to be fully aware of these facts, and are moving cautiously in the direction rather of exhorting their constituents to be prepared to act when there is a chance of success, than to adopt extreme measures at present.

The returns of the shipping trade in the Clyde for the past year give the arrivals at 1,117,488 tons, and the sailings at 1,311,423 tons, showing an improvement of 176,635 in the imports and of 180,800 in the exports as compared with those of 1879.

Within the past week or ten days some good orders have been placed in the Clyde shipbuilding trade.

WALES & ADJOINING COUNTIES.

(From our own Correspondent.)

THOMAS JONES, of Ynyshir, Rhondda Valley, an intelligent coalowner, claims to have discovered the best possible means of ventilation, one which, clearing away all the gas from the roof of the heading, and stalls, as it evolves, renders an explosion almost an impossibility. I notify this publicly so that the mining world may investigate.

We are evidently on the turning-point again of a rise in the coal market. The opinion of leading coalowners is that a considerable advance may be expected. Prices may not touch the highest points of '74, but they are not going to remain at present highest rates, which are about 10s. 6d. f.o.b. Cardiff, best colliery screened. Various reasons support this. The iron trade is well sustained, and a large demand comes from that quarter on the coal market. Then there is great uncertainty about the Northern men, and a good deal of extra tonnage is coming in this direction in consequence. Good substantial contracts are also secured, so that there is a large regular demand as well as great flushes of a spasmodic character which invariably act successfully in forcing a market up.

I am favoured with some details of the last year's coal trade, and on the whole they are very gratifying.

The marine colliery of Fowler and Co. has been sold to a London firm, and henceforth will figure as the Pontypridd Junction Welsh Collieries.

The enquiry into the accident at Penygraig has begun and promises to be most important. The two coroners, Messrs. Overton and Reece, are assisted by Mr. Wright, barrister-at-law, and Mr. Hall, inspectors of North Wales, both sent down from the Home-office. The manager is at present under examination. He deposes to not having a barometer in the colliery; one had been ordered; and not to understand the law which enjoins no blasting within three months after a blue "cap" has appeared in a lamp. It appears that blue flame has appeared not long ago. A professional gentleman watching the case is going to see if evidence can be elicited showing how such an explosion is aided by coal dust. His theory is, that if the black speckled matter found so invariably on the faces of the dead be charred, then the "fire damp" must have acted upon it, and the power of the explosion be increased.

Jones Brothers and Co., of Newport, have just started a new line of steamers to run between Newport, Plymouth, and New York. The agents are Budgett, Bristol. The first vessel, the James Grice, started last week. A new steamship company is on the eve of being launched at Cardiff; some of these are doing well. I have heard of one the last dividend of which was 40 per cent. I have just heard that on one of the bodies taken out of Penygraig this week a box of matches has been found. The colliers do not take kindly to the Permanent Fund because it does not include sickness as well as accidents. The discussion on the suggestion to contract themselves out of the Employers' Liability Act is proceeding, and in several cases the colliers oppose it. At Upper Cwmbran Colliery the result of a long discussion was a refusal, and the reason given, "That it would be an insult to the Government not to accept the measure after it had been passed."

The activity recorded lately as prevailing in the steel, and to some appreciable extent also in the iron trade, continues, and any day this may be increased considerably, as it is known that America is on the eve of increasing demands, and there are several of the colonies which will require heavy consignments in the spring. Lest I forget it, the voice of science is at last finding vent, for the chief local daily has begun the issue of "Colliery Warnings," urging extreme care durlng barometrical depressions.

Numerous iron and steel orders from South and North America are still on hand, and 4000 tons were cleared out last week. In addition to foreign and colonial orders, the home trade is decidedly better, and very lately the Great Western Railway placed an order for 12,000 tons steel rails at Dowlais, 5000 at Ebbw Vale, and 5000 at Blaenavon.

There is no advance in price worth recording, but quotations are firm with an upward tendency. Ebbw Vale has secured a good share of New South Wales trade.

Tin-plate dull. Reduction in wages under existing circumstances inevitable.

THE PATENT JOURNAL.

Condensed from the Journal of the Commissioners of Patents.

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

Applications for Letters Patent.

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

4th January, 1881.

27. LIME-LIGHT LAMPS, A. M. Khotinsky, Russia.
28. MOULDING, C. G. Goddard, Brighton.
29. RECEPTACLES or VESSELS, F. C. Glaser.—(*H. Schomberg, Russia.*)
30. REVOLVING SEATS, &c., W. H. Blain, Liverpool.
31. SCREENING APPARATUS, P. V. Gelder and T. Apsimon, Liverpool.
32. STRAINING PAPER PULP, D. Bentley, Lancashire.
33. GAS-BURNERS, H. H. Doty, London.
34. WHEELS, J. Rigby, London.
35. BICYCLES, &c., W. Woolley, Birmingham.
36. WIRE NAILS, H. H. Lake.—(*J. Hitchcock and D. C. Knowlton, Boston, U.S.*)
37. FELT HAT BRIMS, R. Grimshaw, Stockport.
38. CASTING METALS, H. J. Haddan.—(*S. L. Clemens, D. Slote, and C. Sneider, New York, U.S.*)
39. STREET CURBS, &c., H. J. Haddan.—(*J. D. Townsend, New York, U.S.*)
40. STEAM BOILERS, G. Petrie, Rochdale.
41. KNITTING, J. and H. Kiddier, Nottingham.
42. KILNS, &c., J. Craven & H. Chamberlain, Yorkshire.
43. WASHING COMPOUND, A. Watt, Lewisham.
44. ARTIFICIAL LEATHER, T. E. Hardy, Battersea.
45. EXPANSION GEAR, J. Bodington, Harborne.
46. STEAM, &c., APPARATUS, E. F. Osborne, St. Paul, U.S.
47. LASTING BOOTS, &c., A. M. Clark.—(*S. B. Ellithorp, Rochester, U.S.*)
48. ELECTRICITY, W. R. Lake.—(*E. Etève, Paris.*)
49. STRETCHING CLOTH, W. R. Lake.—(*Goudiat Bros., France.*)
50. TOYS, T. Wrigley.—(*G. Fischer, Germany.*)

5th January, 1881.

51. BRAKES, J. Imray.—(*A. Wenger, Paris.*)
52. AXLE-BOXES, C. D. Abel.—(*D. G. Labbé, Paris.*)
53. VENETIAN BLIND ACTIONS, H. Tylor, London.
54. STEAM-TRAPS, H. Lancaster, Pendleton.
55. WASHING APPARATUS, J. Hughes, West Bromwich.
56. TELEGRAPHS, W. Chadburn, Liverpool.
57. WINDOW, &c., FASTENER, J. Stables, Longsight.
58. MOTIVE-POWER, W. Freakley, Shelton.
59. BRAKE APPARATUS, J. Batey, Stockwell.
60. ENGINES, C. D. Abel.—(*N. A. Otto, Germany.*)
61. SEWING MACHINES, &c., J. Holden, Swindon.
62. INKSTANDS, R. G. Chipperfield, Surrey.
63. COMPOSITION, W. R. Lake.—(*C. D. Bradley, Quebec.*)

6th January, 1880.

64. KNITTING MACHINES, T. Coltman, Leicester.
65. ELECTRIC LIGHTING, P. M. Justice.—(*H. C. Spalding, Boston, U.S.*)
66. BLIND ROLLERS, J. E. Ditchfield and K. Hothersall, Manchester.
67. BALE-TIES, &c., E. Hale, Wigan.
68. WEAVING, G. H. Hodgson & J. Broadley, Bradford.
69. CASTING METAL PIPES, C. B. Palmer, R. E. B. Crompton, and J. Chambers, Derby.
70. STOP MOTION, A. T. Lawson and S. Dear, Leeds.
71. BOTTLES, T. Marshall, London.
72. COMPOUND, H. J. Haddan.—(*H. G. Julien, Brussels.*)
73. TUBE-CUTTER, P. Skeldon, Wolverhampton.
74. WAGONS, W. R. Lake.—(*W. H. Paige, Springfield.*)
75. METALLIC PACKINGS, T. Tripp, East Stoughton, U.S.
76. ANILINE SOLUTIONS, W. R. Lake.—(*N. C. Armand and J. E, Berton, Paris.*)
77. COMPASSES, D McCallum, Plymouth.
78. DYNAMO-ELECTRIC MACHINES, J. Gordon, Dorking.
79. CHRONOGRAPH, A. M. Clark.—(*H. J. Eisen, Geneva.*)

7th January, 1881.

80. HOLDERS, &c., for SEWING THREAD, J. Coats, jun.—(*W. S. Anchincloss, Philadelphia, U.S.*)
81. MOTIVE POWER, F. R. Shaw, Manchester.
82. REVOLVING MOTION, &c., W. Jones, Manchester.
83. CIRCULAR REVOLVING MEASURE, H. J. Allison.—(*M. J. Mourrier, France.*)
84. BURNERS, J N. Douglass, Dulwich.
85. TREATING PAPER, &c., W. Fitch & H. Barton, London.
86. RACK and COG-WHEEL, W. Prowett, Birmingham.
87. GAS REGULATORS, H. E. Newton.—(*MM. Avoiron and Clément, Paris.*)
88. FIRE-ARMS, A. M. Clark.—(*L. N. Valasse, Paris.*)

8th January, 1881.

89. VELOCIPEDES, R. C. Fletcher, Lancashire.
90. WRAPPING-UP MACHINE, W. Rose, Gainsborough.
91. CAP SPINNING, &c., R. and W. H. Dawson, Hunslet.
92. EMBOSSING, &c., T. J. Palmer, Fulham, and C. F. Dietrich, Dalston.
93. TELEPHONES, J. Imray.—(*C. Herz, Paris.*)
94. COLOURING MATTER, F. Wirth.—(*O. Fischer, Munich.*)
95. LOCKING APPARATUS, W. Pinkerton, Larne.
96. METAL FENCING, R. R. Main and J. Dick, Glasgow.
97. KNITTING MACHINERY, I. Stubley, Leicester.
98. STEAM GENERATORS, S. and J. Dawson, Mossley.
99. SECURING CORKS in BOTTLES, T. Burns, Staffordshire.
100. MILL GEARING, N. Macbeth, Bolton.
101. FURNACES, J. Lart.—(*C. W. Doten, Boston, U.S.*)
102. METALLIC WAGONS, R. Hudson, Gildersome.
103. VENTILATING MINES, J. W. Hackworth Darlington.
104. STEAM GOVERNOR, J. Galley and T. Smith, London.
105. WRINGING MOPS, J. Whittingham, Cheshire.
106. PEN-HOLDERS, R. Spear, London.
107. WEAVERS' MAILS, J. C. Ramsden, Yorkshire.
108. ELECTRICITY, J. C. Ramsden, Yorkshire.
109. LOWERING, &c., SHIPS' BOATS, J. Barry, London.

10th January 1881.

110. PERFORATING CARDS, T. G. Lomas, Withington.
111. PREVENTING SHIPS SINKING, R. G. Sayers, London.
112. SMOKE CONSUMING APPARATUS, J. Teer, Salford.
113. TWISTING, &c., YARNS, J. Farrar, Halifax.
114. STEERING VESSELS, W. Legge, Middlesbrough.
115. BEARINGS, L. A. Groth.—(*A. Gravelin, Belgium.*)
116. CARDING ENGINES, P. Klein & G. Hundt, Prussia.
117. BRUSHES, G. W. von Nawrocki.—(*C. E. Flemming, sen., Saxony.*)
118. BRUSHES, G. W. von Nawrocki.—(*C. E. Flemming, sen., Saxony.*)
119. CLOTH TENTERING MACHINES, H. H. Lake.—(*G. P. Wood, Johnston, U.S.*)
120. RAILWAY SWITCHES, &c., J. T. Bucknill, Surrey.

Grants and Dates of Provisional Protection for Six Months.

4733. COKING, &c., COAL, L. V. Semet and E. Solvay, Brussels.—17*th November*, 1880.
4755. ELECTRIC LAMPS, J. A. Berly, Relf-road, Peckhamrye, and D. Hulett, High Holborn, London.—18*th November*, 1880.
4765. CUTTING the OUTER SOLES or CLUMPS of BOOTS, &c., G. F. Claypole, Finedon.—18*th November*, 1880.
4869. SULPHATES of SODA, &c., J. Hargreaves and T. Robinson, Widnes.—24*th November*, 1880.
4895. MOTIVE-POWER, W. P. Kelly, Mount Brandon.—25*th November*, 1880.
4903. SPILES, VENT PLUGS, &c., D. Scott and J. Mackay, Edinburgh.—25*th November*, 1880.
4959. BRICK, H. A. Bonneville, Cannon-street, London.—A communication from E. Beaucantin, Rouen, France.—29*th November*, 1880.
4969. DRAWING BEER, &c., A. Specht, Hamburg.—A communication from K. Wilhelm, Weissenborn.—29*th November*, 1880.
5025. CLEANING FLUES, R. Sutcliffe, Castle Mills, Idle.—2*nd December*, 1880.
5027. FIRE and BURGLAR PROOF SAFES, R. Sutcliffe, Castle Mills, Idle.—2*nd December*, 1880.
5093. SCREW PROPELLERS, W. Cooke and D. Mylchreest, Liverpool.—7*th December*, 1880.
5103. EMPTYING CESSPOOLS, N. Talard, Boulevard Magenta, Paris.—7*th December*, 1880.
5153. PROPELLING VESSELS, C. O. Rogers, Old Broad-street, London. — A communication from W. S. Welton, Malpaso, U.S.—9*th December*, 1880.
5227. BRAKES, N. Talard, Boulevard Magenta, Paris. — 14*th December*, 1880.
5229. CUTTING TENONS, E. Cory, Porteous-road, Harrow-road, London.—14*th December*, 1880.
5231. SUGAR, H. Stokes, Liverpool.—A communication from O. A. de Gramont, Lima.—14*th December*, 1880.
5235. BOBBINS, &c., R. A. Edwards, Southampton-road, Haverstock-hill, London.—14*th December*, 1880.
5237. BRAIDING, &c., MACHINERY, W. T. Glover and G. F. James, Salford.—14*th December*, 1880.
5239. LOOMS, R. Greenwood and W. H. Hayhurst, Blackburn.—14*th December*, 1880.
5242. WEIGHING, &c., MACHINES, W. H. Baxter, the Lawn, Brixton-hill, London.—14*th December*, 1880.
5244. STOPPERING BOTTLES, &c., H. Smith, Holland-street, Brixton-road, London.—14*th December*, 1880.
5246. DISCHARGING, &c., CARGOES, H. Adams, Queen Victoria-street, London.—14*th December*, 1880.
5247. COAL GAS, J. Macdonald, Queen Victoria-street, London.—14*th December*, 1880.
5249. STOCKING, &c., CLASP, L. von Hoven, Castle-street, Holborn, London.—14*th December*, 1880.
5250. CLASPS, L. V. Hoven, Castle-street, Holborn, London.—14*th December*, 1880.
5251. BOWS, &c., for WATCHES, W. R. Lake, Southampton-buildings, London.—A communication from C. S. Hirst, Philadelphia, U.S.—14*th December*, 1880.
5252. OVERHEAD SEWING, A. Storer, Vienna.—A communication from L. Bollmann, jun., and J. Bollmann, Penzing, Austria.—14*th December*, 1880.
5256. WIRE ROPE TRAMWAYS, G. Brown, Finsbury-circus, London.—A communication from G. Kilgour, Dutoitspan, South Africa.—15*th December*, 1880.
5258. CARDING ENGINES, G. and J. Aimers, Galashiels, and D. Wright, Selkirk.—15*th December*, 1880.
5260. COUPLING, &c., PIPES, W. Brett and J. B. Abbey, Huddersfield.—15*th December*, 1880.
5262. SAFETY APPARATUS, G. B. Richards, Bristol.—15*th December*, 1880.
5264. BOTTLES, F. Trotman, Albert House, Albert-street, Regent's Park, London.—15*th December* 1880.
5266. VENTILATING, &c., APPARATUS, W. and B. Verity, Stanhope-street, London.—15*th December*, 1880.
5268. TRANSMITTING APPARATUS, A. W. L. Reddie, Chancery-lane, London.—A communication from J. André, Paris.—15*th December*, 1880.
5270. ROTARY PROPELLERS, &c., M. P. W. Boulton, Tew Park, Oxford.—15*th December* 1880.
5272. SAWING MACHINES, E. Rayner, Liverpool.—16*th December*, 1880.
5274. JOINING LEATHER STRAPS, T. Wheelhouse, Clifton.—16*th December*, 1880.
5276. WINDLASSES, G. D. Davis, Commercial-road, Stepney, London.—16*th December*, 1880.
5280. PIPES, H. E. Grapel and J. Candelent, Birmingham.—16*th December*, 1880.
5286. PURSES, &c., W. R. Lake, Southampton-buildings, London.—A communication from W. Leissler and Sohn, Germany.—16*th December*, 1880.
5288. IRON, P. S. Justice, Southampton-buildings, London.—A communication from C. M. Dupuy, Philadelphia, U.S.—17*th December*, 1880.
5290. PAVING ROADS, B. J. B. Mills, Southampton-buildings, London.—A communication from A. Trenaunay, France.—17*th December*, 1880.
5292. PUMPS, R. G. Abercrombie, Alloa.—17*th December*, 1880.
5294. WHEELS, J. Radges, Coventry.—17*th December*, 1880.
5296. EVAPORATING, &c., APPARATUS, C. D. Abel, Southampton-buildings, London.—A communication from N. Rillieux, Paris.—17*th December*, 1880.
5300. IRON, &c., S. Pitt, Sutton.—A communication from M. Rollet, France.—17*th December*, 1880.
5302. REELS, W. H. Harfield, Mansion House-buildings, London.—17*th December*, 1880.
5308. CLIPS for GUTTER SPOUTING, J. Wiley, Darlaston.—18*th December*, 1880.
5310. TREATING TOBACCO, &c., T. W. Beale, Upper Norwood.—18*th December*, 1880.
5316. BUOYS, J. Sample, Blyth.—18*th December*, 1880.
5318. HEEL PARING MACHINES, F. Cutlan, Cardiff.—18*th December*, 1880.
5320. CLEANING IMITATION CARVING on WOOD, A. Guattari, Chancery-lane, London.—18*th December*, 1880.
3322. LOOMS, C. Catlow, Burnley.—18*th December*, 1880.
5524. REPEATING FIRE-ARMS, T. Nordenfelt, Saint Swithin's-lane, London.—18*th December*, 1880.

Inventions Protected for Six Months on deposit of Complete Specifications.

36. WIRE NAILS, H. H. Lake, Southampton-buildings, London.—A communication from J. Hitchcock and D. C. Knowlton, Boston, U.S.—4*th January*, 1881.

38. CASTING METALS, H. J. Haddan, Strand, London.—A communication from S. L. Clemens, Hartford, and D. Slote & C. Sneider, New York.—*4th January*, 1881.
39. STREET CURBS, &c., H. J. Haddan, Strand, London.—A communication from J. D. Townsend, New York, U.S.—*4th January*, 1881.
74. RAILWAY DUMPING WAGONS, W. R. Lake, Southampton-buildings, London.—A communication from W. H. Paige, Springfield, U.S.—*6th January*, 1881.
75. METALLIC PACKINGS, E. Tripp, East Stoughton, U.S.—*6th January*, 1881.

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

60. INJECTORS, J. Hall, Manchester.—*4th January*, 1878.
127. PENHOLDERS, J. H. Johnson, Lincoln's-inn-fields, London.—*10th January*, 1878.
414. GRAIN ELEVATORS, W. H. Power, Threadneedle-street, London.—*31st January*, 1878.
69. LEATHER HAT-LININGS, W. Morgan-Brown, Southampton-buildings, London.—*5th January*, 1878.
74. THREAD WINDERS, S. Carter, Oldham, and J. Bradley, Lees.—*5th January*, 1878.
95. PIANOFORTES, N. Browne, Queen-street, Cheapside, London.—*8th January*, 1878.
280. INKING ROLLERS, R. Lanham, Abchurch-lane, London.—*22nd January*, 1878.
87. TOBACCO-PIPE JOINTS, W. H. Sharman, Red Lion-square, London.—*7th January*, 1878.
89. TYPE-WRITING MACHINES, W. R. Lake, Southampton-buildings, London.—*7th January*, 1878.
94. UTILISING STEAM, W. R. Comings, New Britain, U.S.—*7th January*, 1878.
110. PRESERVING WOOD, A. M. Clark, Chancery-lane, London.—*8th January*, 1878.
126. ICE, D. Guillod, Chelsea.—*10th January*, 1878.
98. WATER-CLOSETS, H. Owen, Marlborough-road, London.—*8th January*, 1878.
130. STEAM ENGINES, D. Longworth, Birmingham.—*10th January*, 1878.

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

57. COKING COAL, &c., H. Aitken, Falkirk.—*5th January*, 1874.
124. TELEGRAPHIC CONDUCTORS, E. T. Truman, Old Burlington-street, London.—*9th January*, 1874.
102. CLIPS OR HOLDERS, D. Stewart, Glasgow.—*15th January*, 1874.
128. PIPES and TILES, J. Woodward, Darlington.—*9th January*, 1874.
109. THERMOMETERS, H. Negretti and J. W. Zambra, Holborn Viaduct London.—*8th January*, 1874.

Notices of Intention to Proceed with Applications.

Last day for filing opposition 28th January, 1881.

3456. TIME-KEEPER, L. Dee, Sherwood-street, Golden-square, London.—*1st September*, 1880.
3552. PREVENTING SURREPTITIOUS WITHDRAWAL OF WINES, &c., J. Betjemann, Pentonville-road, London.—*1st September*, 1880.
3564. SIGNAL WIRES, C. Gaunt, York.—*2nd September*, 1880.
3568. CLOSING BOTTLES, T. Walker, Sumner-road, Croydon.—*2nd September*, 1880.
3570. EXHIBITING GOODS, F. M. B. Bertram, Myddelton-square, Clerkenwell, London.—*2nd September*, 1880.
3574. LOOMS, T. Singleton, Over Darwen.—*3rd September*, 1880.
3578. VEHICLES, W. J. Fraser, Adelaide-road, Haverstock-hill, London.—*3rd September*, 1880.
3580. BRAKE APPARATUS, R. Smith, Southampton-buildings, London.—*3rd September*, 1880.
3582. PROPELLING SHIPS, G. F. Harrington, Ryde.—*3rd September*, 1880.
3588. ARTIFICIAL TEETH SETTINGS, P. Jensen, Chancery-lane, London.—A communication from E. Rauzerot.—*3rd September*, 1880.
3589. SPINNING, B. Berry and S. S. Freeman, Bradford.—*3rd September*, 1880.
3593 YEAST, J. E. Newby and J. F. Ramsay, Durham.—*4th September*, 1880.
3600. PIANOFORTES, J. Gautier, Euston-road, London.—*4th September*, 1880.
3605. WHEELS, J. W. Morgan, Garth.—*4th September*, 1880.
3608. TIN, &c., PLATES, E. Parry, New Bridge-street, London, and T. H. Cobley, Dunstable.—*4th September*, 1880.
3609. DECORATING CEILINGS, &c., C. Brothers, St. Pancras, London.—*4th September*, 1880.
3619. MEASURING ANGLES at BILLIARDS, J. F. Armistead, Blackburn.—*6th September*, 1880.
3628. TUBE EXPANDERS, F. W. Bond, Lambeth.—*7th September*, 1880.
3637. LIGHTING CITIES, P. M. Justice, Southampton-buildings, London.—A communication from H. C. Spalding.—*7th September*, 1880.
3648. LAMP and TIME INDICATOR, F. M'D. Robertson, Gurtain-road, London, and J. Joyce, Lower Edmonton.—*8th September*, 1880.
3712. TOOL, E. H. Bennett, Leadenhall-street, London.—*11th September*, 1880.
3741. TAPS, E. Ludlow, Birmingham.—*14th September*, 1880.
4177. FIRE-GRATES, E. Taylor, Blackburn.—*14th October*, 1880.
4610. BLEACHING WOVEN FABRICS, W. Birch, Salford.—*10th November*, 1880.
4745. ELECTRIC LAMPS, J. E. H. Gordon, Dorking.—*17th November*, 1880.
4841. DRYING STARCH, B. J. B. Mills, Southampton-buildings, London.—A communication from W. Angele.—*22nd November*, 1880.
4948. VELOCIPEDES, &c., W. H. Thompson, Finsbury-square, London, and F. G. Henwood, Budge-row, London.—*27th November*, 1880.
5104. PULVERISING MACHINE, W. R. Lake, Southampton-buildings, London.—Com. from F. Luckenbach, J. Wolfenden, and L. F. Holman.—*7th December*, 1880.
5122. GAS GOVERNORS, W. Cowan, Edinburgh.—*8th December*, 1880.
5162. TRANSMITTING, &c., APPARATUS, H. V. Hoevenbergh, Ludgate-circus, London.—*10th December*, 1880.
5167. STEEL, T. Hampton, Sheffield.—*10th December*, 1880.
5168. IRON and STEEL, G. Ellinor, Sheffield.—*10th December*, 1880.
5192. SPINNING MACHINERY, J. C. Fell, Ashton-under-Lyne.—*11th December*, 1880.
5194. FURNACES, D. and J. Warren, Glasgow.—*11th December*, 1880.
5221. GRINDING MILLS, C. M. Sombart, Magdeburg.—Com. from R. Schneider.—*13th December*, 1880.
5224. PRINTING MACHINERY, J. Davies, Bermondsey, London.—*13th December*, 1880.
5226. TRANSMITTING TELEPHONIC MESSAGES, A. M. Frankenberg, Baltimore, U.S.—*14th December*, 1880.
5336. VALVES, J. B. Handyside, Glasgow.—Com. from G. H. Reynolds and T. J. Rider.—*20th December*, 1880.
5416. COMPRESSED TOBACCO, W. R. Lake, Southampton-buildings, London.—A communication from I. Lindsley.—*24th December*, 1880.

Last day for filing opposition, 1st February, 1881.

3612. HAT CASE, L. Hutchings, Sandymount, Ireland.—*6th September*, 1880.
3616. AMALGAMATORS, P. B. Wilson, Baltimore, U.S.—*6th September*, 1880.
3621. AUTOMATIC APPARATUS, W. R. Lake, Southampton-buildings, London.—A communication from H. von Leesen.—*6th September*, 1880.
3635. GOVERNORS, A. S. F. Robinson, Ipswich.—*7th September*, 1880.
3638. HOISTING APPARATUS, W. R. Lake, Southampton-buildings, London.—A communication from B. Hinsley.—*7th September*, 1880.
3641. DECOMPOSITION of SALTS of AMMONIA, L. A. Groth, Finsbury-pavement, London.—A communication from W. Rube, H. T. Eugelcke, and C. J. Bernhard.—*8th September*, 1880.
3644. CEMENTS, J. C. Bloomfield, Castle Caldwell.—*8th September*, 1880.
3666. METAL FENCING, D. Ross, Hilton Farm, Inverness.—*9th September*, 1880.
3688. SPRINGS, H. L. Wilson and J. Clegg, Atlas Works, Clayton-le-Moors.—*10th September*, 1880.
3689. ICED AIR INHALATORS, W. Brierley, Halifax.—Com. from L. Stackfleth.—*10th September*, 1880.
3693. PECKS, &c., G. R. Postlethwaite, Aston.—*10th September*, 1880.
3713. RAISING APPARATUS, C. Haslett, Southampton-row, and J. G. Thomson, Little Guildford-street, London.—*11th September*, 1880.
3743. SHELLS, C. D. Abel, Southampton-buildings, London.—A communication from E. J. B. Delacourt.—*14th September*, 1880.
3762. INDICATING APPARATUS, G. W. Warren, Newington-green-road, London.—*16th September*, 1880.
3837. HOT PLATES for PRESSES, F. C. Glaser, Berlin.—Com. from R. Dinnendahl.—*22nd September*, 1880.
3859. COOPERAGE MACHINES, A. Ransome and T. J. Wilkie, Chelsea.—*23rd September*, 1880.
3374. PAPER, J. Wetter, Strand, London.—A communication from P. Neuman.—*24th September*, 1880.
3893. FIREPLACES, J. Russell, Neath.—*25th September*, 1880.
3998. METAL FRAMES, H. Tonkinson and W. Rockliffe, Sunderland.—*2nd October*, 1880.
4013. LAVATORIES, E. W. de Rusett, Anerley, and F. P. and J. T. Prestige, and E. J. Preston, Deptford.—*2nd October*, 1880.
4015. PRINTERS' METAL FURNITURE, P. M. Justice, Southampton-buildings, London.—A communication from J. L. Chapin.—*4th October*, 1880.
4188. LOCKS, H. K. Bromhead, Glasgow.—*15th October*, 1880.
4341. ELECTRICAL APPARATUS, G. Skrivanoff, Paris.—*25th October*, 1880.
4356. AERATED BEVERAGES, L. Shapter, the Barnfield, Exeter.—*25th October*, 1880.
4472. UTILISING STEEL RAIL ENDS, C. Jones and J. D. Jones, Swansea.—*2nd November*, 1880.
4495. ELECTRIC LIGHTING APPARATUS, W. R. Lake, Southampton-buildings, London.—A communication from J. V. Nichols.—*3rd November*, 1880.
4571. LOOMS, C. Campbell, Kirkcaldy.—*8th November*, 1880.
4626. LIGHTING, &c., GAS, W. R. Lake, Southampton-buildings, London.—A communication from G. D. Bancroft.—*10th November*, 1880.
4720. BURNING PETROLEUM, &c., J. M. Forbes, jun., Cornhill, London.—A communication from B. N. Huestis.—*16th November*, 1880.
4772. POLISHING METALS, W. J. Clapp, Nantyglo, Monmouth.—*19th November*, 1880.
4826. MACHINES for HEELS, S. H. Hodges, Street, Somerset.—*22nd November*, 1880.
4839. PROPULSION of BODIES in AIR, F. Hime, London.—*22nd November* 1880.
4863. BACK SIGHTS for SMALL-ARMS, C. Wozencroft, Fort Elson, Gosport.—*23rd November*, 1880.
5068. TELEPHONIC APPARATUS, J. N. Culbertson, Holborn Viaduct, and J. W. Brown, Upper Kennington-lane, London.—*6th December*, 1880.
5086. CARDING MACHINES, H. H. Lake, Southampton-buildings, London.—Com. from the Whitehead and Atherton Machine Company.—*6th December*, 1880.
5113. TELEPHONES, J. B. Morgan, Coleman-street, London.—Com. from T. A. Edison.—*8th December*, 1880.
5156. GAS, A. P. Chamberlain, Finsbury, London.—*10th December*, 1880.
5193. FOOTSTEPS for SPINDLES, J. Greenwood, jun., G. A. Helliwell, W. Hammond, S. Holt, Todmorden.—*11th December*, 1880.
5247. COAL GAS, J. Macdonald, Queen Victoria-street, London.—*14th December*, 1880.
5447. PURIFYING STEAM, &c., J. F. Belleville, Paris.—*28th December*, 1880.

38. CASTING METALS, H. J. Haddan, Strand, London.—A communication from S. L. Clemens, D. Slote, and C. Sneider.—*4th January*, 1881.
39. STREET CURBS, H. J. Haddan, Strand, London.—Com. from J. D. Townsend.—*4th January*, 1881.
75. METALLIC PACKINGS, T. Tripp, East Stoughton, Norfolk, U.S.—*6th January*, 1881.

Patents Sealed

List of Letters Patent which passed the Great Seal on the 7th January, 1881.)

2816. CARBURETTING AIR, E. Edmonds, Fleet-street, London.—*8th July*, 1880.
2828. PRESERVING WOOD, F. H. F. Engel, Hamburg.—*9th July*, 1880.
2832. STAMP CUSHIONS, G. W. von Nawrocki, Leipziger-strasse, Berlin.—*9th July*, 1880.
2833. DYNAMOMETRICAL REGULATOR, X. Moussard, Boulevard St. Denis, Paris.—*9th July*, 1880.
2859. SEWING MACHINES, F. H. F. Engel, Hamburg.—*10th July*, 1880.
2860. AUTOMATIC REGULATOR, W. A. Barlow, St. Paul's-churchyard, London.—*10th July*, 1880.
2868. KIERS, J. Hawthorn, Newtown.—*12th July*, 1880.
2869. ASBESTOS PACKING RINGS, H. Wedekind, Fenchurch-street, London.—*12th July*, 1880.
2870. WHEELED VEHICLES, J. Wood, Burnley.—*12th July*, 1880.
2872. WINDOW FRAMES, &c., W. Wilson, Liverpool.—*12th July*, 1880.
2898. FOLDING CHAIRS, &c., J. and N. Blezard, Padiham.—*14th July*, 1880.
2899. TREATING FUEL, W. Gorman, Glasgow.—*14th July*, 1880.
2932. STEAM GENERATOR, L. Mills, Tynemouth.—*16th July*, 1880.
2945. EXHAUSTING APPARATUS, W. Mooney, Ringsend-road, Dublin.—*17th July*, 1880.
2950. CORKSCREWS, W. B. Baker, Birmingham.—*17th July*, 1880.
2951. VELVETS, J. Lees, J. Travis, and J. Lees, Chadderton.—*17th July*, 1880.
2972. KNEADING or MIXING DOUGH, &c., T. Lindop, Middlewich.—*19th July*, 1880.
2985. PLOUGHING, R. Sellar, Huntly.—*20th July*, 1880.
2997. VESSEL, H. C. Bagot, Conway.—*21st July*, 1880.
3001. PRESERVING FOOD, F. Artimini, Jermyn-street, London.—*21st July*, 1880.
3060. PERMANENT WAY, C. de Féral, Longeville, Germany.—*24th July*, 1880.
3146. PUMPS, H. E. Newton, Chancery-lane, London.—*30th July*, 1880.
3342. ABSORBENT and DEODORISING POWDER, T. B. Gibbs, Stoke Newington.—*17th August*, 1880.
3829. OIL LAMPS, W. P. Thompson, High Holborn, London.—*22nd September*, 1880.
4168. STOPPERS for BOTTLES, &c., A. Kohlhofer, Nicholas-square, Hackney-road, London.—*13th October*, 1880.
4376. PERMANENT WAY, D. Macnee, Westminster-chambers, London.—*27th October*, 1880.
4382. MOTIVE-POWER, M. Travers, Reform Club, Pall-mall, London.—*27th October*, 1880.
4555. CENTRIFUGAL MACHINES, C. D. Abel, Southampton-buildings, London.—*6th November*. 1880.
4625. HAND TRUCKS or BARROWS, W. R. Lake, Southampton-buildings, London.—*10th November*, 1880.

(*List of Letters Patent which passed the Great Seal on the 11th January*, 1881.)

2874. SATURATING ATMOSPHERIC AIR, &c., S. Trotman, Mornington House, Wanstead.—*12th July*, 1880.
2903. CHILDREN'S CRADLES, &c., J. Friborg, Store-street, London.—*14th July*, 1880.
2919. HORSESHOES, C. Wittenström, Stockholm.—*15th July*, 1880.
2926. HARVESTING MACHINES, W. R. Lake, Southampton-buildings, London.—*15th July*, 1880.
2928. BAGS, J. Nicholls, Huddersfield.—*15th July*, 1880.
2929. AERATED WATERS, G. O. Willis, Monmouth.—*16th July*, 1880.
2931. REMOVING WINDOW SASHES, J. Hayes, jun., Hermes-street, London.—*16th July*, 1880.
2934. SAFETY GUARDS, T. Rochford, Brunswick-square, London.—*16th July*, 1880.
2947. AXLES, W. Harker, Kingston-upon-Hull.—*17th July*, 1880.
2954. PREVENTING WASTE of WATER, A. Cole, Norwood, Surrey.—*17th July*, 1880.
2962. CLEARING, &c., APPARATUS, W. R. Lake, Southampton-buildings, London.—*17th July*, 1880.
2970. RAISING WATER, J. B. Duckett, Chapeltown, York.—*19th July*, 1880.
2995. EXPANDING BOILER TUBES, D. J. Morgan, Cardiff.—*20th July*, 1880.
3007. MEASURING, &c., APPARATUS, J. J. and W. A. Tylor, Newgate-street, London.—*21st July*, 1880.
3028. DRY GAS METERS, J. Foxall, Newport.—*23rd July*, 1880.
3071 WEAVING SEAMLESS CORSETS, &c., J. C. Mewburn, Fleet-street, London.—*26th July* 1880.
3209. SPRING MOTORS, E. A. Brydges, Königgrätzer-strasse, Berlin.—*5th August*, 1880.
3341. COUPLINGS, E. C. Bowen, Tokenhouse-yard, London.—*17th August*, 1880.
3534. TAWING, &c., HIDES or SKINS into LEATHER, F. Wirth, Frankfort-on-the-Maine.—*31st August*, 1880.
4304. LOCKS or LATCHES, W. White, Wimpole-street, London.—*21st October*, 1880.
4329. SHARPENING SAWS, S. Rolland, Pacy, France.—*23rd October*, 1880.
4349. BUTTONS, F. Dittermann, Aldermanbury, London.—*25th October*, 1880.
4392. FRICTION COUPLING, W. Mather, Platt, Salford.—*27th October*, 1880.
4396. CARPET SWEEPERS, A. C. Herts, Bloomsbury, London.—*28th October*, 1880.

List of Specifications published during the week ending January 8th, 1881.

1161, 6d.; 1719, 4d.; 1830, 2d.; 2134, 6d.; 2281, 6d.; 2287, 6d.; 2290, 6d.; 2291, 6d.; 2293, 6d.; 2299, 6d.; 2301, 2d.; 2302, 4d.; 2305, 2d.; 2306, 4d.; 2307, 6d.; 2309, 2d.; 2310, 6d.; 2311, 2d.; 2313, 2d.; 2314, 2d.; 2315, 6d.; 2317, 2d.; 2340, 6d.; 2321, 2d.; 2322, 4d.; 2323, 6d.; 2325, 10d.; 2326, 4d.; 2327, 2d.; 2328, 2d.; 2330, 2d.; 2331, 6d.; 2335, 4d.; 2336, 6d.; 2337, 2d.; 2338, 6d.; 2339, 2d.; 2340, 2d.; 2343, 2d.; 2344, 6d.; 2345, 6d.; 2346, 4d.; 2348, 6d.; 2350, 6d.; 2351, 6d.; 2352, 6d.; 2353, 6d.; 2354, 2d.; 2355, 6d.; 2357, 2d.; 2358, 2d.; 2359, 4d.; 2361, 6d.; 2362, 6d.; 2363, 6d.; 2364, 2d.; 2366, 2d.; 2367, 6d.; 2368, 2d.; 2372, 6d.; 2373, 2d.; 23,75 2d.; 2377, 4d.; 2379, 2d.; 2380, 2d.; 2381, 2d.; 2383, 2d.; 2384, 2d.; 2386, 2d.; 2387, 6d.; 2389, 6d.; 2396, 10d.; 2394, 2d.; 2395, 4d.; 2396, 2d.; 2398, 2d.; 2399, 6d.; 2400, 2d.; 2401, 2d.; 2402, 2d.; 2405, 6d.; 2409, 6d.; 2414, 1s. 2d.; 2415, 4d.; 2431, 2d.; 2442, 6d.; 2444, 6d.; 2481, 4d.; 2486, 6d.; 3125, 6d.; 3658, 6d.

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

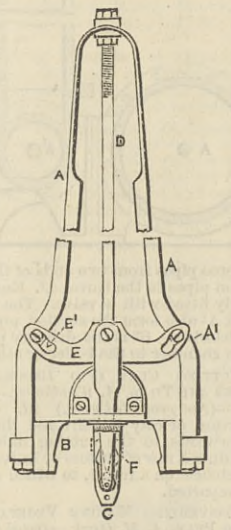
ABSTRACTS OF SPECIFICATIONS.

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

1161. APPARATUS FOR FORMING THE NECKS OF BOTTLES, *H. Codd and H. Barrett.—Dated 18th March*, 1880. 6*d.*

This consists of tongs or apparatus for forming the necks of bottles with undercut grooves, such tongs being furnished with teeth, which in retiring descend in the bottle, in order to clear themselves from the undercut groove which they produce. A A are the arms of the tongs, carrying at their ends the moulding cheeks B B, by which in the usual way the form is given to the exterior of the neck. C is the plug which enters within the neck of the bottle; it contains the

1161.



teeth for moulding the undercut groove. The plug is carried by the adjustable stem D, which is fixed by locking nuts in the bow of the tongs. E is a cross-bar, which is able to slide upon the stem D. E¹ E¹ are inclined slots in the cross-bar, and A¹ A¹ are pins passing through the slots, and fixed in the arms A A of the tongs. F F are the teeth within the plug.

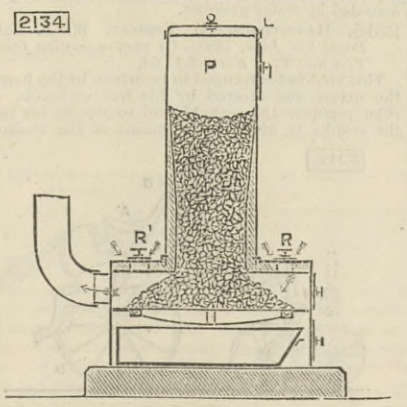
1719. FASTENINGS FOR GLOVES, &c., *J. Whitby.—Dated 27th April*, 1880. 4*d.*

On one side of the glove is fastened a metallic collar, ring, or eyelet, with parallel interior sides with a set-off or wider opening at the front. On the other side is fixed a stud containing a spring projecting through the side, so that when the collar is passed over the stud the spring contracts, and on coming into the wider portion it expands, and holds the two parts together.

2134. FURNACES OR STOVES, *W. R. Lake.—Dated 25th May*, 1880.—(*Com. from R. Marburg.*) 6*d.*

The main principle of this construction of grate is that of a generator furnace, the fuel being converted into combustible gas by a current of air, which is not sufficient to cause entire combustion. The

2134.



combustible gas thus obtained is caused to burn by a second current of atmospheric air, which can be accurately regulated by means of a register, and can be easily made sufficient to cause the total combustion of the gases without any surplus of air being introduced. In the drawing P represents a vertical pit or chamber, which contains the fuel. This pit has a lid or a door L for closing the same hermetically. Below the said pit is situated the fire space or combustion chamber where the fuel, resting on the grate, is horizontally dispersed or distributed by a current of air entering the register R. In this chamber the fuel is transformed into combustible gas, whose total combustion is induced by the second current of air entering the register R¹.

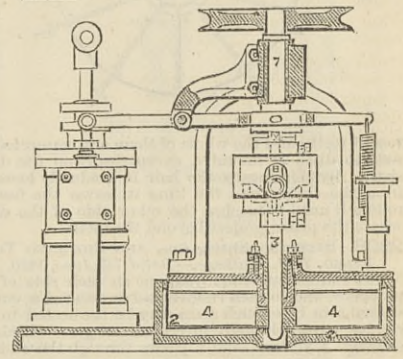
2281. STANDS FOR DECANTERS, &c., *J. Betjemann.—Dated 4th June*, 1880. 6*d.*

Projections are formed in the base of the stand and fit into recesses formed in the bottoms of the decanters. To lock up the decanters in the stand a pivotted bar passes over the stopper and can be locked in this position.

2287. APPARATUS FOR REGULATING THE SUPPLY OF STEAM TO STEAM ENGINES, *J. D. Churchill.—Dated 5th June*, 1880. 6*d.*

The adjusting movement of the throttle or other valve is effected through a connection actuated by a spindle, which is intermediate between two other spindles, and is operated by inclines brought into action when one of those spindles driven by the engine to be controlled overruns the other spindle, which is furnished with means for retarding its rotation, such as vanes revolving in liquid, balls suspended by rods, or other suitable means for effecting the same

2287

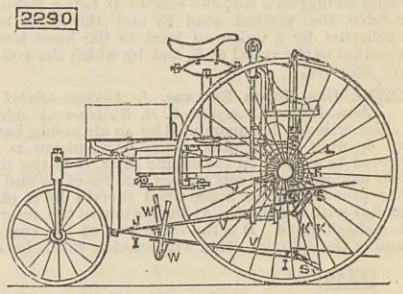


object. A vessel is provided with baffles 2, and charged with water or other liquid; 3 is the vane or brake spindle, and 4 are its vanes. This spindle carries a cam, constructed with two pairs of inclines. 7 is the spindle driven from the engine to be controlled. It is arranged in the same axial line as the vane or brake spindle 3, and between them is arranged concentrically the intermediate spindle 8, which enters recesses in the vane or brake spindle and in the driving spindle respectively.

2290. VELOCIPEDES, *L. Hardaker.—Dated 7th June*, 1880. 6*d.*

The frame is preferably of hollow metal and the driving wheels are mounted on separate shafts, the inner ends of which are so arranged that motion may be communicated from an intermediate shaft actuated by treadles I and J, through belts or chains K, pulleys L, and ratchet wheels and pawls on the intermediate shaft. The pulleys have each two grooves of different diameter to receive double cords attached to the treadles by links S, having slots to receive studs on the treadles. To the links are attached rods V capable

2290

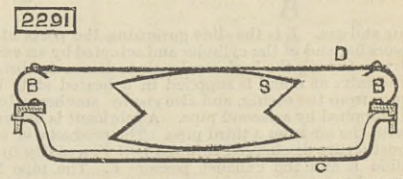


of sliding on the treadles, so as to adjust the links to any required position on the studs, such adjustment being effected by the hand levers W. A second set of treadles Y are mounted crosswise from the centre of the vehicle over the treadles I and J. The seats are adjustable. An atmospheric engine and a gas engine are fitted to the vehicle, the charge of the latter being exploded by electricity.

2291. ELASTIC BOTTOMS FOR BEDS, *R. Hunt.—Dated 7th June*, 1880. 6*d.*

C-shaped springs B are secured to the frame by clips, and have raised lips by which transverse lathes D and

2291

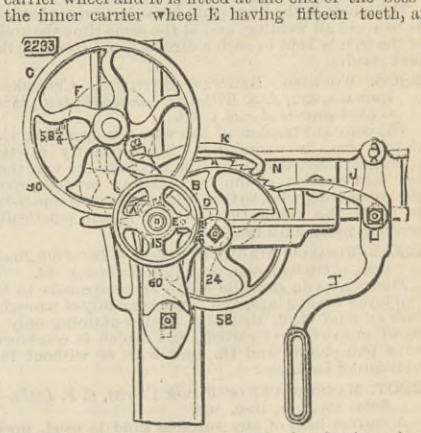


longitudinal laths are connected to them. A stretcher C prevents the twisting of the frame. The transverse laths are supported by springs S resting on the stretcher.

2293. LOOMS, *T. Sagar.—Dated 7th June*, 1880. 6*d.*

This relates to the taking-up motion. N is a portion of the loom frame, I the taking-up lever, K the retaining catch, and J a taking-up catch which actuates the driven ratchet wheel A having fifty-eight teeth, attached to and revolving with a driver wheel D having twenty-four teeth, which gives motion to the driven change wheel B having sixty teeth. This is the outer carrier wheel and it is fitted at the end of the boss of the inner carrier wheel E having fifteen teeth, and

2293



transmits motion to the beam wheel C having ninety teeth on the taking-up roller F whose circumference is fifty-eight quarter inches. By this arrangement the requisite motion is imparted to roller F to take up fifteen picks per quarter inch. If fifteen and three-quarter picks per quarter inch be wanted a change wheel of sixty-three teeth is substituted for that of

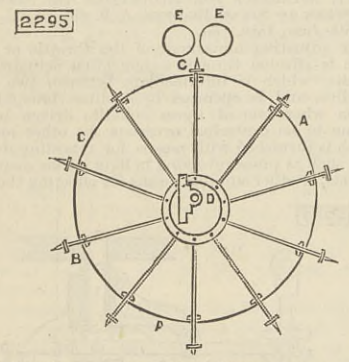
sixty teeth, and so on, increasing or diminishing in direct proportion to the number of picks per quarter inch required.

2294. WINDOW SASHES, *N. Welton.—Dated 7th June*, 1880.—*(Not proceeded with.)* 2*d*.

One end of a rope or chain is attached to the top sash and the other end to the bottom sash, such chain passing over a pulley fixed at the top of the window frame, by which means the sashes are suspended and counterbalance each other.

2295. COMBING HORSEHAIR, &c., *J. R. Meyer.—Dated 7th June*, 1880. 4*d*.

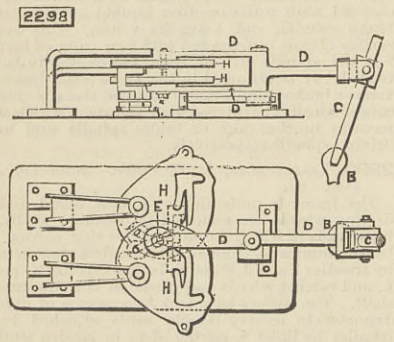
The toothed drum A is mounted centrally and is combined with a series of plates B mounted excentrically in relation to the drum, the teeth C projecting through the plates. There is a separate plate to each



row of teeth, and the whole of them are connected by rods to discs D, mounted excentrically on the drum shaft. By this means the hair is gradually loosened from the teeth from the time it leaves the feeding rollers E until it reaches the other side of the drum where the plates project beyond the teeth.

2298. STEERING SHIPS, &c., AND CHECKING THEIR SPEED, *T. B. Heathorn.—Dated 7th June*, 1880. 6*d*.

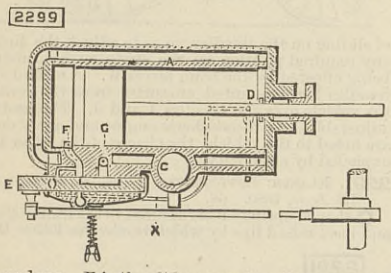
Two rudders are employed, one on each side of the propellor, and to each rudder post is secured a curved slotted arm H, or such arms may be connected to the rudder posts through intermediate gear wheels as shown. A vertical stud E passes through the slots in



the arms H, and is connected to a bar D, pivotted to a block sliding on a bar, one end of D being forked to receive the vertical stud E, and the other being connected by a universal joint to the hand lever C pivotted to the vessel at B, and by which the rudders are actuated.

2299. GAS MOTOR ENGINES, *J. Livesey.—Dated 7th June*, 1880.—*(Com. from F. H. W. Livesey.)* 6*d*.

The cylinder is surrounded by an air casing having an opening to the atmosphere. The piston is connected to a crank on the engine shaft, C is the reservoir containing the compressed charges of air and gas, the pressure being maintained therein by a piston loaded with a weight. At the bottom of the reservoir is a check valve. D is the valve box at the charging end of the cylinder fitted with suction valves for both



air and gas. E is the slide governing the ports at the working end of the cylinder and actuated by an excentric. During the back stroke air is drawn in through the valve at D and is supplied in a heated state by a pipe from the casing, and also gas by another valve at D supplied by a second pipe. A lubricant is drawn in with the air from a third pipe. The products of combustion are discharged through port F, a cavity in the slide E and the exhaust passage F. The pipe X is brought into communication with a passage in the slide and so supplies the charge to the cylinder.

2301. WATER-CLOSETS, *J. and F. Hubber—Dated 7th June*, 1880.—*(Not proceeded with.)* 2*d*.

The pan is hemispherical and the outlet is at the front and above the bottom thereof so that water always remains in the pan. From the outlet passes a syphon forming one piece with the basin, the arrangement being such that the syphon which forms the trap is above the floor line.

2302. HORN PLATES FOR RAILWAY VEHICLES, *W. R. Lake.—Dated 7th June*, 1880.—*(A communication from I. Hennequin.)*—*(Not proceeded with.)* 4*d*.

The whole of the horn plate is made in one piece, so as to avoid all welding, and at the same time the grain of the iron is kept in such a direction as to produce the best results.

2305. WORKING RAILWAY SWITCHES, CROSSINGS, SIGNALS, &c., *J. S. Williams.—Dated 8th June*, 1880. —*(Not proceeded with.)* 2*d*.

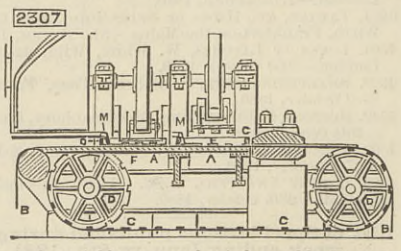
The constant tension of the wire for operating the signal, &c., is maintained independently of the operating lever, which is so connected to the wire that the continuation of the lever clamps or acts upon the connecting wire, so that when the lever commences to move the connection to the signal practically becomes made with the lever.

2306. METALLIC ALLOYS, *G. A. Dick.—Dated 8th June*, 1880.—*(Partly a com. from C. J. A. Dick.)* 4*d*.

This relates to metallic alloys or compounds to be employed for castings, and consists mainly of wrought iron or mild steel, that is a steel containing only a small proportion of carbon, and which is combined with phosphorus and tin, and with or without the addition of lead.

2307. MANUFACTURE OF FLOOR CLOTH, *C. F. Leake.—Dated 8th June*, 1880. 6*d*.

A canvas base of any suitable kind is used, upon which is rolled or spread a coat of linoleum compound, for the purpose of rendering the fabric firm and of sufficient rigidity to steer or guide it with accuracy and certainty; after which the coated cloth is passed over a bed or table, and to the surface is applied granulated linoleum composition of various colours, the several colours being kept separate and apart from one another, so as to form the desired pattern, and subsequently the granular coating is pressed, whilst in a more or less heated state, on to the base cloth, so as to render the coating smooth and solid, and cause it to adhere to the base. The drawing shows a machine for applying the coloured granulated compositions. A is a flat bed or table; B is the coated base cloth which is to be passed over such table, and which is to have coloured granulated compositions applied in patterns to its surface; C is an endless chain or band, with spikes standing out from it; this band is supported by wheels D. The cloth is moved with a step-by-step movement over the face of the bed by giving an intermittent rotating movement to the axle of one or other of the pairs of wheels D. Above



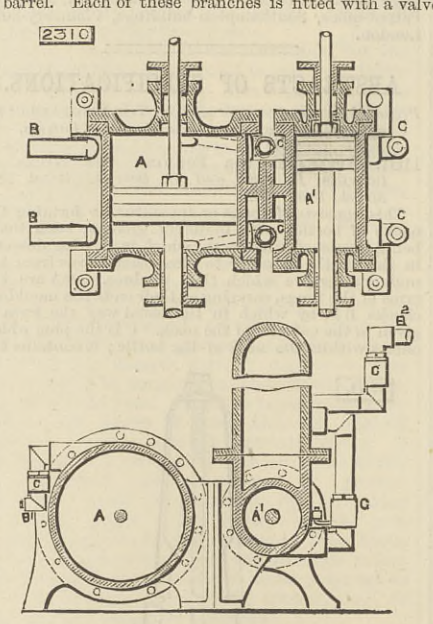
the bed or table are perforated moulds F, each of which is surrounded on the underside by a steel or metal knife edge which projects downwards from it. Each mould is carried by a tray G, which can be moved upwards or downwards a short distance in guides in the frame of the machine, so as to allow the descending knife edges of the mould to rest upon the base cloth, or lift the mould upwards away from the cloth. M are scrapers, one for each tray, for as many trays as there are in the machine. A separate tray is required for each colour used in forming the pattern.

2309. TRICYCLES, *J. Barling.—Dated 8th June*, 1880.—*(Not proceeded with.)* 2*d*.

The rider sits between two driving wheels and works a single treadle, which is attached to the crank in such a position underneath the rider that his whole weight may be brought to bear on it.

2310. PUMPING A MIXTURE OF STEAM AND WATER OR OTHER SATURATED VAPOUR OR GAS, *R. M. Marchant.—Dated 8th June*, 1880. 6*d*.

A is the first or large pump barrel, and A^1 the second or smaller pump barrel. There is an air or storage chamber. B is the suction pipe of the first barrel, with branches leading to the two ends of the said barrel. Each of these branches is fitted with a valve



C. The force pipes from two ends of the barrel A form the suction pipes to the barrel A^1. Each of these pipes is similarly fitted with a valve. The force pipes from the barrel A^1 also form the suction pipes to the air or storage chamber. B^2 is the delivery pipe from the air or storage chamber to the boiler or other receiver.

2311. CUTTING CLAY INTO BLOCKS FOR MAKING BRICKS AND TILES, *A. Woodhouse.—Dated 8th June*, 1880.—*(Not proceeded with.)* 2*d*.

The stream of clay is delivered through a die, and moved forwards to the cutting table, where it is forced against a row of cutters or knives of fine spring steel, stretched on a frame, to which a sliding movement is imparted.

2313. CONVERTING MARINE VEGETATION, &c., INTO PAPER PULP, *A. M. Clark.—Dated 8th June*, 1880.—*(A communication from E. V. J. L. Gorges.)*—*(Not proceeded with.)* 2*d*.

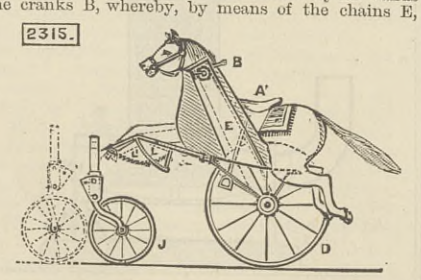
Marine plants are first incinerated to obtain an alkaline lye of soda and potash, which is then rendered caustic by milk of lime. In this lye the plants to be converted into pulp are macerated for some hours, and then drained and plunged into dilute sulphuric acid. The cellulose and ligneous fibres will thus be converted into firm pulp.

2314. PREVENTING THE ENTRANCE OF SEWER GAS INTO BUILDINGS, *A. M. Clark.—Dated 8th June*, 1880.—*(A communication from A. F. Pflughaupt.)*—*(Not proceeded with.)* 2*d*.

A close iron tank is interposed between the waste pipe and the sewer, into which everything passing through the waste pipe is discharged. With the upper part of the tank is connected the inner end of a pipe open at both ends, its upper end being near the surface of the ground, so that the warm air from the tank may pass up through the waste pipe, and be replaced by fresh air. An outlet in the bottom leads to the sewer, which is closed by a valve, the stem of which passes through both ends of a cylinder secured to the top of the tank, and inside which moves a piston actuated by water pressure.

2315. HAND-PROPELLED VEHICLE, *W. R. Lake.—Dated 8th June*, 1880.—*(A communication from A. Vick and T. J. Harbeck.)* 6*d*.

This vehicle is arranged to be driven by the hands of the driver, and steered by his feet or hands. The rider occupies the seat A^1, and rotates by his hands the cranks B, whereby, by means of the chains E,



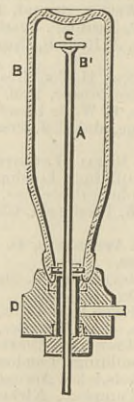
power is communicated to the rear wheels D, which thus propel the vehicle. When it is desired to steer by the feet, the pedal L is connected to a bar or bars by means of cords or chains L^1, and thus, by moving the said bar or bars, the wheel J may be turned to the right or left.

2317. SWITCHES AND CROSSINGS FOR RAILWAYS, *W. F. Reynolds.—Dated 8th June*, 1880.—*(Not proceeded with.)* 2*d*.

The switch rails are so arranged that the inner portions, near where the curve takes place, are high enough to permit the flanges of the carriage wheels to pass over the main rails, and the free ends of the switch rails are lengthened, and lodge upon the main rails. One switch rail is placed on the inside, and one upon the outside of the main rails.

2320. STOPPERING BOTTLES HAVING INTERNAL STOPPERS, *J. Varley.—Dated 9th June*, 1880. 6*d*.

The drawing is a sectional elevation showing an arrangement employed in the case in which the filling or charging apparatus is provided with the ordinary air tube or rod. The upper end of this rod A is provided with a cup or dished end B^1. The bottle B, to be filled, is placed in the cup or socket D of the filling



apparatus, which is of ordinary contruction, and the said air tube or rod A is passed into the bottle, and the cup or dished end B coming against the stopper C will raise it and retain it in a flat position while the bottle is being filled, and on the rod A being withdrawn it will leave the stopper C properly placed on its seat in the neck of the bottle.

2321. AUTOMATIC CANDLE EXTINGUISHER, *C. Tester.—Dated 9th June*, 1880.—*(Not proceeded with.)* 2*d*.

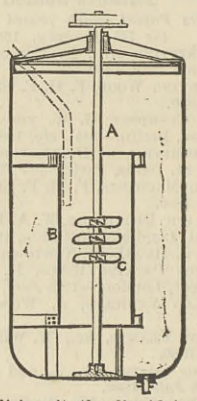
An ordinary extinguisher is secured by a spring clip in any position on a candle, which when burnt down to such position, will be extinguished by the extinguisher passing over the top thereof.

2322. VARNISHES, *J. B. Freeman.—Dated 9th June*, 1880. 4*d*.

To make colourless varnish Manilla gum or other gum-resin is dissolved in fusel oil, or in any of the amylic alcohols or their derivatives, or in ethylic alcohol containing amylic alcohol and its derivatives; and a separate solution of pale resin in turpentine is made and the two solutions mixed, a small quantity of spirits of wine, methylated spirit, finish or naptha being added. To make transparent coloured varnish fine Manilla gum or other gum-resin is dissolved in fusel oil and a small quantity of one of the coloured salts of aniline or other colour soluble, in fusel oil or in spirit, is added.

2323. EFFECTING OXIDATION, REDUCTION, AERATION, DECOLOURISATION, OR SEPARATION BY THE INTERACTION OF GASES OR VAPOURS WITH LIQUIDS OR WITH EACH OTHER, &c., *J. Storer.—Dated 9th June*, 1880. 6*d*.

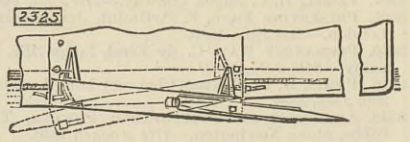
One form of the apparatus to effect the above object is shown in the drawing, and consists of a cylindrical vessel open at top and containing a central shaft A carrying a pulley by which it is revolved. Inside the cylinder is a concentric shell B, and within it on the shaft A is a series of screws or oblique blades C. If air is to be made to interact with a certain liquid, for the



purpose of oxidising it, the liquid is filled into the cylindrical vessel up to the level of the top of the internal shell B, and the shaft A is revolved so as to cause the liquid to circulate systematically, either down the inside of the inner shell and up in the space between it and the cylindrical vessel, or *vice versâ*.

2325. STOWING IN OR DISCHARGING TORPEDOES FROM TORPEDO BOATS, &c., *J. E. Atkinson.—Dated 9th June*, 1880. 10*d*.

A water-tight trunk or well is formed in the hull of the vessel, and within it are placed a number of torpedoes one over the other, so arranged that they can



be lowered in quick succession with a discharging trunk or tube, out of which they can be impelled in the usual manner. This trunk is fitted accurately in the bottom of the well, and when not in position for discharging completely closes the opening in the vessel's bottom.

2326. ORNAMENTING VARIOUS SURFACES, &c., *G. L. Batonnier.—Dated 9th June*, 1880.—*(A communication from E. A. Batonnier and P. A. Michel.)* 4*d*.

A paste is made from some amylaceous substance and a thin layer is spread over a sheet of paper, cardboard, or metal. On this surface any of the colouring matters employed in dyeing fibrous materials are placed in a powdered form. The surface to be ornamented is then placed on the colour and clamped to the sheet of paper, when the two are plunged in boiling water, thus causing the colours to dissolve and fix themselves into the surface.

2327. ATTACHING DOOR KNOBS, &c., TO THEIR SPINDLES, *H. Ferrer.—Dated 9th June*, 1880.—*(Not proceeded with.)* 2*d*.

In one end of the square spindle a slot is formed extending nearly to the end, the uncut part being drilled with a hole opening into the slot, and being screw-threaded. The knob is placed on the end of the spindle, the screwed hole coming opposite a hole in the front of the knob. A screw pin is then passed through the knob and takes into the hole in the spindle.

2328. SOLITAIRES, &c., *W. W. Twigg and W. C. Williamson.—Dated 9th June*, 1880.—*(Not proceeded with.)* 2*d*.

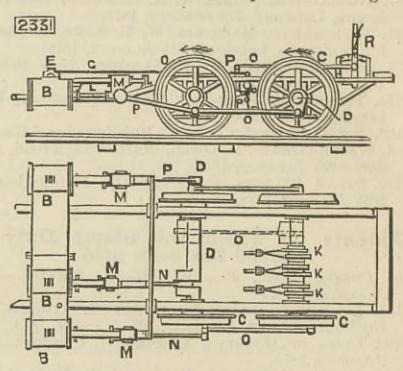
The back consists of a disc with a shank terminating in a head, and the front is formed of two disc-shaped shells, the back one having a raised portion to receive the head of the shank, and bow spring securing the two parts together.

2330. SOWING SEED, *W. R. Lake.—Dated 9th June*, 1880.—*(A communication from T. Carron)*—*(Not proceeded with.)* 2*d*.

Beetroot seeds are sown in small lots at equal distances apart in the furrow made by the share or cutter attached to the sowing machine. When the plants commence to come up, they grow in tufts or bunches, and the outside plants of each bunch protect in the event of drought or extreme dryness the central one, which alone will be preserved when the subsequent clearing or thinning is effected. A special apparatus is employed to sow the seed so as to produce this result.

2331. LOCOMOTIVE ENGINES, *W. R. Lake.—Dated 9th June*, 1880.—*(A communication from J. Band and G. B. Smith.)* 6*d*.

Three cylinders are employed and are connected to the slide valve gear and reversing gear, so as to allow steam to enter successively each end of the three cylinders at every revolution of the driving wheel. B are the three cylinders; C the driving wheels; and D the crank axles. The crank pins are arranged at



angles of about 120 deg. to each other. E are the slide valves, and G the valve stems driven by arms and links from the excentrics K; L are the piston-rods, connected to a crosshead M, and to the connecting-rods N attached to the driving axles. O are coupling-rods, P link lift arms, Q a rod extending from P to the reversing lever R.

2335. AFFIXING AND SECURING THE COVERS OF UMBRELLAS TO THEIR FRAMES, &c., *H. Shaw and W. Spencer.—Dated 9th June*, 1880.—*(Not proceeded with.)* 4*d*.

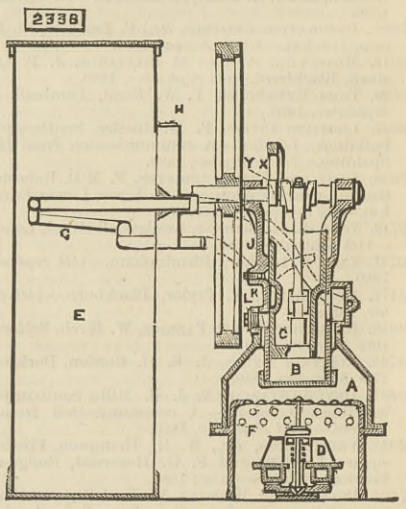
The cover is attached to the outer ends of the ribs by a metal clip secured to the cover, and having a hole through which the end of the rib passes. A special apparatus is used to secure the clip to the cover.

2336. MUSTARD POTS, &c., *H. Shaw and W. Spencer.—Dated 9th June*, 1880. 6*d*.

A dome of india-rubber is placed on the top of the pot and by applying pressure thereto, a certain quantity of mustard will be forced up a spout, the mouth of which is near the level of the top of the pot, while its lower end is near the bottom of the inside.

2338. CONDENSING STEAM ENGINE AND BOILER, &c., *J. G. Wilson.—Dated 9th June*, 1880.—*(A communication from H. Hoffmeister and E. Friedrich.)* 6*d*.

The engine consists of an inexplosive steam generator A, and an open topped cylinder B, in which the working piston C distributes the steam, and regulates at the same time the water supply; E is a surface condenser provided with a serpentine pipe G, through which the exhaust steam passes from the cylinder, and is thereby condensed. The generator A has horizontal tubes F, and its bottom or crown of the furnace is constructed of a thin corrugated sheet metal plate, which is caused to bulge in case of an alteration of pressure, and by being connected to a gas supply valve regulates the flame of the Bunsen burner D, and thus,



when the engine stops, only sufficient gas is supplied to keep up the steam pressure. The slide piece X fixed to the upper end of the piston C is moved from one side to the other by the cam Y on the fly-wheel shaft, so as to communicate a partial rotary motion to the piston. The exhaust enters pipe G and blows the air out through the valve H. The condensed water flows into chamber J and thence through the groove K in the piston, into chamber L, and back to the generator A.

2339. FILE FOR LETTERS, BILLS, &c., *T. Birkbeck and J. E. Miller.—Dated 9th June*, 1880.—*(Not proceeded with.)* 2*d*.

To the base board near the upper edge and on opposite sides are two standards one notched and the other with a screw thread and thumb screw. The screwed upright receives below the thumb screw the eye of a cross bar of hard drawn wire shaped so as to form a spring to press upon the papers. The free end of the bar can enter any of the notches in the opposite standard.

2340. FLUTES, *C. A. Drake.—Dated 10th June*, 1880 —*(Not proceeded with.)* 2*d*.

The pillars to support the centre to which the keys are affixed, are each formed with two or more bearings so as to carry two or more centres. One or more continuous rods are used, and pass from end to end serving to support the tubes on which the keys work. The keys operated by the left hand are specially arranged.

2343. VENTILATION OF WATERPROOF CLOTHING, *J. Neville.—Dated 10th June*, 1880.—*(Not proceeded with.)* 2*d*.

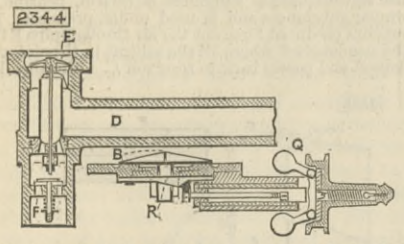
Round the arm hole a piece of the material is attached passing up to the armhole, and going back into the garment about 4in. The sleeve is then fastened to this piece, air being admitted through holes cut therein. The seams under the arms have a portion left open also for ventilation.

2344. GAS MOTOR ENGINES, *H. Robinson.—Dated 10th June*, 1880. 6*d*.

The centrifugal governor Q driven from the engine shaft actuates the inclined plane or wedge R, and holds it in a position varying according to the speed of the

engine, so as to limit the lift of valve B, and so regulate the amount of explosive mixture to enter the pump and clearance through this valve. D is a pipe leading from the pump and clearance to the ignition chamber, the delivery valve E being at the end nearest the ignition chamber. F is a small air valve below the delivery valve and opening inwards. While the gas

2344

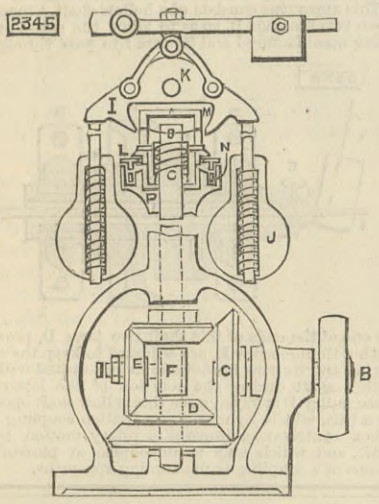


and air pump is drawing in the gas and atmospheric air through valve B, the pump at certain times draws into the pipe D a certain quantity of atmospheric air through valve F thus keeping the valve E cooler, and also causing that part of the charge which is near the delivery valve E to consist entirely of air, or to be more diluted with air.

2345. ENGINE GOVERNORS, *H. J. Haddan.—Dated* 10*th June*, 1880.—(*Com. from E. Mas.*) 6*d.*

A driving shaft B carries a bevel wheel C, gearing with one of two wheels D cast together and mounted loosely on shaft G. The other wheel D gears with a wheel E fixed on shaft F, free to turn on shaft G by means of a sleeve. The wheel E gears with a wheel fixed to shaft G. I are the heads of two pendulous arms, with balls J, inside which are springs, placed over the rods passing through balls, and allowing the latter to alter their distance during their revolution round the central shaft. K is the head of the central shaft, at the lower end of which turns the spindle G, but which

2345



is retained by a pin. L is a steel ring hollowed out at bottom, the cavities corresponding to a counterpart. M is a support, on the raised portion of which rest the heads of the pendulous arms. The feet of this support communicate this pressure to ring L. A weigh lever is employed to increase at will the pressure on rings L and N, and horns at the heads of the pendulous levers serve to support the balls when not in motion. A spring lodged in casing P has a constant tendency to depress the shaft G.

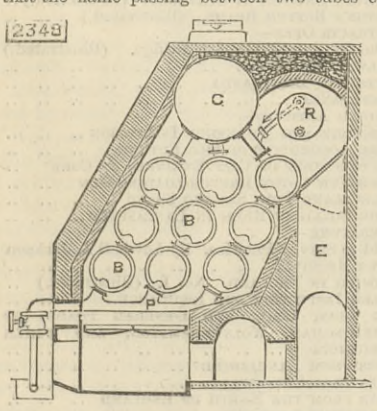
2346. TRANSFERRING PICTURES, *P. O'Halloran.—Dated* 10*th June*, 1880.—(*Com. from C. A. Pocher.*) 4*d.*

The picture is prepared with a varnish, consisting of seven parts boiled refined linseed oil, colophony, gum-mastic, samderic, and gumcopal, and is printed to its margin. Before the varnish is quite dry, the picture is sprinkled with a composition of colophony and gum-mastic in equal parts, and is then placed in a cylinder heated by steam. The picture is placed on the object to which it is to be transferred, and wiped over with a damp sponge, and a heated iron run over it, when, on removing the picture, a *fac-simile* will be seen on the object.

2348. STEAM GENERATORS, *J. C. Mewburn.—Dated* 10*th June*, 1880.—(*A communication.*) 6*d.*

The generator is composed of a series of water tubes B and a cylindrical barrel C forming a steam reservoir. These tubes and the reservoir can be placed longitudinally or transversely as shown. The tubes are set at an inclination and are superposed quincially so that the flame passing between two tubes comes

2348

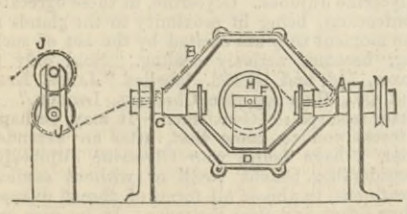


against the middle of the tube above and so on up to reservoir C. The smoke and gases pass off through flue E in which is arranged a feed water heater R. The ends of the tubes are closed by caps with necks to connect them with the caps above and below, those of the top tubes communicating with the reservoir. On the descending side a collecting pipe P is fitted in which the sediment collects, and can be emptied by opening a cock.

2351. TWISTING OR DOUBLING YARN, &c., *J. King, jun.—Dated* 10*th June*, 1880. 6*d.*

This consists in holding the bobbins nearly stationary while the thread passes wholly round both ends of the bobbin, so as to obtain a double twist for a single revo-

2351



lution of the flyer. A is the spindle with a hole in it through which the thread passes to arm B, connecting the spindle to a tubular continuation C. D is a yok hung tightly on A and C, and its arms carry the spindle F, on which the bobbin H is placed, being connected by a hinge joint so as to facilitate the introduction of fresh bobbins, which are kept from flying out by a spring. A drag or friction pad is applied against the end of the bobbin, and rollers revolving synchronously with the spindle, but at a much less speed to regulate the feed of the yarn that it may receive the right amount of twist. The threads pass from the bobbin through the hole in the spindle A round arm B through tubular spindle C and between rollers J. As it enters A it receives one twist, and as it leaves C it takes another.

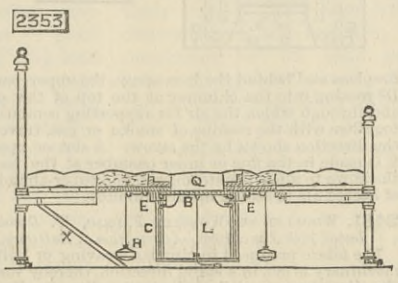
2352. METAL HEELS OF BOOTS AND SHOES, *J. W. Jones and E. K. Bridger.—Dated* 10*th June*, 1880. 6*d.*

A metal shell is applied to the heel and fixed by means of screws or nails passing into the sole-piece. A metal tip or plate is fixed by screws to the bottom of the shell. In order to attach spurs to the shell the shank of the spur is passed through a slot in the back of the shell and is fixed by one of the screws by which the shell is secured to the heel passing through it.

2353. INVALID BEDSTEADS, *H. J. Dalton.—Dated* 10*th June*, 1880. 6*d.*

Under the bed frame is fitted a rising and falling platform B guided in its movements by depending rods C, on or against which bear rollers attached to the platform. Lugs E are also attached to the platform and to them are secured cords provided with balance

2353



weights H. The platform s pulled downwards by a cord L. The platform has on its upper side a plug Q to fit a hole in the centre of the bed, and into which a bed pan is introduced. The head end of the bed frame is hinged and may be inclined and kept in position by the strut X.

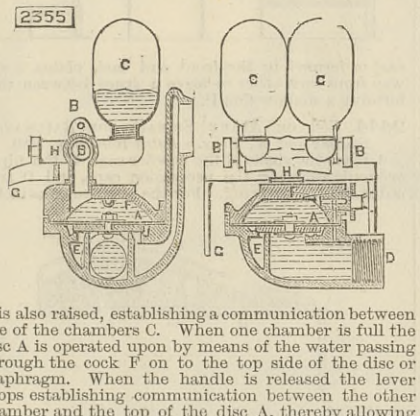
2354. BATTERIES FOR THE TRANSMISSION OF SOUND, *R. H. Courtenay.—Dated* 10*th June*, 1880.—(*Not proceeded with.* 2*d.*

This consists in the construction of either a single cell or a series of batteries in such a way as to form either a single or compound transmitter of sound by means of a tension spring adjusted to the negative element of battery or batteries, the advantages being that no resisting substance is employed in circuit other than the ordinary elements of the batteries and line in the usual way, the result being that more electro-motive force is used on the primary circuit of any transmitter constructed on this principle, than on that of any other at present used.

2355. VALVES FOR WATER-CLOSETS, &c., *J. Smeaton.—Dated* 10*th June*, 1880. 6*d.*

The drawings show one form of valve. A is a disc secured between two metal parts, and to its underside an india-rubber seating is secured. B are cocks working in connection with the chambers C above disc A. D is the inlet pipe, and E the outlet around the inlet, both being covered by the disc A. F is a regulating cock and G a lever. When the pull is raised the lever

2355



G is also raised, establishing a communication between one of the chambers C. When one chamber is full the disc A is operated upon by means of the water passing through the cock F on to the top side of the disc or diaphragm. When the handle is released the lever drops establishing communication between the other chamber and the top of the disc A, thereby allowing an after flush to the water-closet pan, and by the same operation and at the same time the water from the chamber is discharged through the orifice H.

2357. SECURING THE LIDS OR COVERS OF BOXES, &c., *E. A. Brydges.—Dated* 10*th June*, 1880.—(*Com. from J. Fischer.*)—(*Not proceeded with.*) 2*d.*

The lid is formed with a bolt which when in its locked position can be covered with sealing wax, so that the lid cannot be opened without breaking the seal.

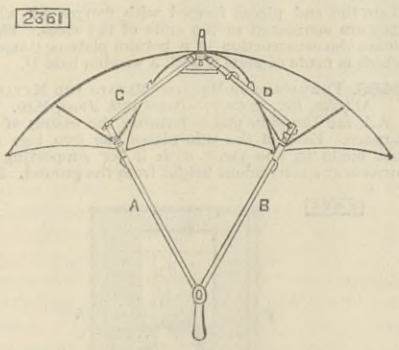
2359. COLOURED PLASTER OR CEMENT, *A. M. Clark.—Dated* 10*th June*, 1880.—(*Com. from C. F. Fabre.*) 4*d.*

The substances ordinarily employed to manufacture mortar, plaster, or cement, are washed and coloured in any suitable manner so as to permanently fix the colours.

2361. UMBRELLAS, *J. Foster.—Dated* 11*th June*, 1880. 6*d.*

The stick consists of four rods, A, B, C, and D, which, when the umbrella is closed, lay close together

2361

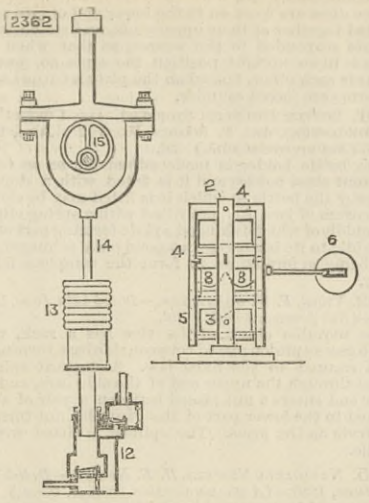


side by side in two lines, but when open form a quadrangle large enough to give room for the head and hat of the person using the umbrella.

2362. PREPARING AND TREATING POTTER'S CLAY, &c., *W. Boulton.—Dated* 11*th June*, 1880. 6*d.*

So that the slop clay may be prepared ready for being pumped into the filtering press it is first treated in a sifting apparatus in which no glasses are required. The sifting apparatus is shown at the 1st Fig., and consists of end frames 1 with upper and lower centre points 2 and 3 carrying upper and lower articulated sifter frames 4 and 5, and on which they are made to oscillate by an excentric or crank 6, two springs 8 being attached to each end of the lower frame to keep it steady, and the articulation of both frames complete when running at a high speed. The 2nd Fig. shows a pumping apparatus for forcing the clay into the filtering press. An air chamber 12 is provided in connection with the suction chamber in order to give a more uniform suction. Any required pump pressure can be obtained

2362

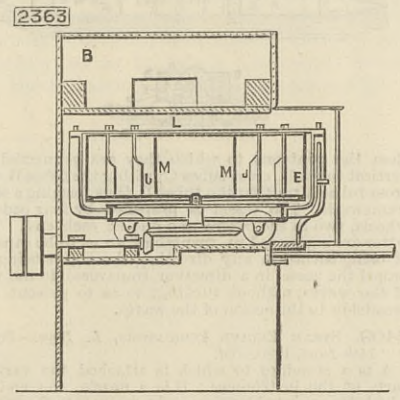


by the use of cheese weights 13 on the ramrod 14, the weighted ram being returned for a new stroke by means of the excentric 15.

2363. APPARATUS FOR ROASTING COFFEE, &c., *P. Pearson.—Dated* 11*th June*, 1880. 6*d.*

Inside of a revolving pan E is a series of scrapers J fixed to the pan cover and placed at such an angle as will have a tendency to throw the coffee towards the centre, thus counteracting the centrifugal force, well stirring the coffee, and keeping the layer always level and even. So as to prevent burning or over roasting

2363



of that portion of the coffee which, being nearer the centre of the pan moves at a lower velocity, a ring of metal M is employed to keep the centre of the pan quite clear, and a fixed screen L of sheet metal is placed over the centre part to screen off a portion of the heat of the fire from the coffee. The heating flues B are above the pan E.

2364. FASTENER FOR BOOTS, SHOES, &c., *O. M. C. Chamberlain.—Dated* 11*th June* 1880.—(*Not proceeded with.*) 2*d.*

The fastening consists of three levers jointed together, and the ends of the outer ones attached to the boot or shoe. By pressing the levers together the opening in the boot or shoe is closed.

2366. LOOMS FOR WEAVING, *W. Taylor.—Dated* 11*th June*, 1880.—(*Not proceeded with.*) 2*d.*

So as to check the shuttle when it is sent home or when it is sent from one shuttle-box to the other, a pulley is fixed on the picking rod, and on the shuttle-box frame is a projection which at each forward movement of the shuttle-box frame comes in contact with the pulley and pushes down the picking rod, thereby moving the picking arm and picker in a position to check the shuttle on its being sent into the box.

2367. WIRE HEDDLES OR HEALDS FOR LOOMS, &c., *H. E. Newton.—Dated* 11*th June*, 1880.—(*A communication from A. Argo.*) 6*d.*

The wires after twisting are rolled so as to make them smoother, more rigid and thin than usual. The drawing shows the rolling apparatus, which consists of a bed-plate supporting a shaft actuated by a crank handle and carrying a pinion gearing with a rack on the underside of a plate, which slides on the bed-plate. To the upper face of this plate is secured a

2367

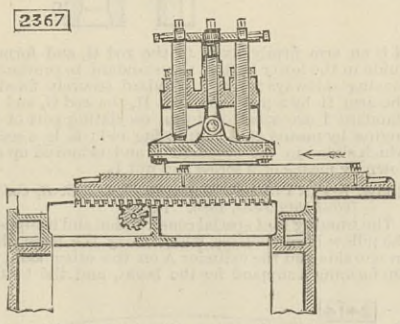


plate of hard steel with a smooth surface. To the bed-plate is bolted an upright frame the upper part of which is flat and receives screws Through the centre of the frame passes a screwed rod, capable of adjustment by nuts, and secured at its lower end to a plate. A small space is left in the two plates to receive the eye of the heald, which is placed on the lower plate and rolled by the passage of the top plate over it. An additional eye is formed above the loop by which the healds are mounted on the shaft so as to prevent the healds shifting one over the other.

2368. SAMPLE CASES, &c., *A. J. Eli and P. Hargan.—Dated* 11*th June*, 1880.—(*Not proceeded with.*) 2*d.*

The box is formed so that when opened out it stands on a counter self-sustained at an angle of 45 deg. and so conveniently expose the articles it contains. The sides are hinged together so as to close up in a small space.

2373. COPYING LETTERS, &c., *S. A. Cochrane.—Dated* 11*th June*, 1880. 2*d.*

In place of the ordinary oiled paper and blotting-paper a sheet of copper or zinc with a fine granulated surface is employed. The surface is moistened with a sponge, the letter to be copied placed under a dry sheet of copying paper, and then placed on the moistened metal surface, the whole being then introduced in a press and pressed in the usual manner.

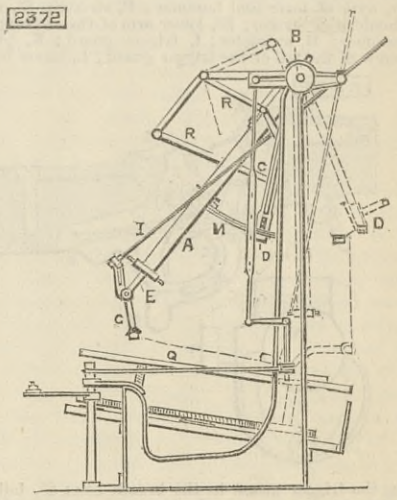
2377. WATERPROOFING, STRENGTHENING, AND PRESERVING LEATHER, HIDES, &c., *W. R. Lake.—Dated* 11*th June*, 1880.—(*A communication from C. Ballat schano and H. Trenk.*) 4*d.*

A quantity of grease is caused to decompose by an acid capable of effecting the same, and the decomposed grease is deoxidised by means of a base, such as carbonate of soda, and cleaned by washing with water The mixture is warmed and mixed with a thick solution of glue, in which is dissolved a small quantity of oxalic acid. A second mixture is made, consisting of glue dissolved in water, and a small quantity of oxalic acid is added, and also a small quantity of glycerine with acetic alumina dissolved therein. The first mixture is rubbed into the leather, which when dry is immersed in the second mixture, the operations being continued until the desired result is obtained.

2372. PAPER MAKING MACHINERY, *J. Hird.—Dated* 11*th June*, 1880. 6*d.*

The drawing shows the apparatus applied to machines that deliver the sheets in a vertical direction, and consists of pneumatic apparatus to remove the sheet when cut and deposit it on a receiving table. A is a hollow lever attached to a rocking shaft B. C a lever with a connecting rod D attached to it, and which drives the machine, E is a tube sliding telescopically into lever A, and having at its end a socket

2372



in which a hollow arm G swivels, and is fitted with a perforated mouth-piece to form a sucker for holding the sheet of paper. I is a screw rod working from a pivot on arm G, which it causes to swivel. A valve shuts off and opens communication between the mouthpiece and the exhaust, such valve being operated by levers governed by stops on a baacket M. Q is the receiving table. R are flyers which descend on the sheet as it is deposited on the receiving table.

2375. APPARATUS FOR SHIPS CARRYING GRAIN CARGOES, *P. Clarke.—Dated* 11*th June*, 1880.—(*Not proceeded with.*) 2*d.*

A number of movable partitions are employed to divide the hold into different compartments, running the whole length, fore and aft. These partitions may be placed in any position to resist the force or weight of the grain.

2379. CUTTING, PARING AND SCRAPING VEGETABLES AND FRUITS, *H. Brandes.—Dated* 12*th June*, 1880.—(*Not proceeded with.*) 2*d.*

A revolving disc is fitted with knives or scrapers, and serves to cut vegetables or fruits into slices, the vegetables or fruits being fed into the machine by suitable mechanism.

2380. EXHAUSTERS FOR GASES OR LIQUIDS, *J. A. R. Hildebrandt.—Dated* 12*th June*, 1880.—(*A communication from J. Gareis.*)—(*Not proceeded with.*) 2*d.*

Within a cylinder with open bottom is fitted a piston consisting of a hollow cylinder open at top and bottom and divided by an oblique partition. The top of the cylinder is closed by a cover carrying a stuffing-box and bearings for three shafts, on the outside end of one of which is a driving pulley and on the inside end a bevel wheel gearing with two larger wheels, one on each of the other studs, and the latter wheels have each a ball and socket joint to which is attached a cross bar connected with the piston rod.

2381. LUBRICATING FLUID, *E. Poole.—Dated* 12*th June*, 1880.—(*A communication from S. Rogers and C. H. Schooley.*)—(*Not proceeded with.*) 2*d.*

India-rubber is placed in benzine or oleine oil and when pulpy is placed in a boiler and heated to 250 deg. Fah., more oleine, or paraffine being added until the compound becomes dissolved into a liquid paste, which is used as a lubricating fluid.

2383. TRAPPING WATER CLOSETS, &c., *P. M. Justice.—Dated* 12*th June* 1880.—(*A communication from J. E. Folk.*)—(*Not proceeded with.*) 2*d.*

Quicksilver or other equivalent fluid substitute of greater specific gravity than water, and which will not mix or unite with the water, is used as a fluid seal in the trap, the quicksilver being so heavy that it will always remain below the water, and so dense that the gases cannot pass through it.

2384. METAL HURDLES, FENCING, AND GATES, *W. Bailey.—Dated* 12*th June*, 1880.—(*Not proceeded with.*) 2*d.*

A hole is punched through the upright at the point where it is connected to the horizontal bar, such hole being of the shape of the section of the bar, but with its vertical axis inclined. The bar has an inclined niche on one side extending from the top, where it is cut into any desired depth, to about the middle of the depth of the bar where it runs out to the surface, and also a corresponding niche at the under and at the opposite side of the bar. The bar is fixed by threading it through the hole and then turning it into its proper vertical position, whereby the edges round the hole enter the niches and prevent the upright moving endwise of the bar.

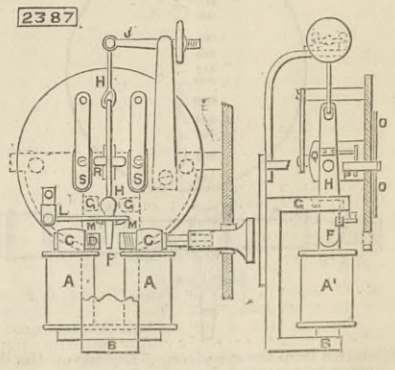
2386. METAL FOUNDERS' BLACKING, *J. S. Sawrey and A. Patterson.—Dated* 12*th June*, 1880. 2*d.*

The carbonaceous crust which forms inside gas and other retorts is cooled as it leaves the retort by dilute sulphuric acid or water, with or without soapstone or salt, and ground it into a fine powder. It is then mixed with prepared plumbago and used as founders' blacking, or in a very finely pulverised condition it may be used as a lubricant.

2387. IMPROVEMENTS IN ELECTRIC TELEGRAPHS AND IN APPARATUS CONNECTED THEREWITH, *Sir C. T. Bright.—Dated* 12*th June*, 1880. 6*d.*

This improvement is intended to render the action of the moving parts more distinct, and to reduce the E. M. F. required. Part of the improvement is the

2387



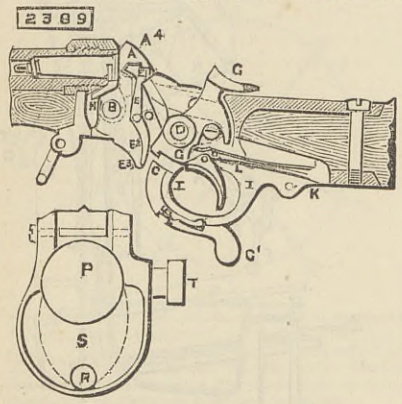
devising of an instrument at once a sounder and a recorder. There are nineteen claims of which Figs. 1 and 2 will give a fair example. Fig. 1 shows back and Fig. 2 section of instrument, A A' are electro-magnetic coils, fixed to B the end of a permanent magnet and so

polarised. C C are the upper poles of coils through which soft iron pole pieces are screwed. The distance between the ends of these pole pieces can be adjusted as shown. F is the free end of an armature polarised by G G upper poles of magnet B. The other end of F is supported as shown, and an aluminium lever H H extends from axis of tongue to lever J mounted on centres and carrying an adjustable weight. L an arm resting on pins M M checks the signals. The needle O O is connected with a short arm P P as shown, which engages a pin Q. R is the hammer, S and S the sounders, the latter serving also as stops.

2389. FIRE-ARMS, *E. Nagant.—Dated 12th June*, 1880. 6*d.*

The drawing shows the mechanism closed, but with the hammer cocked ready for firing. A is the obturator; B, axis of obturator and of extractor; C, lever; D, axis of lever and hammer; E, striker; E^1, rear shoulder of striker; E^2, lower arm of the striker; G, hammer; H, extractor; I, trigger guard; K, pivot screw of the tail of the trigger guard; L, screw hold-

2389



ing the trigger guard in the breech box; C^1, tail of lever; A^3, lower part of obturator, against which slides the lever to open the mechanism; A^4 upper and hinder part, against which the head of the lever slides to close the mechanism. The second figure shows under view of upper ring; P, hole through which passes the barrel; R, hole through which passes the cleaning rod; S, recess for the wood of the stock; T, tenon or stud of sword bayonet.

2390. WORKING OF RAILWAY SIGNALLING APPARATUS, *G. K. Winter.—Dated 12th June*, 1880. 10*d.*

The general principle of this invention is simple to understand, though the details are numerous. The block telegraph instruments require the combined action of the signalmen at the ends of a section in order that the indications of the instruments may be varied. The invention also relates to the semaphore in view of the driver. The needle of each indicator

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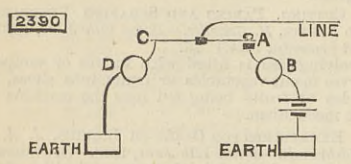


has two positions, from one to the other of which the needles are actuated by coils not in the line circuit. The mode of effecting combined action to alter the nstruments is well known in duplex work. Suppose a key, is used to give signals. A current coming from the other end of the section, as shown by position of key, only influences instrument D, whilst pressing down key at A allows the current at this end to actuate instrument B. Thus the combined actions are shown.

2394. PRODUCING COLD OR ICE, *H. A. Dufrené.—Dated 12th June*, 1880.—(*Com. from "La Société Anonyme de Froid."*)—(*Not proceeded with.*) 2*d.*

This consists in apparatus for the expansion or production of gases or vapours; then in compressing these gases or vapours to bring them back to their primitive volume or into a liquid state; but instead of effecting this compression by means of an arrangement of compressing pumps, pumps are employed in which the pressure is obtained by the aid of a liquid which does not absorb the gas or vapours to be compressed.

2395. PRESERVING MEAT, &c., *H. A. Dufrené.—Dated 12th June*, 1880.—(*A communication from "La Société Anonyme de Froid."*) 4*d.*

The meat is exposed in chambers through which a current of air is caused to pass, then it is dried by means of chloride of calcium and cooled, so as to cause it to lose a certain quantity of water, at the same time maintaining it at a temperature a little above that at which water freezes. The meat thus partly dried is placed in wagons, ships, or other conveyances, and during transport is subjected to a temperature of a little above 0 deg. Cent., but without being subjected to ventilation.

2396. POTATO RAISING OR LIFTING MACHINES, *W. H. Sleep.—Dated 12th June*, 1880.—(*Not proceeded with.*) 2*d.*

This relates to a machine for raising the potatoes from the ground, at the same time cutting off the tops and weeds overhanging the row. The potatoes are lifted into a revolving screen by a wide curved share, and the tops and weeds are cut off while in the ground by means of circular revolving knives.

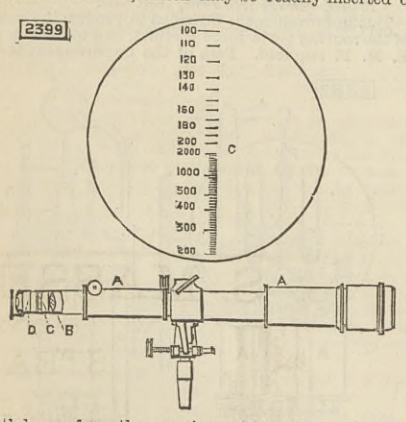
2398. BEDDING FOR HORSES, &c., *D. Gaussen.—Dated 12th June*, 1880.—(*Not proceeded with.*) 2*d.*

This consists of an elastic bed made of india-rubber or other suitable elastic non-absorbent material to be used in place of a straw litter.

2399. INSTRUMENT FOR ASCERTAINING DISTANCES, *H. Hensoldt.—Dated 12th June*, 1880. 6*d.*

A is an ordinary telescope within which is inserted the eye-piece B having a glass disc C on which are a series of irregular divisions. This disc is secured in a detachable tube D, which may be readily inserted or

2399



withdrawn from the eye-piece. The scale on the disc is divided by a central line, the divisions in the top half being larger than those in the bottom half. When taking the vertical dimensions of an object the disc is turned so that the lines are horizontal, and when taking a horizontal measurement the lines are placed vertically

2400. DRESS SUSPENDERS, *W. W. Twigg and W. C. Williamson.—Dated 12th June*, 1880.—(*Not proceeded with.*) 2*d.*

Two discs are fixed on to the lower end of two arms jointed together at their upper ends, and connected to a plate suspended to the wearer, so that when the plate is in an upright position the arms are pushed towards each other, but when the plate is turned aside the arms are forced asunder.

2401. BOTTLE HOLDERS, STOPPERS, AND COVERS FOR DECANTERS, &c., *T. White.—Dated 12th June*, 1880. —(*Not proceeded with.*) 2*d.*

The bottle holder is made adjustable so as to fit different sized bottles and it is fitted with a stopper, whereby the bottle to which it is fitted may be closed. The covers of jars, &c., are fitted with a spring clip to the middle of which is hinged a plate forming part of the lid, while to its inner edge a second plate is hinged, the two being so formed as to form the complete lid or cover.

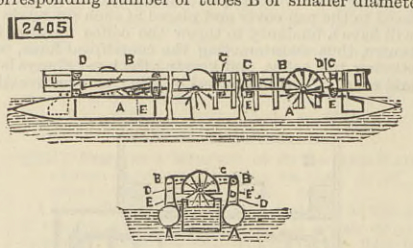
2402. VICES, *F. W. Onfermann.—Dated 12th June*, 1880. —(*Not proceeded with.*) 2*d.*

The movable cheek of the vice has a rack, with which gears a pinion placed between side bars, turning on bolts secured to the fixed jaw. A vertical spindle passes through the upper end of the side bars, and its lower end enters a nut placed between a pair of arms secured to the lower part of the vice, the nut turning on pivots on the arms. The spindle is fitted with a handle.

2405. NAVIGABLE VESSELS, *H. E. Newton.—Dated 14th June*, 1880.—(*A communication from A. Olsen.*) 6*d.*

The vessel is supported by pontoons A, one or more on each side, and preferably pointed at the ends so as not to impede the progress of the vessel, and divided into compartments by transverse partitions, so that if one is penetrated, the others will still be free from water. Parallel with and above the pontoons A is a corresponding number of tubes B of smaller diameter

2405

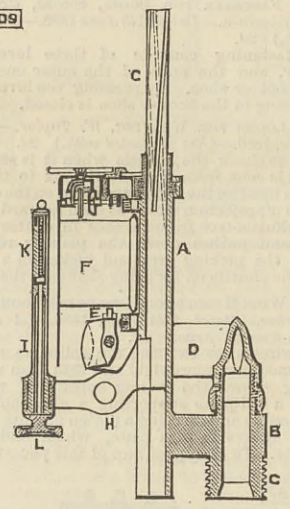


than the pontoons to which they are connected by vertical tubes D, cross tubes C uniting the tubes B and cross tubes E uniting the tubes D, thus forming a solid framework. The vessel is propelled by four paddle-wheels, two in the centre and one at each end. The latter are supported in turntables, so as to be capable of being turned in any direction, the object being to propel the vessel in a direction transverse to the run of the waves without turning, so as to present the broadside to the action of the waves.

2409. STEAM ENGINE INDICATORS, *L. Boye.—Dated 14th June*, 1880. 6*d.*

A is a standard to which is attached the various parts of the instrument; B is a nozzle, one end of which is connected by means of a screw C to the steam cylinder in the usual manner, the other end of which is attached to a spring steel tube D, which is connected with a card drum segment F by means of a connecting link E. The drum segment F moves on two points which are adjustable, and has a suitable card holder at the sides to secure the cards to the drum; G is a rod which fits inside the standard A;

2409

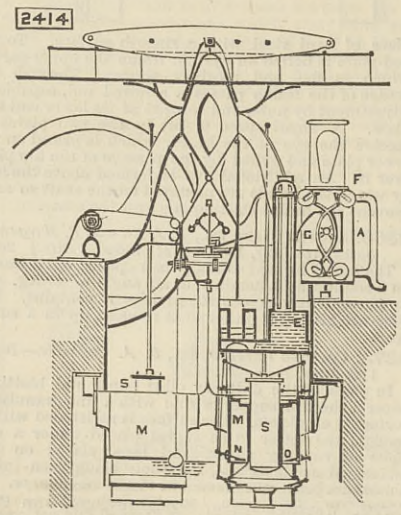


H is an arm firmly fixed to the rod G, and forms a guide in the lower part of the standard to prevent its moving sideways; I is a standard securely fixed to the arm H by a nut; the arm H, the rod G, and the standard I are attached to an oscillating part of the engine by means of a connecting rod; K is a socket which slides in the standard I, and is moved up and down by means of a screw and nut L.

2414. STEAM PUMPING MACHINERY, &c., *G. H. Corliss. —Dated 15th June*, 1880. 1*s.* 2*d.*

The framing is of special construction and it supports the pillow block brasses which carry the main shaft on one side and the cylinder A on the other side, the top forming a support for the beam, and the bottom

2414

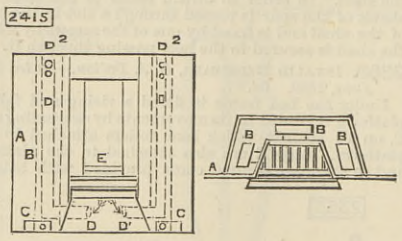


supports the pumps M. E is the condenser to which a tall chamber is bolted with water pipes entering the same at top, such pipes being in several pieces and united so as to cause the water to traverse up and down several times in passing to the exit. The cylinder A has four valves, two steam valves and two exhaust valves turned by shafts F. A skeleton lever G turns on a centre and is rocked by a rod operated by excentric, so as to actuate the valves. A special form of governor is described. The pumps are provided with removable bonnets, covering apertures large enough to allow the introduction and removal of the valves. N are shafts mounted in the bonnets and having arms extending inwards to take hold of the disc valve O. Another arm is attached to the projecting end of each shaft N, and to it is pivotted a rod which leads up to mechanism which aids the working of the valves. The latter rod connects at top to the outer end of an elastic lever pivotted to the plunger S.

2415. STOVE FOR CONSUMING SMOKE, *J. Moore.—Dated 15th June*, 1880.—(*Complete.*) 4*d.*

A is the body of the stove, B hot air chambers from which heated air is distributed to the rooms by means of the openings C C; D D the flues or inner chambers (passing through the hot air chambers), the lower parts D^1 of which are brought underneath the grate or

2415



fireplace and behind the iron apron, the upper portion D^2 passing into the chimney at the top of the stove, and through which the air for supporting combustion, together with the residue of smoke or gas, travels in the direction shown by the arrow. A slot or opening E is made in the flue or inner chamber at the back of the stove to allow the steam, gas, and super-abundance of heated air to escape up the chimney.

2431. WOOLLEN OR WORSTED FABRIC, *W. Brookes.—Dated 16th June*, 1880.—(*Com. from C. Halliday.*) 2*d.*

The fabric produced in circular weaving or knitting machinery is cut in a spiral direction, thereby varying the direction or pitch of cut according to diagonal direction of the pattern or other effect desired to be obtained. The width and length of the piece from the same size of tubular fabric may also readily be varied, and also the extent or direction of its elasticity. Pieces thus obtained may be sewn together at their opposite edges, and then finished by washing, scouring, milling, dyeing, &c., the fabric being set firmly by passing it repeatedly between rollers.

2442. COOKING RANGES, *D. and T. Robertson.—Dated 16th June*, 1880. 6*d.*

A row of three ovens, A, B and C, are placed one over the other. The shells of the ovens are held by a flange

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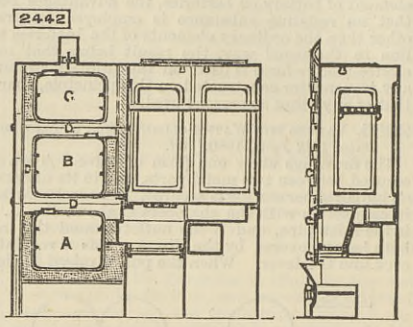

cast or formed in the front and back plates, a short way from each other to leave a space between them, forming a shallow flue D.

2444. FOG OR ALARM SIGNALS FOR RAILWAYS, *T. Jenkins and W. Price.—Dated 16th June*, 1880. 6*d.*

A B are the shells of the powder case, C the nipples or anvils carrying the percussion caps, and D is the outer shell or covering. For the purpose of attaching

2444

the signal to the railway rail, a spring wire clip having semi-circular ends is attached to the thin edge of the signal.

2481. MOULDING BRICKS, *G. H. Dean.—Dated 19th June*, 1880. 4*d.*

Figs. 1 and 2 show the form of mould used, and it consists of side portions A of steel, formed thinner at the middle of their height than at the top and bottom.

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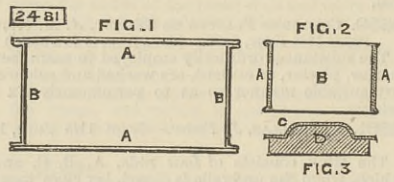

B are the end pieces formed with flanges by which they are connected to the ends of the sides. Fig. 3 shows the construction of a bottom plate or "stock," which is made of steel C with a wooden base D.

2486. FURNACES FOR MELTING METALS AND METALLIC ALLOYS, &c., *C. Carr.—Dated 19th June*, 1880. 6*d.*

A A are the side plates forming the casing of the furnace. Each of the side plates has two legs and feet made in one piece with it for supporting the furnace at a convenient height from the ground. H H

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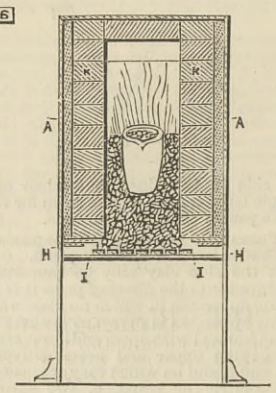
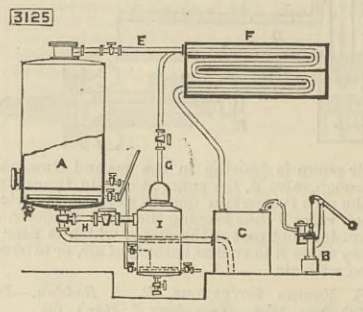


are projections or brackets cast at the lower part and on the inner sides of the side plates. On these brackets the cast iron frame I rests, and on this frame the brickwork lining K of the furnace is supported.

3125. SEPARATING AND RECOVERING FATTY MATTERS FROM BONES, *F. Wirth.—Dated 29th July*, 1880.—(*A communication from F. Seltsam.*) 6*d.*

The air-tight chamber A is filled with bones up to the valve in pipe E, and is then closed. B is a pump which forces the necessary quantity of solvent liquid from the reservoir C into the extracting chamber A. The solvent used is sulphuret of carbon, benzine, or similar substances and is used under pressure. The vapours produced force out the air through pipe E into the condenser F where all the solvent in the air is condensed and passes back to reservoir C. The pipe E is

3125

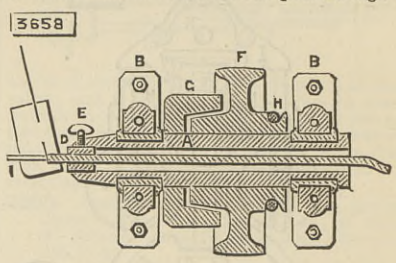


then closed and chamber A heated until the fat is melted out of the bones and runs down to the bottom when the valve in pipe H is opened and the superheated liquid flows into the distilling apparatus I, and the solvent is distilled from the fat by suitable means, the vapours thereof passing into the condenser F, and thence to the reservoir C to be used again.

3658. MANUFACTURE OF ELASTIC SPIRAL STEEL WIRE ROPES, &c., *H. A. Bonneville.—Dated 9th September*, 1880.—(*A communication from A. Jarolimek.*) 6*d.*

This apparatus consists of a hollow shaft A mounted upon two bearings B, so as to allow the spiral spring being manufactured and its core I to pass through it.

3658



To one of the ends of this shaft two jaws D, provided with a thumb-screw E, are adjusted to keep the spiral spring and its core immovable in and united with the hollow shaft during the rotation of the latter. A loose pulley F is keyed upon this hollow shaft operated by a belt, which, by means of a friction coupling G or other contrivance, imparts a rotary motion to the shaft, and which may be uncoupled at pleasure by means of a coupling or uncoupling apparatus.

CONTENTS.

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